The impact of obesity on obstetric outcomes

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Body mass index; Complications Caesarean section; Macrosomia; Venous thromboembolism; Wound infection

Summary
The incidence of obesity (body mass index (BMI) > 30 in the first trimester) is increasing in the UK pregnant population and with it the risks such patients present in their obstetric care. Clinical assessment of fetal growth can be difficult and associated problems of increased risks of pregnancy complications are found: diabetes, hypertension, venous thromboembolism. Caesarean section rates are increased as are complications during and following operative procedures. Greater efforts need to be made to encourage weight loss to within normal BMI ranges to endeavour to reduce these risks in subsequent pregnancies in all obese pregnant women.

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Introduction
Obesity, which is more common in females than in males, has been seen as a problem of predominantly middle-aged and older people. However, in the UK there is an increasing rate of obesity in all age groups, but especially in childhood and adolescents, with a correspondingly greater number of obese women of childbearing age. In women, this has a significant impact on reproductive performance both in terms of infertility and early pregnancy complications. Obese women have a tendency for the development of obstetric complications and obesity is itself a risk factor in pregnancy.

In non-pregnant individuals the most common definition of obesity is in terms of body mass index (BMI). This takes into account both body weight (in kg or stones) and also height (metres or feet and inches). The BMI is calculated from the formula:

$$\text{BMI} = \frac{\text{weight}}{\text{height}^2}$$

It is expressed as a number, the greater the BMI, the more obese the individual. In terms of BMI there is a recognised definition of normal weight, overweight, obese and clinically obese (Table 1). However, the charts for calculating BMI are related to non-pregnant women. In obstetrics, the definition of obesity is unclear and there is no clear consensus view. Some studies use a cut-off maternal weight of 90 kg,\textsuperscript{1} other definitions include 'at least 250 pounds'\textsuperscript{2} during pregnancy, weight 150–204 lb\textsuperscript{3} in non-pregnancy, or pre pregnancy BMI > 29. For consistency with other areas of medicine, we advocate the use of BMI rather than absolute weight.

If pre-pregnancy BMI is unknown it should be calculated at a patient’s booking visit with the midwife or obstetrician in the first trimester of pregnancy, as little weight is gained during this time.
If BMI were to be calculated solely in the third trimester, a significant number of pregnant women would be defined, perhaps incorrectly, as morbidly obese (BMI > 35).

It is advisable that all obese pregnant women should be referred to a dietician in early pregnancy for advice. A few studies have stressed the importance of increasing BMI on the primary Caesarean section rate, and have suggested the importance of optimising pre pregnancy weight to reduce the risk of Caesarean section. However, there is little evidence to suggest that a calorie-controlled weight-loss diet is of any benefit during the pregnancy to try and achieve significant weight loss. One can have concerns about excessive dietary restrictions in pregnant women and its effect on fetal growth. Weight loss thus needs to be tackled before or between pregnancies.

Complications in obstetrics

Complications can be divided into those related to an increased body mass and also in terms of diseases related to obesity. Morbid obesity increases both the need for obstetric intervention and makes intervention more complicated, with a higher risk of morbidity and mortality than in women of a normal pre-pregnancy BMI.

Directly related to body mass index

Obesity is associated with irregular menstruation with longer cycles, often making the expected date of delivery unsure. This is compounded by the fact that vaginal examination to assess uterine size is notoriously inaccurate in overweight individuals. Ultrasound examination of the fetus, both in terms of vaginal and especially abdominal ultrasound is also more difficult in obese women and it might be more difficult to detect structural fetal abnormalities. In addition, it is technically more challenging to perform invasive prenatal diagnostic tests such as chorionic villus sampling and amniocentesis, and the risks of miscarriage are increased three-fold in the obese. In terms of amniocentesis, ‘difficult procedures’, post-amniocentesis amniotic fluid leak and fetal loss were significantly higher in women with an increased BMI than in a control group.

In late pregnancy, obesity makes abdominal palpation to determine the lie and presentation of the fetus more difficult. As assessment of the fetal size by the measurement of symphysisal fundal height is much less accurate than in women with a normal pre-pregnancy BMI, early detection of reduced uterine size and intrauterine growth retardation (IUGR) might be compromised.

Complications due to obesity

These include such serious conditions as pre-existing diabetes and the development of gestational diabetes during pregnancy. Further complications include pre-existing hypertension and ischaemic heart disease, and an increased risk to develop pregnancy induced hypertension in multiparous women.

