

MORBID OBESITY AND ITS IMPLICATIONS ON PREGNANCY

Abstract

Obesity has been defined as excessive body fat that often results in impairment of health and metabolism the worldwide prevalence of obesity has nearly tripled between 1975 and 2016. Rising rate of obesity in women of reproductive age group has negatively impacted both the mother and fetus and pose a challenge for maternal care. This chapter deals with multiple adverse effects of morbid obesity on mother as well as fetal and neonatal adverse effects along with various management options.

Keywords: Obesity, Pathophysiology, Maternal Effects, Fetal Effects, and Management.

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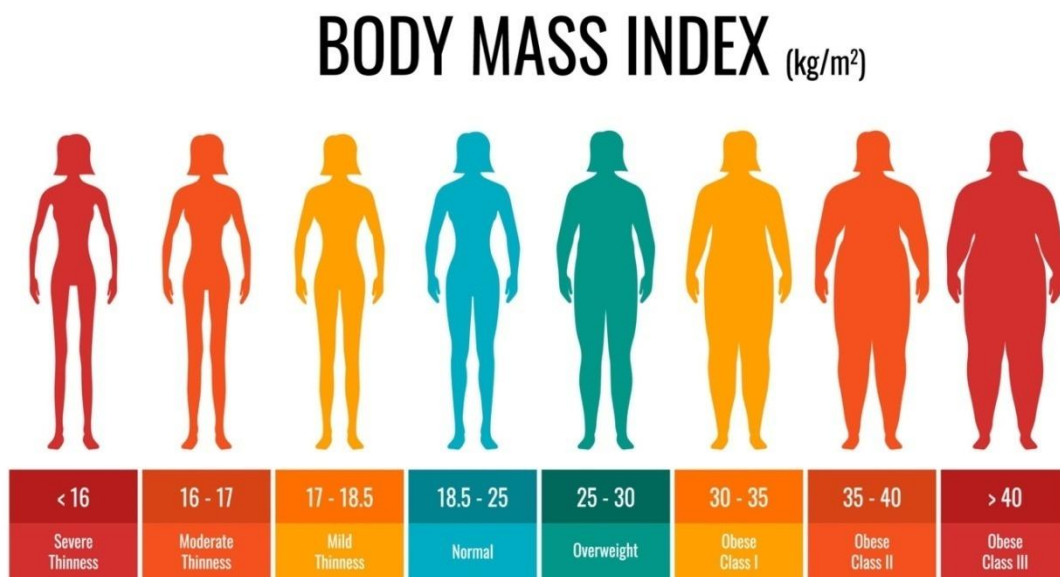
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I. INTRODUCTION

Obesity has been defined as excessive body fat that often results in impairment of health and metabolism. A body mass index (BMI) of greater than 25 is considered overweight while obesity is classified when BMI is greater than 30. Obesity is was declared “a major public health problem” in 2000¹. The prevalence of obesity throughout the globe has increased almost three times between 1975 and 2016. WHO had estimated in 2016 that 39% of adults aged above 18 years (39% males and 40% females) were overweight and 13% were obese which is nearly around 650 million adults worldwide² of these 300 million being women.

In the United States, more than 30% of women belonging to reproductive age group are obese^{3,4}. As per the national family health survey-5NFHS-5 data (2019-21), 23% of females and 22.1% of males belong to overweight category in India. While 40% of women and 12% of men are abdominally obese in the country⁵. Rising rate of obesity in women of reproductive age group has negatively impacted both the mother and fetus and pose a challenge for maternal care. One in five women in the UK is obese and about 40% females in India have a waist circumference above the prescribed upper limit for abdominal obesity⁵. Obesity has a negative impact on fertility and is the cause for increased incidences of congenital malformations and early trimester abortions.

