OBSTETRICS

The influence of maternal body mass index on fetal weight estimation in twin pregnancy

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OBJECTIVE: Sonographic estimated fetal weight (EFW) is important in the management of high-risk pregnancies. The possibility that increased maternal body mass index (BMI) adversely affects EFW assessments in twin pregnancies is controversial. The aim of this study was to investigate the effect of maternal BMI on the accuracy of EFW assessments in twin gestations prospectively recruited for the ESPRiT (Evaluation of Sonographic Predictors of Restricted growth in Twins) study.

STUDY DESIGN: One thousand one twin pair pregnancies were recruited. After exclusion, BMI, birthweights, and ultrasound determination of EFW (within 2 weeks of delivery) were available for 943 twin pairs. The accuracy of EFW determination was defined as the difference between EFW and actual birthweight for either twin (absolute difference and percent difference). Cells with less than 5% of the population were combined for analysis resulting in the following 3 maternal categories: (1) normal/underweight, (2) overweight, and (3) obese/extremely obese.

RESULTS: Analysis of the 3 categories revealed mean absolute variation values of 184 g (8.0%) in the normal/underweight group (n = 531), 196 g (8.5%) in the overweight group (n = 278), and 206 g (8.6%) in the obese/extremely obese group (n = 134) ($P = .028$, which was nonsignificant after adjustment for multiple testing). Regression analysis showed no linear or log-linear relationship between BMI and the accuracy of EFW (P value for absolute difference = .11, P value for percentage difference = .27).

CONCLUSION: Contrary to a commonly held clinical impression, increasing maternal BMI has no significant impact on the accuracy of EFW in twin pregnancy.

Key words: body mass index, estimated fetal weight, sonographic fetal weight, twin pregnancy

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Obesity and multiple pregnancy are 2 factors that carry the potential to increase the complexity of obstetric care, both in isolation and in combination. Obesity is a major public health problem, affecting an estimated 300 million women worldwide.[1] More than 50% of women of childbearing age in the United States[2] and more than 40% of women in an Irish obstetric population are overweight or obese.[3]

As a separate but somewhat related matter, the prevalence of multiple pregnancies is also increasing, secondary to assisted reproductive techniques, advancing maternal age, and other factors.[4] Twin pregnancies now account for 3% of all live births in the United States.[5] Although many factors have contributed to this, it is now apparent that maternal body mass index (BMI) may also have an influence on the rising prevalence of twin pregnancies. Reddy et al[6] reported that a maternal BMI of 30 kg/m^2 or greater was associated with dizygotic twinning, and there is evidence that mothers of dizygotic twins had a higher prepregnancy BMI than mothers of monozygotic twins.[6,7]

Sonographic estimated fetal weights (EFWs) are commonly considered in the management of twin pregnancies,

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particularly when planning obstetric interventions. There are many different formulae utilized to estimate fetal weight, using 1 or a number of fetal biometric measurements.[8,9] Although the reliability of whatever method used is critical to decision making, it is clear that there are other clinical factors, such as gestation,[10] fetal presentation,[11] fetal growth centile,[12] and maternal body habitus,[13] which may influence the predictive accuracy of the measurements obtained.

In relation to maternal body habitus, the accuracy of ultrasound assessment of the fetus in women of high BMI is controversial. There are published reports outlining that both for detection of the anomalous fetus[13,14] and for sonographic EFW,[15] increased maternal BMI is associated with decreased accuracy. There are other studies that have concluded that maternal obesity does not alter or decrease the accuracy of sonographic EFWs.[16-18]

Most of these studies and the majority of data on the accuracy of sonographic EFW pertain to singleton pregnancies. However, for multiple pregnancies, the potential impact of increased BMI on sonographic EFW is important because of the recent increased prevalence of both twin gestations[19] and obesity[1] in the developed world. One study by Gandhi et al[20] has previously addressed the issue of maternal BMI and EFW in twin pregnancy. Using a chart review, Gandhi et al[20] analyzed the EFWs made within 6 days of delivery for 194 patients with twin pregnancies and concluded that increasing maternal obesity reduced the accuracy of sonographically determined weights in twin gestations, particularly so for the second twin.

