Effects of Obesity on Obstetric Ultrasound Imaging

Loralei L. Thornburg, MD

KEYWORDS

• Ultrasound scan • Obesity • Anatomic evaluation • First-trimester screening • Genetic sonogram • Anomaly • Nuchal translucency

KEY POINTS

- Obesity, especially morbid obesity, limits the ability to complete screening in pregnancy.
- Obese patients are at higher risk for fetal anomalies and failure to detect anomalies before birth than their normal-weight counterparts.
- Birth weight prediction in obese patients by the gestation-adjusted prediction method seems to be accurate and allows evaluation of the fetus at a gestational age when visualization is improved.

INTRODUCTION

Obesity is increasing worldwide, with most of the industrialized world having obesity rates of 20%–30% in the adult population and some selected populations, such as the southern Pacific, reporting obesity rates of 44%–80%.[1,2] Obesity is defined as a body mass index (BMI) of greater than 30 and is generally divided into classes, with class I consisting of BMI of 30.0–34.9 kg/m^2, class II BMI of 35.0–39.9 kg/m^2, and class III BMI of $\geq$40 kg/m^2. Class III has also been called *extreme obesity* and represents body weights 50%–100% higher than ideal.[1,3] According to the World Health Organization, "(obesity) is now so common that it is replacing the more traditional concerns…as one of the most significant contributors to ill health."[1] Weight, age, and parity all tend to increase in concert, and obesity can lead to increase medical concerns; therefore, the obese woman often tends to have additional medical concerns and may be of advanced maternal age.[4,5]

The ability to penetrate an obese patient can be limited in ultrasound scan; therefore, understanding the limitations of visualization in this population is important for the clinician counseling patients regarding their pregnancy risks. Obesity is also a major risk factor for numerous obstetric complications and may limit a clinician's ability to assess the health of the fetus by ultrasound scan.

GENERAL APPROACH TO ULTRASOUND IN THE OBESE PATIENT

There is no question that with increased depth of penetration, there is increased absorption and dispersion of the sound waves, such that the reflected signal is distorted and weakened, resulting in backscatter and an increased noise-to-signal ratio.[6] Therefore, when performing ultrasound scan on the obese patient, the sonographer must take into account the altered habitus and plan accordingly. In general, the sonographer should make an effort to find and use the best acoustic windows for a woman's habitus. Adjusting approaches to improve ultrasound visualization has been suggested, most with little prospective data (**Box 1**). In general, abdominal adiposity tends to cluster centrally below the umbilicus and above pubis, with little at the inferior abdomen, umbilicus, or laterally.[6] Therefore, for some morbidly obese women, visualization may

Disclosures: None.
Conflicts of interest: None.
Division of Maternal Fetal Medicine, Department of OB/GYN, University of Rochester Medical Center, University of Rochester, 601 Elmwood Avenue Box 668, Rochester, NY 14642, USA
E-mail address: Loralei_thornburg@urmc.rochester.edu

Ultrasound Clin 8 (2013) 39–47
http://dx.doi.org/10.1016/j.cult.2012.08.013
1556-858X/13/$ – see front matter

Box 1
Tips for scanning obese patients to improve visualization

- Use of the lateral, inferior, or periumbilical regions, because abdominal adiposity tends to cluster centrally below the umbilicus and above pubis
- Retraction of skin apron to allow visualization within the superpubic fold
- Rolling patient onto her side
- Making use of the iliac fossa
- Use of a narrow probe or even the transvaginal probe within a deep umbilicus
- Use of the maternal bladder as a window and to raise the uterus out of the pelvis
- Combined transvaginal/transabdominal approach with the transvaginal probe used to elevate the uterus out of the pelvis, and the transabdominal approach to visualize the fetus
- Upright scanning with the patient sitting to displace adipose inferiorly
- Transvaginal assessment for those fetal parts near the cervix
- Use of harmonic imaging, spatial compounding, and speckle reduction filters

Data from Paladini D. Sonography in obese and overweight pregnant women: clinical, medicolegal and technical issues. Ultrasound Obstet Gynecol 2009;33:720–9; Bromley B, Shipp TD, Mitchell, et al. Tricks for obtaining a nuchal translucency measurement on the fetus in a difficult position. J Ultrasound Med 2010;29:1261–4; Thornburg LL. Antepartum obstetrical complications associated with obesity. Semin Perinatol 2011;35:317–23.

be best underneath the pannus at the pubis, whereas for others, the skin apron may be relaxed and inferiorly displaced enough that the depth of penetration is actually better above the fold. If an under-the-pannus approach is taken, the sonographer may need to request help from the patient or family in holding or retracting her abdomen to allow hand movements once within the fold. Additionally, care should be taken to fully dry this area after completion, because it is prone to breakdown with increased wetness. Rolling a patient onto her side may improve visualization (**Fig. 1**), as can using the iliac fossa, which generally also has less adipose tissue (**Fig. 2**). Prior abdominal scarring from cesarean delivery or multiple gestation, both more frequent in obese patients, can also decrease visualization.[4,6]

For some women, the umbilicus may provide a window, and a narrow probe or even transvaginal probe within a deep umbilicus may improve visualization. However, the angles and mobility of the probe are limited. Using the maternal bladder as a window is critical, especially in the first trimester, and in later pregnancy, a full bladder may serve to raise the uterus out of the pelvis and move the fetal target closer to the surface of the maternal abdomen.[6] Other suggested strategies include combining transvaginal/transabdominal approach, using the transvaginal probe to elevate the uterus out of the pelvis, and the transabdominal approach to visualize the fetus.[7] Upright scanning with the patient sitting may further displace the adipose inferiorly and provide acoustic windows, and for those fetal parts that are near the cervix, transvaginal assessment may also be valuable.[8]

Visualization may be limited even with the best equipment, and scanning of the obese patient can represent a physical challenge to the sonographer, with the literature suggesting that scanning obese patients contributes to injury.[9,10] Making sure that the physical environment is not contributing to sonographer burden is important (**Box 2**), and ideally alterations should include higher stools and high-rated, motorized patient beds so that patients can be easily positioned and repositioned as the scan proceeds. If patients lack mobility, ultrasound scans can be performed in motorized wheelchairs and scooters, especially if these can be reclined, to avoid staff having to transfer patients. If a transvaginal approach is used, the weight rating of the bed should be checked against the patient weight, because if a morbidly obese patient is placed in stirrups on an unbolted, underrated bed, weight readjustment can cause the bed to tip. The larger the patient, the pressure a sonographer will have to apply over likely a prolonged period of time is higher, and this prolonged orthopedic strain likely increases the risk for injury.[6,9,10] Therefore, sonographers may need to adjust their body position frequently or, in the case of particularly long ultrasound examinations, such as an anatomic survey in twins on a morbidly obese patient, change operators midway through the examination.

Ultrasound equipment should have optimized obesity and penetration settings to aid in completing scans more comfortably and quickly, which may help reduce the risks of sonographer injury because of needing to use less pressure and time to adequately visualize. Harmonic imaging (**Figs. 3** and **4**) and spatial compounding and speckle reduction filters can markedly improve the visualization in these women and should be