37 Maternal obesity

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EPIDEMIOLOGY

Obesity is recognized as a major increasing health threat in the United States. In the year 2000, 117 billion dollars in health-care costs and 300,000 deaths were attributed to obesity (1,2). In 2003 to 2004, 62% of women were overweight or obese, 33% were obese, and 7% were severely obese (3). Women suffer a disproportionate burden of disease compared with men as a result of the increases in morbidity (4).

Regrettably, the obesity epidemic has spilled over into the obstetric population. In fact, recent statistics have shown a marked increase in the prevalence of pregravid overweight and/or obesity over the past few decades (5,6). In a study of 66,000 women in nine states, 22% of women were obese prepregnancy, a 70% increase in the study period (6). As a testament to the pervasiveness of maternal obesity, no subgroup had less than 43% increase in obesity over the interval. The greatest increases in obesity were seen in those who were >20 years of age, black, parous (three or more children), with a high school education, nonsmokers, and enrolled in WIC.

The rising prevalence would not be problematic if it were not for the sequelae for mother and baby. Obesity has been associated with infertility, spontaneous abortion (SAB), intrauterine fetal demise (IUFD), inaccurate fetal imaging, gestational diabetes mellitus (GDM), pre-eclampsia, cesarean delivery, anesthetic complications, deep vein thrombosis/pulmonary embolus (DVT/PE), wound complications, mood disorders, breast-feeding difficulties, contraceptive failures, and longer-term issues such as excess gestational weight gain (GWG), later-life obesity, diabetes, and heart disease (5,7–16). Likewise, the fetus incurs risks of macrosomia, associated complications, and pediatric obesity (11,17) (Table 1).

Increasing maternal obesity has potential public health implications as well. As an example, a study in Utah revealed a 40% increase in overweight and obesity between 1991 and 2001 (5). While this study described a smaller overall increase in body mass index (BMI) compared with Kim's data, it described the impact to the community as a whole. An estimate of the attributable fraction of cesarean delivery in the state revealed that one in seven were attributable to obesity after controlling for other factors. Additionally, after assessing trends among potential confounders including maternal age, ethnicity, chronic hypertension, and renal disease, the study described a parallel rise in pre-eclampsia among nulliparous women from 5% to 8% in the same interval in which obesity increased (5).

ETIOLOGY

The etiology of maternal obesity is complex and multifactorial. While not classically discussed in perinatal textbooks, the ecologic context in which a patient lives is important to

include in a chapter on maternal obesity, given that some management is dependent on lifestyle interventions. Access to healthy foods and physical activity (PA) opportunities have a potential effect on maternal and fetal well-being. Living more than 4 miles from a supermarket doubles the likelihood of having the lowest quartile of food quality (18). This type of research has recently been linked to adverse birth outcomes. Lane and colleagues documented that mothers living near markets without fresh produce and dairy were at significant risk of delivering low-birth weight infants (19). Also living in areas with social spaces lowers the risk of low or excess GWG (20). Inquiring about the environment may guide counseling for obese women.

PATHOPHYSIOLOGY

Complex alterations in glucose and lipid metabolism, inflammation, adipokines, and vascular dysfunction occur in obese women. Significant endocrinopathies are associated with obesity, and examples from nonpregnant populations are relevant as they describe the milieu into which a fetus is exposed. Obese individuals are more likely to develop insulin resistance and hyperinsulinemia (21). Adult twins who were discordant with respect to weight were studied and the obese twin of the dyad had significantly higher insulin levels and less insulin sensitivity to maintain normal glucose levels (21). At a cellular level, obesity causes post-receptor binding defects, impaired second messengers, and enzymatic defects, which diminish the ability of the cells to import glucose into the cell. This is exacerbated by the production of human placental lactogen during pregnancy. Additionally, obesity causes abnormal lipogenesis and protein synthesis and increases lipolysis, which then increases free fatty acids (FFAs). At the muscle, this results in FFA oxidation and decreased glucose use leading to hyperglycemia, and at the liver, the increased FFA oxidation increases gluconeogenesis also resulting in hyperglycemia. Thus, at least three mechanisms result in hyperglycemia associated with obesity. These pathophysiologic changes in the overweight and obese translate into increased relative risks of developing diabetes mellitus both during pregnancy and outside of pregnancy (22). In a meta-analysis of over 20 studies, increasing BMI increased the odds of having GDM. The unadjusted ORs of developing GDM were 2.14 (95% CI 1.82–2.53), 3.56 (3.05–4.21), and 8.56 (5.07–16.04) among overweight, obese, and severely obese compared with normal-weight pregnant women, respectively (23). Likewise, obese women with GDM were twice as likely to develop type 2 after pregnancy.