The above complications increase the likelihood of a morbidly obese woman having had a previous Caesarean section. It is also well recognised that morbid obese women have a higher rate of Caesarean section (Box 1) per se.

Problems in labour

There is evidence that morbidly obese women have a tendency to post-maturity, with a resulting increase in the rate of induction of labour. In addition, it might be difficult to perform external fetal heart rate monitoring due to the increased layer of adipose tissue between the external

<table>
<thead>
<tr>
<th>Table 1</th>
<th>World Health Organization classification of normal and abnormal body weight using body mass index (BMI).</th>
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</thead>
<tbody>
<tr>
<td>BMI</td>
<td>Class</td>
</tr>
<tr>
<td>18.5–24.9</td>
<td>Ideal BMI</td>
</tr>
<tr>
<td>25–29.9</td>
<td>Class 1: overweight</td>
</tr>
<tr>
<td>30–39</td>
<td>Class 2: obese</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>Class 3: grossly obese</td>
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</tbody>
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Box 1 Antenatal problems in obese women.
Pre-existing complications:
- insulin dependant diabetes
- hypertension
- ischaemic heart disease
- polycystic ovary syndrome

Antenatal complications
- difficulty with ultrasound scanning
- dating scan
- anomaly scan

Pre-natal diagnosis
- chorionic villus sampling
- amniocentesis

Antenatal assessment
- difficulty with assessment of fetal growth
- fetal lie and presentation determination

Pregnancy complications:
- gestational diabetes
- pregnancy-induced hypertension
- fetal macrosomia
- prolonged pregnancy
- CTG monitoring
- increased risk of stillbirth
transducer and the fetus. This problem could perhaps be reduced by the use of fetal scalp electrodes once the woman is in established labour and the membranes have ruptured. In a recent study, the rate of Caesarean section for failure to progress or for the diagnosis of cephalopelvic disproportion, was six-fold higher in women with a BMI >30 than in women with a BMI <20. This higher rate of Caesarean section is also present in obese women (pre-pregnancy BMI >29), who were considered to be a low-risk population.

Caesarean section is more of a technical challenge in those who are morbidly obese, especially in terms of exposing the lower uterine segment and further difficulties arise should there be a uterine angle extension. In women with a normal BMI, it is usually possible to exteriorise the uterus to identify the angles and suture them to obtain haemostasis, this can be more difficult in women with obesity and a midline incision might often be indicated.

The panniculus (which might weigh 70 kg), can make exteriorisation difficult, if not impossible; therefore the suturing is more difficult and a higher morbidity is associated with this. This might in part explain why the duration of Caesarean section in the obese is longer than in control women. Other technical problems can be encountered: transfer of the patient to operating tables (particularly if the woman has already had an effective epidural) and the need for special operating tables in the grossly obese.

Further problems occur in women requiring instrumental vaginal delivery. It can be very difficult to assess whether any of the fetal head is palpable abdominally, which is a contraindication to an attempt at instrumental vaginal delivery. Also, vaginal tears and lacerations of the cervix can be much harder to identify and suture due to limited access, an increased vaginal length and vaginal adipose tissue.

There is an increased incidence of fetal macrosomia (birth weight >4 kg) in obese women and, if delivered vaginally, there is an increased risk to the woman of a third-degree tear. With regard to the fetus, trauma is more common, especially brachial plexus injuries, due in part to a higher incidence of shoulder dystocia.

Anaesthetic complications

Morbidly obese women present a challenge to obstetric anaesthetists because of their dimensions. Difficulty with venous access and the increased depth of tissue to the intervertebral space make the establishment of an epidural or spinal for analgesia more difficult; thus the rate of general anaesthesia is higher. Morbidly obese women also have a higher risk of problems with general anaesthesia and a higher rate of episodes of severe hypertension. The rate of general anaesthesia quoted is as high as 62.5% in such women undergoing Caesarean section.3

Postoperative complication after Caesarean section

It is well recognised that postoperative complication rates are significantly higher in emergency operations when compared to elective procedures. It is also established that obese women have a higher rate of emergency intervention. With these two factors combined, it is not surprising that Caesarean section in the morbidly obese causes much higher postoperative morbidity when compared to women with a normal first-trimester BMI.

