

## Obesity and Pregnancy

Obesity is a healthcare issue of epidemic proportions in the United States. Among reproductive aged women, the Centers for Disease Control and Prevention (CDC) estimates that 30% are obese and nearly 57% are overweight. The classification of obesity is based on body mass index (BMI) (Table 1). Given the rapid increase in the prevalence of obesity among adults, adolescents and children over the last two decades, obesity is altering the landscape of medicine in which we practice. Maternal pre-pregnancy obesity is a significant risk factor for multiple adverse pregnancy outcomes. Although this letter cannot offer a comprehensive review of this broad subject, we hope to offer an overview of pregnancy complications and any interventions that may minimize these risks to both mother and fetus.

**Table 1—World Health Organization (WHO) BMI Classification**

Classification	BMI (kg/m <sup>2</sup> )
Normal	18.5-24.9
Overweight	25.0-29.9
Obese class I	30.0-34.9
Obese class II	35.0-39.9
Obese class III (morbidly)	>40

### Antepartum Risks

Pregravid maternal obesity (in comparison to women with normal BMI as controls) increases the risk of spontaneous abortion and recurrent miscarriage in spontaneously conceiving women (Table 2). A similar effect is likely present in pregnancies requiring reproductive technology, but this association has not proven quite as consistent. In addition, the developing fetus is at greater risk for congenital anomalies, especially neural tube defects (NTD). Although some of this increased risk of anomalies is likely due to undiagnosed type 2 diabetes mellitus, it is likely that there are other mechanisms at work, such as altered folate metabolism. However, simply increasing the amount of folic acid intake does not offer protection from fetal NTDs.

In addition to increased risk of neural tube defects, the fetus is also at an increased risk for omphalocele, heart defects, and multiple anomalies. Obesity prevention efforts are needed to increase the number of women who are healthy weight before pregnancy.

Not only are obese women at greater risk of fetal anomalies, they are also at greater risk of poor fetal anatomic visualization via ultrasonography. Reduced visualization has been particu-

larly problematic for the fetal heart and spine. The rate of suboptimal visualization increases by 10% for each higher class of obesity. There is no gestational age at which the anatomic survey “normalizes” to that of a patient with a normal BMI. Although there is a trend toward improved visualization at 20 to 22 weeks gestation compared to 18-20 weeks, this difference is not statistically significant. Assuming there are no other abnormalities on early ultrasounds, waiting until 20 weeks to complete the anatomy ultrasound will likely improve visualization. Fundal height measurements are a poor predictor of fetal growth in the obese patient population, due to the significant abdominal girth. While obese patients are not at greater risk of intrauterine growth restriction (IUGR), repeat ultrasounds throughout the third trimester may be the best way to assess fetal growth.

Obese women, gravid and non-gravid, are at increased risk for the metabolic syndrome, which encompasses insulin resistance, hypertension and abnormal cholesterol metabolism. The normal decrease in insulin sensitivity during pregnancy is exacerbated in obese women who already are insulin resistant with decreased glucose uptake in peripheral tissues. Morbidly obese women are at higher risk for having undiagnosed type 2 diabetes mellitus and should be screened for this early in gestation. The incidence of gestational diabetes also increases with each higher classification of obesity. Encouraging physical activity and moderation of gestational weight gain may be methods to minimize the risk of gestational diabetes. The suggested gestational weight gain for obese women from the Institute of Medicine (IOM) is currently more than 15 lbs (6.8kg). However, the IOM is currently in the process of reviewing these recommendations and will likely report new guidelines soon. There is a wealth of information to suggest that this population of women would not have any increase in pregnancy risks (specifically IUGR) with lower weight gains.

Gestational hypertension and preeclampsia are more commonly seen in the obese gravida, in comparison to those with a normal BMI. Preeclampsia is approximately 1.5 times more likely in the obese patient and up to 5 times more likely in the morbidly obese patient. Similar to our protocol for our type 1 and type 2 diabetic patients, we obtain labs and a 24-hour urine for protein at baseline (preferably 1st trimester) in our morbidly obese patients. This can help to distinguish women with any baseline impairment in renal or liver function (especially non-alcoholic fatty liver) and later complications of preeclampsia or gestational hypertension.