Hypertensive consequences also increase with overweight and obesity. Nurse's Health Study data show a 1.7-fold increase in the risk of hypertension in overweight women compared with normal-weight women (24). A fivefold

increase is seen in obese women and abdominal obesity doubles the risk. Likewise, both weight gain and loss modify these risks. Thus, obese women entering pregnancy are at risk for chronic hypertension. The literature supports the association between obesity and pre-eclampsia, even lacking chronic hypertension. Sibai et al. reported a threefold increase in pre-eclampsia to 12% of women with a BMI of $\geq 34\text{kg/m}^2$ compared with lean women (25).

Unlike hyperinsulinemia and hyperglycemia, the mechanism remains to be elucidated. The vascular volume is increased in obesity and in pregnancy, but peripheral resistance is only slightly elevated in obesity and decreased in pregnancy. Other theories include increased renal sodium and water, activation of the sympathetic system, alteration in the function of sodium-hydrogen ATPases and changes to the vascular wall, and subclinical inflammation (22,26).

Overall, the data regarding preterm birth (PTB) and obesity are conflicting. In a large European cohort, the rate of PTB was increased (aOR 1.6) (10), others have reported a decrease (7), and yet some report that postdate pregnancy is increased by obesity (27). Nohr and colleagues suggest that actually indicated PTB is increased as a result of maternal medical conditions, not spontaneous PTB (28).

Obesity increases multiple aspects of parturition including induction, duration of labor, oxytocin requirement, and cesarean delivery (29,30). Cesarean delivery is performed in up to half of obese women and increases as BMI rises. As an example, cesarean delivery rates are shown in Figure 1 for women with and without the risk factors of diabetes and hypertension (31). Obesity has been shown to similarly decrease the success of women undergoing a trial of labor after cesarean. Juhasz and colleagues demonstrated that overweight and obese women were 50% less likely to have a successful vaginal birth after cesarean (VBAC), and a weight gain of over 40lb decreased a woman's chance of VBAC 40% when compared with underweight women (32). Similar failure rates with trial of labor were described by Durnwald et al. even after controlling for other additional factors (normal BMI 70.5%, obese 54.6%, $p = 0.003$) (33).

Psychosocial Factors and Obesity in Pregnancy (Table 2)

When undiagnosed depression has potential to take a severe and prolonged course for the mother resulting in behavioral

issues in their children, this makes identifying and treating those at greatest risk essential (34,35). Obesity is one of the factors that has recently been found to be a risk marker for depressed mood during pregnancy and postpartum.

The link between BMI, eating attitudes, and depression and anxiety during pregnancy and at 4 and 14 months postpartum was first described by Carter et al. (8). A recent analysis showed that depression, one of six negative psychologic states assessed, was associated with pregravid BMI. While the relationship was seen in all overweight and obese women, a BMI of >40 was strongly associated with depressive and anxiety symptoms, locus of control, perceived stress, powerful others, restrained eating and dieting, and weight cycling (9).

In a 2010 study of over 1000 predominantly Caucasian women, recruited immediately postpartum, prepregnancy BMI was associated with depressive symptoms (12). The percentage of women screening positive for postpartum depression was 14.4% in normal-weight women with an increase in all other BMI strata: underweight, 18.0%; overweight, 18.5%; obese class 1, 18.8%; obese class 2, 32.4%; and obese class 3, 40.0%. In a regression model, class 2 and class 3 obesity were strongly associated with screening positive for depression.

Not all studies have found this association. A secondary analysis of overweight and obese women enrolled in a postpartum weight loss intervention did not find a link between obesity and depressed mood. However, by virtue of the recruitment into an intense trial, obese women with depression could have been excluded (36).