Obesity	BMI (kg/m ²)
Class I	≥30 to <35
Class II	≥35 to <40
Class III (morbid obesity)	≥40
Class IV (super obesity)	≥50



II. PATHOPHYSIOLOGY

Excessive adipose tissue in obesity functions as an endocrine tissue. Excess adipose tissue is also associated with inflammation and linked to insulin resistance and cardiovascular diseases. Obese females have higher levels of C-reactive protein (CRP) and interleukin -6 (IL-6)⁶. High CRP levels have shown to cause abnormal endothelial function and altered insulin sensitivity. Hence, inflammation caused by obesity may be a cause of elevated risk of pre-eclampsia, gestational diabetes and thromboembolism in pregnancy⁷. Maternal serum leptin is secreted by adipose tissue and is elevated in obese women. These increased leptin levels lead to placental tissue ischemia and endothelial dysfunction.



Figure 1⁸: Effects of Obesity

III. MATERNAL EFFECTS

1. Antepartum:

- **Pre-Eclampsia:** There is a 2-3 times greater risk of pregnancy induced hypertension (PIH) in females with obesity. Insulin resistance, endothelial cell activation, dyslipidemia and raised cytokines have been implicated as link between obesity and high blood pressure⁹. A study stated that pre-eclampsia risk doubles with every 5kg/m² increase in BMI¹⁰.
- **GDM:** Maternal obesity is a direct cause that increases risk of developing GDM with an odds ratio (OR) of 2.1 in overweight females, 3.6 in obese females and 8.6 in severely obese females.¹¹

Interpregnancy weight alteration is important in subsequent occurrence of GDM a gain in BMI of 1-2 kg/m² between two pregnancies has been shown to increase the risk of GDM by 20-40%¹². Obese females with GDM have greater likelihood to require insulin for adequate blood sugar control.

- **Thromboembolism:** Maternal obesity has four times greater risk of venous thromboembolism compared to non-obese counterparts with maximum risk being in the post-partum period. RCOG recommends that all females with class 3 obesity (BMI ≥ 40) should be considered for prophylactic LMWH for 10 days immediately postpartum¹³.
- **Cardiovascular:** Maternal obesity is seen to increase the incidence of peripartum cardiomyopathy. Leptin has a role in vascular dysfunction leading to cardiovascular compromise and leads to transition to a chronic nonischemic cardiomyopathy¹⁴.
- **Metabolic Syndrome of Pregnancy:** Obese females have a greater proportion of saturated subcutaneous fat and have a tendency to accumulate greater amount of fat centrally than lean women. Central obesity is linked with abnormal metabolic outcomes including gestational hypertension, pre-eclampsia and GDM. In normal pregnancy, initially insulin secretion increases without much change in insulin sensitivity. Later on, insulin mediated glucose utilization is decreased thus increasing insulin secretion by several times.

In pregnant females with obesity, there is of fasting hypoglycemia in early pregnancy along with an elevation in peripheral and hepatic insulin resistance. Also, in obesity there is a chronic low-grade inflammation state which causes increase in insulin resistance and hence a lower threshold to develop metabolic syndrome than their lean counterparts¹⁵.

- **Respiratory:** Obesity accentuates the effect of increased intra-abdominal pressure and reduction in lung volumes associated with pregnancy.

The incidence of obstructive sleep apnea (OSA) is higher in obese females. It is recommended that all women with greater than class III obesity should undergo screening for OSA before conceiving. Pregnant women with have greater tendency to develop pre-eclampsia, cardiomyopathy and pulmonary embolism¹⁶.

- **Endocrinology:** Maternal obesity is a major risk factor for development of gestational diabetes mellitus. Vitamin D deficiency is also more common in obese females and pre-pregnancy obesity is linked with both maternal and neonatal vitamin D deficiency¹⁷. It is reported that about 60% of women with obesity have vitamin D deficiency as compared to 35% of normal weight females¹⁸. Hypovitaminosis D is linked to increased risk of developing pre-eclampsia, worsening glucose tolerance, low birth weight and increased cesarean section rates¹⁹.

- **Gestational Weight Gain:** Around 40-50% of obese females gain greater than the recommended weight during pregnancy and this serves as a risk factor for postpartum weight retention and metabolic dysfunction. The Institute of medicine (IOM) recommends a net weight gain of 11-20lbs for all obese females during pregnancy²⁰.

Limited weight gain may be beneficial in reducing risk of cesarean section and postpartum weight retention but there is also known risk of SGA infants. Hence it is better to determine BMI at patients initial most prenatal visit with targeted counseling regarding recommendations for weight gain.