Non-gravid obese women are at increased risk of cardiac

*continued on page 14*

# Obesity and Pregnancy

*continued from page 13*

dysfunction and obstructive sleep apnea. However, these complications have not been well-studied in the pregnant population. Currently, there is no recommendation for baseline screening studies (echocardiogram or sleep study) to be completed in obese gravidas. However, if patient history (daytime somnolence, loud snoring, and longstanding chronic hypertension) or clinical exam reveals further cause for suspicion, referral of patients for further evaluation is warranted. Untreated sleep apnea may lead to pulmonary hypertension, right heart failure, stroke and cardiac arrhythmias. Treatment with CPAP has favorable outcomes so history of daytime sleepiness and sleep hygiene should be part of the screening questions in all obese patients.

Conflicting data exist on whether obesity increases the risk for preterm delivery. When accounting for all of the complications which may prompt an indicated premature delivery due to maternal medical indications, it does not appear that there is an increased risk of spontaneous premature delivery or premature rupture of membranes. However, other studies suggest that there may be a small increase in spontaneous PTL. Obese women are clearly at increased risk of induction of labor due to the other maternal comorbidities. Unfortunately, these inductions are more likely to result in Cesarean deliveries.

Intrauterine fetal demise (IUFD) has been more recently identified as a risk associated with increased pre-pregnancy weight, even after controlling for other maternal comorbidities. The pathology of this increased risk for IUFD is not certain. Although this risk is almost twice of that seen in a patient with a normal BMI, given the rare occurrence of IUFD, there is no current recommendation to perform routine antenatal testing in these patients. The cost/benefit of intensive monitoring is speculative at this time. Given other associated comorbidities, one may consider weekly non stress tests starting 30-32 weeks gestation.

**Table 2**

<i>Antepartum Risks</i>	<i>Odds ratio</i>
Spontaneous abortion	1.2
Neural tube defect	1.7-3.1
Suboptimal ultrasound visualization	
Gestational diabetes	2.6-5.4
Gestational hypertension	1.6-3.0
Preeclampsia	1.6-4.8
Premature delivery	1.0-1.8 (NS)
Intrauterine fetal demise (IUFD)	1.5-2.1
Macrosomia	2.0-3.8
Shoulder dystocia	1.5-3.1
Cesarean section	1.5-3.0

Macrosomia is a significant pregnancy risk for the fetus of the obese gravida, even when controlling for the presence of gestational or pre-gestational diabetes. However, gestational weight gain may play an even more important role in predicting fetal macrosomia than pre-pregnancy obesity. Limiting pregnancy

weight gain and strictly controlling blood glucose are the best methods to minimize the risk of macrosomia and subsequent shoulder dystocia. Preterm induction for suspected macrosomia is not recommended.

## Antepartum Care

Record the height and weight at the initial visit and calculate the patients BMI. This baseline BMI is an important tool to counsel the patient on appropriate weight gain (see BMI Information Sheet). They should be offered nutrition consultation and screened early for diabetes. You may consider a Glucola at the initial visit and repeat if normal at 24-28 weeks. Depending on the presence of additional comorbidities anesthesia consultation may be appropriate prior to delivery. They should continue to exercise. You may consider a sleep study if history is suspicious for sleep apnea, liver function tests (fatty liver), renal functions and an EKG.

## Intrapartum/Postpartum

Monitoring of the fetal heart rate and uterine contractions are more challenging during labor. A fetal scalp electrode may also be helpful if a maternal pulse oximeter is not available to distinguish maternal and fetal heart rates. Special operating tables may be necessary therefore it is important to know the weight limit of your tables. Blood products should be available. Difficulty with IV placement and patient transfer may occur. Obese patients have a higher incidence of operative vaginal deliveries and when they are successful often have vaginal tears which are difficult to visualize and repair. They have an increased incidence of third and fourth degree lacerations. The increased risk of shoulder dystocia may be secondary to macrosomia, soft tissue dystocia, as well as ineffective maneuvers (McRoberts).