Table 2 Psychosocial Factors Linked to Obesity in Women

Psychosocial stressors
Early traumatic events
Socioeconomic/workforce
Depression/anxiety/suicide
Stigmatization

Table 1 Adverse Maternal Outcomes Associated with Obesity

Infertility
SAB/IUFD
Inaccurate imaging
Gestational diabetes
Pre-eclampsia
Cesarean delivery
Anesthetic complications
DVT/PE
Wound complications
Mood disorders
Breast-feeding difficulties
Contraceptive failures

Abbreviations: SAB, spontaneous abortion; IUFD, intrauterine fetal demise; DVT/PE, deep vein thrombosis/pulmonary embolus.

Figure 1 Cesarean delivery by body mass index strata and risks of diabetes and hypertension. Abbreviations: DM, diabetes mellitus; HTN, hypertension; nl, normal.

Long-Term Consequences

While an increasing number of studies have focused attention on the immediate maternal and neonatal complications associated with prepregnancy overweight and obesity, less attention has been paid to the long-term consequences of excess maternal weight gain and postpartum weight retention, which may contribute to midlife obesity and subsequent development of diabetes and heart disease (5,14,15). Olson demonstrated that only 42% of women had attained their prepregnancy weight and 26% of women had retained over 10 lb 1 year after delivery (37). They estimated that 69% of incident cases of obesity could have been prevented by decreasing weight gain during pregnancy. This excess weight gain and postpartum retention translated into an increase in long-term obesity and subsequent development of obesity-related illnesses. One decade after delivering, women who gained less than recommended during pregnancy were 4kg heavier on average, compared with 6 and 8kg in women gaining the recommended and greater-than-advised, respectively. A weight gain of 16kg during pregnancy was a significant predictor of long-term weight retention (14,15,38).

Bariatric Surgery

Between 1998 and 2005, bariatric surgery has increased 800% with the majority of the procedures performed on women (39). Overall, women who have successfully lost weight after bariatric surgery appear to have lower rates of GDM, hypertension, cesarean delivery, and macrosomia (40). Maggard and colleagues reported a GDM rate of 22% in obese women and 0% in the post-bariatric surgery group. Pre-eclampsia rates were lower as well (3% obese women vs. 0% post-bariatric surgery group). There was no evidence of increased growth restriction or preterm deliveries in the post-bariatric surgery group compared with the obese controls (39).

Some women after bariatric surgery experience deficiencies of iron, folate, vitamin B₁₂, and calcium, particularly in those with malabsorptive procedures. Additionally, there are reports in the literature of complications during pregnancy after bariatric surgery including anastomotic leaks, internal hernias, intestinal obstruction, gastrointestinal bleeding and erosion, band migration, and maternal death (41). Population-level data comparing the benefits and risks of bariatric surgery compared with pregnancy in the severely obese are not readily available.

Breast-Feeding

Interesting work reveals an association between obesity and breast-feeding failures even after controlling for socioeconomic status (42,43). Increased prepregnancy BMI is associated with shorter breast-feeding duration (42). This is unfortunate as both maternal obesity and short duration of breast-feeding are independent risk factors for childhood overweight (43). Recently, biologic data support this epidemiologic association between obesity and short duration of breast-feeding. Increased prepregnancy BMI predicts a lower prolactin response to suckling at 48 hours. Prolactin is responsible for stimulating milk production and thus a decrease in responsiveness could lead to a diminished ability to make milk and perhaps contribute to breast-feeding discontinuation (44). Perhaps interventions that improve

pregnancy BMI and or maternal weight gain might improve a woman’s ability to breast-feed.

Effects on the Offspring (Table 3)

Fetal anomalies are reportedly increased in fetuses of obese women. Specifically, neural tube, cleft palate, and cardiac defects are increased, and concomitantly the ability to detect defects is impaired in this population by at least 20% (45). Stothard and colleagues attempted to determine how the decreased detection rate might contribute to the overall increase in anomalies by a decrease in pregnancy terminations in obese women. They included pregnancy terminations in their analyses and found no change in the odds (46).