- **Antenatal Ultrasound and Fetal Well Being Assessment:** Ultrasound detection of congenital anomalies has a lower sensitivity in obese women. Also due to increased volume of distribution, cell free fetal DNA screening has a greater likelihood to be indeterminate.

A detailed second trimester ultrasound for all obese patients with additional techniques like transvaginal ultrasound or probe placement over the umbilicus is recommended²¹.

MRI can be employed for patients with obesity but due to limited availability and high cost it is routinely not offered²².

Leopold maneuvers and vaginal examination may be inaccurate when assessing fetal presentation in obese pregnant females making ultrasound necessary in such situations.

Localization and tracing of fetal heart rate with external fetal monitor may be inadequate in obesity. Recently GE Monica Novii Wireless Patch system has shown promising results in improving fetal heart tracings in obese women²³.



2. Intrapartum:

- **Prolonged Labour:** Obesity is associated with an increased need for induction of labor, prolonged labor, increased chances for need of ARM, shoulder dystocia, postpartum hemorrhage and increased cesarean section rate. Rate of successful VBAC is also much lower in obese women²⁴.
- **Anaesthetic Considerations:** Obesity is a well-known risk factor with induction of general anesthesia due to edema of epiglottis and also there is difficulty in gaining venous access. Difficult epidural anesthesia with increased chances of epidural failure. Incidence of failed regional anesthesia in super obese population is around 12-17%²⁵ Intraoperative BP monitoring, patient positioning and post operative analgesia is also a matter of concern in obese women.
- **Cesarean Section:** Almost 50% of super obese females undergo cesarean section while the rate in women with BMI 40-49.9 kg/m² is 43% and in those with BMI between 30-39.9kg/m² is 33%.²⁶ Prophylactic antibiotics are generally recommended in higher doses for obese women as it has been shown that the BMI of patient is inversely proportional to concentration of cefazolin in adipose tissue at the time of skin incision²⁷.

Skin preparation of maternal abdomen is recommended with ≥ 2 chlorhexidine-alcohol swabs. NICE recommends that all women having a cesarean section with subcutaneous fat measuring greater than 2cm should have suturing of fat prior to closure of skin to reduce risk of wound infection and wound separation²⁸. Cesarean section can be associated with hemodynamic instability and massive hemorrhage.

3. Postpartum:

- **General:** It includes safe transfer, repositioning, hygiene maintenance etc. Patients must be encouraged to mobilize early and frequent ambulation to minimize risk of thromboembolism. Impaired wound healing with higher rates of wound infection has been seen more commonly in women with obesity. There is a 30-50% greater risk of wound complications in females with BMI>50kg/m².
- **Bleeding Risk:** Obesity increase the risk of postpartum bleeding irrespective of the mode of delivery. Prophylactic use of uterotonics in such patients can be considered^{29,30}.
- **VTE:** Pregnancy itself being a hypercoagulable state is a known risk factor for venous thromboembolism and that topped with obesity further accentuates the risk with an OR 5.3 in women with BMI> 30kg/m².³¹

ACOG has recommended mechanical compression devices and pharmacological thromboprophylaxis in females with additional risk factors like known thrombophilia or prior VTE events³².

The ACCP guidelines and recommendations are based on Caprini score which is a risk assessment tool that includes swollen legs, smoking, diabetes, BMI > 25kg/m², blood transfusion and duration of surgery greater than 45 minutes, patient confinement to bed for more than 72 hours, etc³³. A score of ≥ 5 warrants use of mechanical compression devices and pharmacological thromboprophylaxis in combination.

- **Breastfeeding:** Breastfeeding helps in decreasing the risk of developing obesity and diabetes in the offspring and also aids in post-partum weight loss. The overall risk of metabolic syndrome, ovarian and breast cancer also decreases in mother³⁴.

Obesity often leads to decreased rates of breastfeeding and particularly delayed stage II lactogenesis. The likely cause being elevated baseline progesterone levels in obese women, difficult positioning and impaired prolactin response to neonatal suckling³⁵.