Wound infections

Surgical techniques to minimise the risk of wound infection include meticulous attention to haemostasis, with ligation of larger vessels and diathermy to smaller bleeding points in the adipose layer. A fat stitch either interrupted or continuous should be used. The use of such sutures has two advantages: to obliterate the dead space and to reduce the tension on the stitches or clips that have been used to close the skin.

Due to the over hanging of the pannus, women are significantly at increased risk of wound infection even if given postoperative prophylactic antibiotics. To reduce the chance of wound infection, some authors have suggested that a midline incision on the abdomen is employed. Due to the increased incidence of wound rupture, and the increased pain on inspiration, which predisposes to chest infection, we do not recommend a midline abdominal approach as a matter of routine.

Both obesity (BMI >30) and diabetes—either pre-pregnancy or gestational—are both associated with significantly higher rates of wound infections; the combined risk is a 9.3-fold increase. The choice of skin closure can also have a bearing. If a subcuticular continuous suture is used, then there should be a problem the whole wound needs to be re-opened and re-sutured. We would therefore recommend an interrupted suture or skin clips on the basis that if a small haematoma or a localised area of infection develops, a few clips/sutures can be removed to aid resolution. Careful wound care from staff is essential to teach the patient appropriate care when she is discharged home to the community.

Chest infection

These are more common in obese women possibly due to problems in early mobilisation and restricted chest movement. It could therefore be considered that patients could benefit from a postoperative course of chest physiotherapy routinely.

Deep venous thrombosis/pulmonary embolism

According to the last Confidential Enquiries into Maternal Deaths Triennial Report 2000–2002, deep venous thrombosis/pulmonary embolism (DVT/PE) is the third most common cause of maternal mortality. Obese women are at significantly increased risk of developing both these complications. To minimise these risks, patients should be given thromboembolic stockings (TEDS), which should be fitted prior to surgery and possibly used for up to 6 weeks after delivery. Also a course of subcuticular enoxiparin should be considered. The normal dose should be increased to 40 units per 24h for 1 week and possibly for 6 weeks. We would advise that patients should be measured for TEDS stockings prior to admission to hospital (Box 2). Antepartum venous thromboembolism is also increased, with an adjusted odds ration of 2.17 (95% CI 1.30–3.63) in moderate obese patients and of 4.13 (95% CI 1.25–13.54) for severely obese patients.
Maternal mortality
Obesity is associated with an increased instance of maternal mortality from a number of different causes. In the most recent confidential enquiries into maternal deaths, 78 (35%) of women who died from either direct or indirect causes had a BMI $\geq 30$. There appears to be a gradient in maternal deaths in that, of the 78 women who died, 20 were classified as morbidly obese (BMI $\geq 35$).

Pregnancy weight and fetal outcome
There is a consensus view that fetal outcome is compromised in those women who are obese when compared to non-obese controls. This might in part be due to diseases associated with obesity. There is also a higher rate of stillbirth in obese women. This could be due to the development of gestational diabetes or to pre-existing diabetes; another reason could be the difficulty in assessing fetal growth. Most commonly, obese women have large babies, although IUGR can occur, especially in women with hypertension. Should IUGR not be detected this would put the fetus at increased risk of morbidity or even still birth. Other possible causes of still birth could be congenital abnormalities not detected in early pregnancy or difficulties in monitoring the fetal heart rate in labour.

Conclusions
Although there is no consensus view of ‘obesity’ during pregnancy, the literature concludes that even after controlling for various confounding variables, such as age and parity, maternal obesity is a high-risk factor, both for the woman and her fetus. These have been confirmed in a recent 17-year population-based cohort study from Canada, which presents an excellent overview.10

The obesity epidemic is of great concern in terms of long-term morbidity and also for the resource implications for the NHS. The cost of provision of obstetric care to those who are obese is increased. In one study it was estimated that the cost is increased five-fold compared to women who are non-obese.9 We would advocate a healthcare promotion to explain that problems of obesity are becoming increasingly more common in the younger age group.

In view of the higher rate of complications of intervention in obese women, it should be considered that the risks of intervention should be discussed in obtaining informed consent from obese women.

Practice points
- Incidence of BMI $\geq 30$ increasing in pregnancy women and needs to be addressed.
- Increased risk of antenatal and post natal venous thromboembolism.
- Caesarean section rates are increased over normal weight women and not just for cephalopelvic disproportion and macrosomia.
- Complications of Caesarean section are increased—anaesthetic, operative access, wound infection.
- Fetal outcome might also be compromised.

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Further reading