IUFD and Infant Mortality

An increasing number of studies have described an increase in IUFD among obese women. Denison and colleagues reported a threefold increase in IUFD in women with a BMI≥35 (aOR 3.90, CI 2.44–6.22) (27) (Table 3). In a study of 24,000 women, after adjusting for antepartum complications, the association was attenuated but still present for IUFD and neonatal death (47). Mortality after delivery is also increased in neonates born to obese women (48). It is unclear whether this increase in IUFD warrants aggressive antepartum monitoring, given the rising prevalence of obesity and the relatively small risk of fetal demise.

Macrosomia and Childhood Obesity

Birth weight increases with maternal obesity. In a secondary analysis of the hyperglycemia and adverse pregnancy outcomes, Metzger reported that 13.6% nondiabetic obese women developed macrosomia (>4000g birth weight) compared with 6.7% of non-obese normal-weight women (49) (Table 3). In a study of 116,976 macrosomic infants, after controlling for antepartum risk factors, those born to obese mothers were more likely to experience hyaline membrane disease (aOR 2.14, CI 1.73–2.66), extended assisted ventilation (aOR 1.71, CI 1.44–2.04), birth injury (aOR 1.58, CI 1.37–1.84), and meconium aspiration (aOR 1.42, CI 1.09–1.89) (50). The consequences of maternal obesity persist: large-for-gestational-age (LGA) babies and maternal obesity have been shown to have a twofold increase in the risk of metabolic syndrome in children (hazard ratios LGA 2.15, CI 1.25–3.82, maternal obesity 1.81, CI 1.03–3.19) (51). GWG likewise increases macrosomia and is worse in overweight and obese women. It is hypothesized that GWG and maternal obesity lead to

Table 3 Fetal, Neonatal, and Pediatric Consequences of Maternal Obesity and Excess Gestational Weight Gain (GWG)

Maternal obesity	Excess GWG
Birth defects	Macrosomia
SAB/IUFD	Childhood obesity
Infant mortality	
Macrosomia	
Childhood obesity	

Abbreviations: SAB, spontaneous abortion; IUFD, intrauterine fetal demise.

maternal insulin resistance and glucose intolerance, which increase fetal glucose, insulin, steroid and growth hormones, amino acids, and lipids (Fig. 2). The resultant increase in fetal fat deposition leads to accelerated birth weights, neonatal complications, and childhood obesity (52).

DIAGNOSIS
Defining Obesity and Measuring GWG

In nonpregnant adults, BMI is commonly used as a measure of adiposity. The World Health Organization defines normal BMI as a BMI between 18.5 and 24.9, underweight as <18.5, overweight as 25 to 29.9, and obesity as >30. For more detailed assessments and risk stratification, it defines class 1 obesity as 30 to 34.9, class 2 obesity as 35 to 39.9, and class 3 obesity as >40. In obstetrics, it is the practice to use a woman’s prepregnancy BMI for risk assessment and to follow their GWG. Using a measured prepregnancy BMI is preferable. Alternatively, a first-trimester measured BMI or self-reported prepregnancy BMI can serve as a proxy. Notably, a self-reported pregravid BMI will underestimate a woman’s actual BMI category. Table 4 provides formulas for calculation and two online references. BMI can be calculated by (i) dividing

Figure 2 Effect of excess gestational weight gain (GWG) on the fetus. Abbreviations: aa, amino acids; BWt, birth weight.

Table 4 BMI Formulas, Websites—Calculator and Table	
Formulas	
kg/m ²	
lb × 703/in. ²	
Websites	
Calculator	http://www.nhlbisupport.com/bmi/
Table	http://www.nhlbi.nih.gov/guidelines/obesity/bmi_tbl.htm

the individual’s weight in kilograms by height in meters squared or (ii) multiplying their weight in pounds by 703 and dividing this by the height in inches squared. Waist circumference is measured in the horizontal plane at the level of the iliac crest at the end of inspiration.