- **Contraception:** Contraceptive counselling is an important component of antenatal care in obese women with emphasis on long-acting reversible contraception (LARC) Estrogen containing contraceptives have an added risk of VTE in obese women and hence are not recommended. Obese females have a 24 times higher chances of VTE when using combined hormonal contraceptives³⁶.

The US CDC and MEC for contraceptive use have categorized combined hormonal contraception as category 2 after 6 weeks of delivery in obese females without any risk factors for VTE and cardiovascular disease^{36,37} Non hormonal or progestin only methods are considered safe in obesity (MEC 1) LARC methods (IUD, Nexplanon) are recommended as first line contraception by ACOG^{36,37}

IV. FETAL EFFECTS

1. **Abortions:** Obese females have an elevated chance of spontaneous abortion and recurrent miscarriages³⁸. Risk of abortion increases by 30% with a BMI of >30³⁹.
2. **Fetal Anomalies:** Maternal obesity is seen to elevate the risk of neural tube defects (NTD), orofacial abnormalities, cardiac abnormalities and limb reduction defects in neonates^{39,40}. A study conducted by Watkins et al showed that each excess BMI of 1kg/m² resulted in a 7% increased risk of NTD⁴¹. This may be related to decreased folic acid levels reaching the fetus due to decreased maternal absorption. Obese females have an increased chances of having babies with congenital heart defects (CHD) like TOF, septal defects, TGA etc. There is also an increased risk of diaphragmatic hernia⁴²
3. **Growth Abnormalities:** Obesity prior to conception increases risk for large for gestational age infants as well as macrosomia in fetus⁴³. Evidence have shown that severe FGR is also common in obese females and umbilical artery doppler abnormalities are more common to occur with increasing body mass index⁴⁴.
4. **Macrosomia:** Fetuses of obese females are 2-4 times more prone to be large for gestational age with higher percentage of body fat⁴⁵. Macrosomia eventually increases the

incidence of shoulder dystocia, risk of injuries due to difficult delivery and low Apgar score and arterial pH at birth.

- 5. Preterm Delivery:** Obesity in pregnancy is associated with elevated risk of preterm delivery⁴³
- 6. Stillbirth and NICU Admission:** Late and unexplained fetal demise is seen more in fetuses of obese mothers. Women with a BMI ≥ 50 have 5.7 times higher risk of stillbirth compared to normal BMI women at 39 weeks gestation and 13.6 times risk at 41 weeks⁴⁶. Rate of NICU admissions are also 3.5 times higher in babies born to obese mothers³⁵.

V. MANAGEMENT

- 1. First Line Intervention:** education and advice on diet and exercise. It is done at individual level including an MDT approach that involves a dietician and at population level via the role of public health education. Creating awareness about general principles regarding healthy eating and physical exercise as well as diet and activities in pregnancy and period after delivery. Role of government and initiatives like healthy food vouchers and taxes on sugar containing food items.
- 2. Second Line Intervention:** anti-obesity drugs or surgery.

Three main category of anti-obesity drugs used in non-pregnant females;

- **Orlistat:** inhibits intestinal fat absorption
- **Sibutramine:** reduces oral intake
- **Ephedrine:** increases thermogenesis and metabolic rate

Metformin helps in weight reduction by increasing insulin sensitivity in peripheral tissues. Metformin and orlistat are US FDA category B drugs for use in pregnancy⁴⁷.

Bariatric surgery is offered to females with severe obesity who fail to respond to non-surgical methods^{48,49}. Recommendations are to wait for period of 1 year to 18 months after bariatric surgery before conceiving. Post bariatric surgery women will require nutritionist care in pregnancy as bypass surgery results in deficiencies of micro-nutrients like iron, folic acid, vitamin B12, vitamin K etc. Pregnancy also increases the risk of intestinal obstruction in these patients.

VI. KEY POINTS

- Obesity is a global health problem and has significant effects on females of reproductive age group
- It is important to have a careful antenatal planning as obesity is associated with elevated maternal, fetal and neonatal risks.
- Pre-conception education and counselling along with proper care throughout pregnancy and post delivery period is key to successful pregnancy outcomes for both mother and child.

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