The aim of this study was to investigate the effect of maternal BMI on the accuracy of EFW assessments in twin gestations prospectively recruited for the ESPRiT (Evaluation of Sonographic Predictors of Restricted growth in Twins) study, carried out by the Perinatal Ireland consortium.[21]

Materials and Methods

Perinatal Ireland is a multicenter research network involving leading maternal fetal medicine specialists at 8 academic perinatal centers in Ireland, which encompasses a total delivery population of 50,000 per annum. The prospective ESPRiT study was conducted at these centers between May 2007 and October 2009. Institutional review board approval was obtained at each participating site, and the study participants gave written informed consent.

Participants were enrolled between 11 and 22 weeks' gestation, and their BMI was recorded at the first antenatal visit. Chorionicity was assigned at the first ultrasound examination and subsequently confirmed postnatally with pathological examination. EFW assessments were performed at 2-week intervals from 16 weeks on the monochrorionic diamniotic twins, and from 24 weeks on the dichorionic twin pairs, using the composite of 4 parameters (Hadlock formula): abdominal circumference, biparietal diameter, head circumference, and femur length. Umbilical artery Doppler ultrasound measurements were also taken by dedicated research ultrasonographers, and standardized ultrasound equipment (GE Voluson Expert 730; GE Healthcare, Cleveland, OH) was used in all centers. All prenatal and ultrasound data were contemporaneously transferred to an ultrasound software system (Viewpoint; MDI Viewpoint, Jacksonville, FL) and uploaded onto a live Web-based central consolidated database. Ultrasonographers' images and Doppler traces underwent regular quality review by a central ultrasonography quality assurance committee.

Comparisons were made between the EFWs observed at the last available ultrasound examination (within 2 weeks of delivery) and the actual birthweights (BWs) recorded. The accuracy of EFW determination was defined as the difference between EFW and actual BW for both twins (absolute difference and percentage difference). Regression analysis was used to model the data and the data were log transformed to meet normality assumptions. The χ^2 test was used for categorizations of BMI. The Wilcoxon rank-sum test was used to determine statistical significance of nonnormally distributed data.

A linear regression analysis was performed to evaluate the accuracy of prediction across the following 5 BMI categories: underweight (BMI of <18.50 kg/m^2); normal weight (BMI of 18.50-24.99 kg/m^2); overweight (BMI of ≥ 25.00 kg/m^2); obese (class I; BMI of 30.00-34.99 kg/m^2 and class II; BMI of 35.00-39.99 kg/m^2); and extremely obese (class III; BMI of ≥ 40.00 kg/m^2).[22]

The mean absolute difference was defined as the absolute value of BW minus the EFW. The mean percentage difference was defined as the absolute difference divided by the BW. The difference between the actual BW and the EFW was calculated as a percentage of the actual BW.

A separate analysis of mean absolute variations in BW was compared between 3 different BMI groups as follows: group 1 included women who were underweight combined with women of normal BMI; group 2 included women in the overweight BMI category; and group 3 included women in the obese and extremely obese BMI categories. This arrangement of groups was determined so that individual BMI categories that contained less than 5% of the population (namely the underweight and extremely obese categories) were combined with other categories to enhance the accuracy of observed associations. A significance level of 2.5% was used to account for multiple testing (Bonferroni adjustment).

Results

One thousand one twin pregnancies recruited, of which 58 were excluded from analysis because of miscarriage, stillbirth, or unavailable data. The data from the remaining 943 twin pairs were analyzed. Seven hundred sixty four (81%) were dichorionic and 179 (19%) were monochorionic. There was no relationship between maternal BMI and chorionicity; the median BMI for the monochorionic twins was 24.4 (n= 1 79), and the median BMI for the dichorionic twins was 24.4 (n = 764) ($P = .869$).

The mean maternal age was 33 years (SD, 5.3 years; range, 14−47 years). The mean gestation at delivery was 36 weeks