After extensive review, new recommendations for weight gain during pregnancy were released in 2009 by the Institute of Medicine (52). The document states that “Although the guidelines ... are not dramatically different ... fully implementing them would represent a radical change in the care of women of childbearing age.” In fact, the recommendations are not significantly different. Only women in the obese category saw a reduction in the recommended weight gain to 11 to 20lb. The Institute of Medicine (IOM) based the limited changes on the fact that there are limited data on metabolic profile, diet patterns, and eating behaviors of those without weight gain. The IOM cautioned that insufficient gain (<15lb) would imply mobilization of adipose and protein stores and could result in ketonemia with the potential to result in neurologic deficits in the infant (52). The guidelines presented in Table 5 drew some frank criticism from prominent obstetricians who suggested that this decrease in GWG was insufficient.

The IOM modified its recommendations for special populations. Women of short stature, adolescents, and all race/ethnicities are encouraged to gain the standard amount by their prepregnancy BMI category. Additionally, they changed the weight gain recommendations for twins to 37 to 54lb for normal-weight women, 31 to 50lb for overweight women, and 25 to 42 lb for obese women. They were unable to stratify the recommendations for obese women carrying singletons or twins by class 1, class 2, or class 3 obesity citing insufficiency of representative published data.

MANAGEMENT
Logistical Considerations

In order to provide compassionate care, clinicians should recognize the challenges obese women face in obtaining medical care. Simple strategies to make the clinical setting more hospitable will facilitate effective communication and development of rapport. While the following recommendations may seem straightforward and perhaps inconsequential, they in fact set the stage for effective and compassionate communication. Office staff can assist clinicians in making the office more comfortable by evaluating a few key pieces of the patient’s visit (53).

- Chairs with armrests may be constraining to overweight and obese women. Consider making benches available or having access to seating without armboards or wider seats.

Table 5 IOM Recommendations for Total and Rate of Weight Gain During Pregnancy, by Prepregnancy BMI			
	BMI	Total weight gain (lb)	Rates of weight gain in second and third trimesters (lb/week)
Underweight	<18.5	28–30	1 (1–1.3)
Normal weight	18.5–24.9	25–35	1 (0.8–1)
Overweight	25.0–29.9	15–25	0.6 (0.5–0.7)
Obese (includes all classes)	≥30.0	11–20	0.5 (0.4–0.6)

Source: Institute of Medicine, 2009.

- Weight is considered a private issue by many women. Obese women may be embarrassed by having their weight measures in a public location, especially if they are heavier than the maximum capacity of the scale. Weigh women in a *private* location.
- Large blood pressure cuffs should be available at each location where blood pressures are taken to avoid unnecessary embarrassment to the patient. Have larger sized gowns and sheets in each examination room.
- Limited mobility may make it difficult for obese women to get onto an examination table or place their feet securely on the footrests. Provide adequate assistance for accessing the table and consider performing the pelvic examination without footrests.
- Large speculums should be available in each examination room.

Lifestyle Interventions—Nutrition, PA, and Successful Interventions

Currently, attempts are being made to identify interventions improving nutrition and PA during pregnancy. Clearly, there is room for improvement. There are no nationally representative data available on pregnant women, thus using reproductive-aged women as a proxy, women are not eating a diet rich in fruits and vegetables. Less than 2% of women aged 19 to 30 eat the recommended amounts of fruits and vegetables. Even when the requirement is lowered to the essential five-a-day servings of fruits and vegetables, less than 30% of women aged 19 to 30 and less than 40% of women aged 31 to 50 meet the target (54).

We perform no better in the realm of PA. When measured by accelerometry, only 5% of adults meet the recommended 30 minutes of moderate PA per day, 5 days per week (55). Data

in pregnancy are limited; however, DiNallo and colleagues reported that <12% of women meet PA recommendations in pregnancy (56). This is despite more recent data supporting that moderate PA in pregnancy is not associated with preterm labor, low birth weight, or pregnancy loss, and most studies show an inverse association between PA and GWG (57). Lifestyle interventions in overweight and obese women are limited, but none yet in the United States has been completely successful. Of the four intensive interventions, one showed no effect on GWG in obese women, one lowered GWG in low-income women, the other in normal weight, and the last showed that dietary and lifestyle changes resulted in a 7# decrease in GWG. The Europeans have more consistent success with 2- to 3-kg improvements in GWG and improvements in dietary practices. Currently, interventionists are attempting to determine what works and in which populations.