If a non-reassuring fetal heart tracing occurs, the efficiency of performing an emergent Cesarean delivery is limited by maternal obesity. Not only is it more challenging to physically move the patient to the operating room, but general anesthesia carries a greater risk of difficult intubation in the obese patient. Obtaining an anesthesia consult prior to the onset of labor should be strongly considered to thoroughly assess the maternal risks prior to an emergent situation.

Labor dysfunction is common in the obese population. The active phase of labor is often prolonged. The median active phase labor for woman of normal weight is 6.2 hours; overweight 7.5 hours; obese 7.9 hours. Several recent studies suggest that the myometrial contractility of the obese uterus is impaired. The intracellular calcium flux may be altered leading to a decrease in contractility. This may explain why obese women are at increased risk for both cesarean delivery and post partum hemorrhage.

Cesarean delivery is 1.5 to 3.0 times more likely in the obese patient population, with the risk increasing as obesity classification is higher. A Cesarean rate of nearly 50% has been reported for women with a BMI of >40. Induction of labor is less likely to be successful in these patients as well, which is why only medically indicated inductions should be pursued.

Decreased success of VBAC (vaginal birth after Cesarean) has also been noted in the obese population (52% versus 70%). A larger recent trial looking at VBAC from the MFM Network from 2006 suggests even less success of VBAC in the obese patient. This trial included over 14,000 patients in each arm – trial

of labor vs. repeat cesarean delivery. They found that increasing BMI was directly associated with failed trial of labor after previous cesarean delivery. VBAC failure rate was 15% in the normal weight patient and 40% in the morbidly obese. Additionally trial of labor carried a 5 fold risk of uterine rupture (2.1% vs 0.4%). They also found a 5 fold risk of neonatal injury (1.1% vs 0.2%) fractures, brachial plexus injuries and lacerations. Although these risks of maternal morbidity and neonatal injury are small, they should be considered before offering patients a trial of labor after prior cesarean delivery.

Operative complications include increased rates of excessive blood loss, longer operative times, increased rates of wound infection and endometritis, anesthetic challenges – difficult placement and failed intubation. Given these challenges it is important that the operating room where the surgery is performed is stocked with deep instruments and retractors. Antibiotic prophylaxis should be given to all women undergoing cesarean as it has been found to be the single most protective factor in the reduction of wound infection.

The added morbidity of a Cesarean delivery should be of significant concern to the obstetric provider. Unfortunately, there is less evidence to guide us in our operative management in these cases. There are no prospective trials to support whether a vertical or horizontal skin incision is optimal to minimize the risk of infection and wound disruption. This should be based on the body habitus and surgeon's experience. Closure of the subcutaneous tissue has been shown to decrease the risk of wound separation and is strongly recommended. Support for subcutaneous drains to minimize wound infection or separation has not been provided by studies, so this decision should be based on provider preference. Obesity increases the risk for postoperative deep vein thrombosis. Early ambulation and intermittent pneumatic compression devices or graduated compression stockings are recommended. However, there are no recommendations for routinely using prophylactic postoperative anticoagulants, if there are no other risk factors for a thrombosis other than obesity.

Postpartum complications include increased risk of endometritis even when antibiotics are administered, post partum hemorrhage, thromboembolism, prolonged hospital stay and increase in depressive symptoms. Overweight women are twice as likely to report depression compared to women of normal weight.

Breast feeding offers multiple benefits to both infant and mother. There is a correlation between postpartum weight loss and duration of breast feeding. However, morbidly obese mothers are less likely to breast feed. Obese women have a lower rate of lactation initiation and also are more likely to terminate breastfeeding early. The causes are unknown but may be related to socio-cultural factors, physical limitations, and psychological factors. The onset of lactogenesis may be delayed so it is important to offer education and support to these women who desire to breastfeed.