These research interventions clearly include an entire curriculum and consume a significant amount of resources that are not available to most clinicians. If available, clinicians should consider referrals to nutritionists in early pregnancy and each trimester. Alternatively, free online resources for nutritional plans are available for pregnant mothers on mypyramid.gov (Fig. 3).

Assessing current level of PA and encouraging continued exercise and active choices is a simple intervention a physician can perform in clinic. Tables 6 and 7 describe the American College of Obstetricians and Gynecologists recommendations and contraindications and precautions.

Management Plan

A management plan for obese pregnant women is included in Table 8. Acknowledging that half of pregnancies are unintended, the discussion about appropriate weight during pregnancy and consequences of obesity should begin at the well-woman examination. Currently, only one-quarter of

Figure 3 “MyPyramid Plan for Moms.” Source: From MyPyramid.gov.

Table 6 Physical Activity Recommendations in Pregnancy

≥30min/day moderate exercise 5 days/week
 Avoid supine position with exercise
 Avoid trauma, fall risk, and scuba

Source: ACOG, 2006.

Table 7 Contraindications and Precautions for Physical Activity in Pregnancy

Absolute contraindications

Significant heart disease or restrictive lung disease
 Incompetent cervix
 Multiple gestation
 Second- and third-trimester bleeding
 Previa, PROM, PTL, or pre-eclampsia

Relative contraindications

Anemia
 Arrhythmias
 Poorly controlled DM 1
 BMI>40
 Underweight
 IUGR
 Poorly controlled HTN or thyroid disease

Precautions

Loss of fluid, vaginal bleeding, cramping, regular contractions, chest pain, shortness of breath dizziness, decreased fetal movement

Abbreviations: PROM, premature rupture of membranes; PTL, preterm labor; DM 1, diabetes mellitus 1; BMI, body mass index; IUGR, intrauterine growth restriction; HTN, hypertension. Source: ACOG, 2006.

providers address weight among overweight and obese women at annual examinations (58). Documentation of BMI should be performed and overweight and obese patients should be referred to available PA and nutrition counseling. Women who are contemplating pregnancy should be encouraged to take folic acid as obesity is a risk factor for inadequate folic acid supplementation. Also they should be educated regarding the increased risks that obese women and their infants experience and screened for diabetes.

In early pregnancy, BMI should be calculated, recorded, and used to assess risks and set a GWG target. Throughout prenatal care, the GWG should be described and patient be given appropriate feedback, an important point being that clinicians and ancillary services should be providing consistent messaging. Folic acid supplementation should be encouraged. The Royal College of Obstetricians and Gynaecologists recommends increasing folic acid supplementation to 5mg; however, the IOM concludes that the increased rate of neural tube defects may result from inadequate folate use not inadequate dosing (59,60). Serum screening and first-trimester ultrasonographic screening should be encouraged, as second-trimester screening is less efficacious at detecting anomalies. It is unclear whether fetal surveillance for obese women is cost-effective; however, consideration should be made for antenatal testing in the severely obese as they are at greatest risk for IUFD.

Intrapartum care should include anesthesia consultation and assessment of an early epidural, given that a 1-cm increase in neck circumference translates to a 1.13 increase in unsuccessful or complicated intubations (61). VBAC counseling should be modified to include the decrease in success.

Table 8 Management Plan

Preconception care (including gynecologic care and well-woman examinations)

Measure height and weight, calculate BMI
 Address weight, physical activity, and nutrition (referral)
 If considering conception
 Folic acid 400mcg
 Weight loss before conception
 Risk counseling by prepregnancy BMI
 Screen for diabetes

Antepartum

Calculate prepregnancy or early pregnancy BMI
 Set weight gain goal and review risks (2009 IOM recommendations)
 Monitor gain and provide feedback
 Consistent messaging—GWG, nutrition, and PA
 Nutrition website, nutrition referral
 400mcg folic acid
 Serum screening—first, second, and integrated screens are BMI corrected
 Ultrasonographic screening
 Offer first Δ US for NT (no ↓ in detection rate)
 Second Δ scan 20–30% ↓ common anomalies
 Antenatal testing 36 weeks if BMI>40*

Intrapartum

Anesthesia consult, consider early CLE (BMI>35)
 Avoid elective induction
 Modify VBAC counseling
 ↓ 50%
 >40# GWG ↓ 40%

Vaginal delivery

Low threshold to deliver in OR—BMI>35
 Steps

Cesarean delivery

Table limit
 Air mattress and sufficient staff
 Incision placement
 Surgical incise drape or tape (for cephalad retraction of pannus)
 360-degree protected edge
 In situ uterine closure
 Subcutaneous layer 3.0 vicryl closure (if >2 cm)
 Compression stockings or prophylactic heparin

Immediately postpartum

Early ambulation
 Lactation consultation
 Early outpatient visit (7–14 days)
 Wound
 Breast-feeding
 Edinburgh Postnatal Depression Scale (EPDS)

Postpartum visit (6 weeks)

Weight management
 Mood
 Contraception

Abbreviations: BMI, body mass index; IOM, Institute of Medicine; GWG, gestational weight gain; PA, physical activity; NT, nuchal translucency; VBAC, vaginal birth after cesarean. *Consider

The gynecologic, general surgery, and anesthesia literature supports the increased risk of surgical morbidity. Surgical complications include increases in operative time, blood loss, transfusions, length of stay, pressure sores, nerve injuries, deep vein thromboses, wound complications, difficult intubations, and associated pulmonary complications (62–65).

Table 9 Key Points for Women after Bariatric Surgery

Post-op counseling regarding increased fertility
 Delay contraception for 12–18 months after bariatric surgery
 Assess for vitamin and mineral deficiency (Fe, Folate, B₁₂, calcium, vitamin D)
 High suspicion for band/bypass complication
 Co-manage with general surgery

Source: ACOG 2009, Kirshtein 2010.

For cesarean deliveries, the provider must know the weight limit of the OR table and prepare accordingly; table extensions must be available. Sufficient staff and/or air mattress lift devices should be available. Incision placement requires assessment of the location of the anterior superior iliac spine and the pannus. In severely obese women, the pannus tends to deviate the abdominal wall caudally and as such vertical peri- and supra-umbilical incisions might be required to access the lower uterine segment. Two additional techniques that may be useful include taping the pannus to a bar that resides at shoulder level with tape or a surgical incise drape to retract the pannus cephalad and using a cesarean o-ring retractor. Often, it is not possible to exteriorize the uterus and an in situ closure is performed. To decrease the likelihood of these complications, surgeons should be aware of the operating table weight limit, administer an adequate dose of preoperative antibiotics (if BMI > 35 or > 220# double the Ancef dose to 2g), and close the subcutaneous tissue (66). Early ambulation, sequential compression devices, or prophylactic heparin should be used to protect against deep vein thromboses.

Immediately, postpartum women should be encouraged to ambulate and be provided with lactation assistance. Inviting women to return to clinic 1 to 2 weeks postpartum provides an opportunity to assess wounds, support breast-feeding, and ensure that mood is stable. Clinicians should begin a weight management dialogue at 6 weeks postpartum, evaluate mood, and discuss the importance of adequate contraception.

Bariatric Surgery

Even if a woman has a history of infertility, she should be counseled that spontaneous conception is possible after bariatric surgery. It is important that women acknowledge this and delay contraception for the first 12 to 18 months to avoid pregnancy in the rapid weight loss phase to protect the fetus from growth restriction. When pregnancy does occur, women should be screened for vitamin and mineral insufficiency each trimester and supplemented as needed using rapid release or oral solutions in lieu of extended release medications. Some women may not tolerate a 1-hour glucose tolerance test and may require fasting and 1 to 2 hours postprandial glucose levels for 1 week at 25 to 28 weeks. Clinicians should have a high index of suspicion for band or bypass complications when women present with abdominal pain, nausea/vomiting, and anorexia. Consultation with bariatric or general surgeons should be sought readily and early (Table 9) (40,41).

Future Directions

Unanswered questions abound in the care of the obese pregnant patients. Well-designed prospective studies are needed to answer these research questions. Potential topics include

identifying (i) whether modest decreases in weight (5–10%) preconception elicit significant improvement in obstetric outcomes, (ii) appropriate GWG recommendations by class of obesity, (iii) successful interventions to improve GWG, and (iv) the effects of PA on obstetric and psychologic outcomes. Future research should inform best practices.

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