## Bariatric Surgery

Many obstetric patients have a history of prior bariatric surgery. It is important to determine which type—malabsorptive vs. restrictive. Both procedures may result in deficiencies of iron, B12, folate and calcium. These levels should be followed throughout pregnancy and replaced as necessary. Several studies have looked at pregnancy outcomes in patients with a his-

tory of bariatric surgery. They continue to have higher rates of cesarean delivery. The risk for pregnancy induced hypertension and diabetes occurs less frequently in women following bariatric surgery. There are no differences in perinatal outcome. All women undergoing bariatric surgery should delay pregnancy for 12-18 months following the procedure during the rapid weight loss phase.

## Long-Term Sequelae

More evidence is gathering which suggests the infant of an obese mother has long-term sequelae that are a direct result of the altered in utero environment in which the fetus develops. Specifically, the risks of childhood and adolescent obesity are significantly higher when infants are born to obese mothers. This risk is independent of maternal diabetes and socioeconomic status. The risk of adolescent metabolic syndrome is at least twice as high when infants are born to an obese mother in comparison to normal BMI control mothers. Significant research is being conducted to determine the effect of fetal programming on adult disease.

The obesity epidemic is affecting all areas of medicine, not just obstetrics. As primary care providers, we have a responsibility to address the overwhelming health consequences of obesity with our patients. Encouraging long-term weight loss through diet and exercise is the ultimate goal. However, this is not attained by many women and other options should be considered. Bariatric surgery should be discussed with patients who are morbidly (class III) obese. If significant other comorbidities exist, bariatric surgery can be considered for patients with a BMI >30. Surgical options are increasingly covered by private insurance, Medicaid and Iowa Care programs. Both malabsorptive and restrictive procedures have shown promising long-term success rates. Increasing safety data for pregnancies following bariatric surgery is becoming available. Many, but not all, of the pregnancy risk factors associated with obesity are improved following surgical weight loss procedures. Although the surgeries are not without risk, these risks can be balanced with the health benefits of significant weight loss.

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## BMI Information Sheet

Body Mass Index (BMI) – this is calculated by using both your height and weight

Normal BMI is less than 25

Overweight is 25-29.9

Obese is greater than 30

Class 1 obesity is a BMI 30-34.9

Class 2 obesity is a BMI 35-39.9

Class 3 obesity is a BMI greater than 40

**Your current BMI is \_\_\_\_\_**

Obesity is associated with early and recurrent miscarriage. Obese women who conceive with IVF have an increased rate of spontaneous loss.

**Fetal risks associated with obesity** : Prematurity, stillbirth, neural tube defects and macrosomia (large fetal size) as well as other birth defects such as omphalocele (abdominal wall defect) and heart defects. Some of these risks may be related to metabolic abnormalities such as elevated levels of insulin. Large babies are at risk for adolescent obesity, metabolic syndrome (diabetes, elevated blood pressure) and type 2 diabetes.

Ultrasound may be less accurate and fetal malformations may be more difficult to diagnose. The fetal heart and spine may be difficult to assess.

**Delivery considerations**: Difficulty estimating fetal weight, difficulty with fetal monitoring, difficulty with emergent cesarean deliveries, and difficulty with patient transfer. IV placement may be difficult and special operating tables may be necessary.

**Obstetric complications** : Increased risk of gestational hypertension, preeclampsia, gestational diabetes, macrosomia and higher rate of cesarean section.

**Operative complications** : Increased rate of excessive blood loss, longer operative times, wound infection, endometritis and anesthetic complications.

VBAC (vaginal birth after cesarean section) – increasing BMI was associated with failed trial of labor based on a recent large study from the MFM Network. The risk of uterine rupture is 5 times greater in the obese population and there is a 2 fold increase in maternal morbidity.

**Your recommended weight gain is \_\_\_\_\_**

We encourage you to continue or start an exercise program daily by doing the following \_\_\_\_\_.

We recommend a nutrition consultation.

We recommend the following additional tests – liver function tests \_\_\_\_\_, sleep study \_\_\_\_\_, EKG \_\_\_\_\_, echo \_\_\_\_\_, other \_\_\_\_\_.

I have read and understand the above risks and recommendations.

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Name

Date

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Witness

Date