Prenatal Sonographic Prediction of Twin Growth Discordance

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Our aim was to evaluate the ability of prenatal ultrasound scans to predict fetal growth discordance, and to examine the correlation between fetal weight estimated by ultrasound with actual birthweight in twin pregnancies. The study consisted of 221 twin pregnancies with ultrasound fetal weight estimates based on Hadlock's 4 parameter formula. Prediction of intertwin birthweight discordance was examined at 4 different intervals between ultrasound examination and delivery (0–7 days, n = 96; 8–14 days, n = 66; 15–21 days, n = 58; 22–28 days, n = 59 pregnancies), with a total of 279 ultrasound examinations. Birthweight discordance was considered as a difference of 20% or greater. The correlation between fetal weight estimated between 0 and 7 days and actual birthweight was calculated by intraclass correlation coefficient. The predictive values for intertwin discordance of 20% or more in the 0 to 7 days group were: sensitivity = 93.6%, specificity = 79.4%, positive predictive value = 89.2%, negative predictive value = 87.1% and accuracy = 88.6%. In the groups with scans carried out between 8 and 14 days, 15 and 21 days, and 22 and 28 days, the sensitivity and accuracy values were 95.8% and 84.9%, 95.6% and 84.5%, 90.9% and 84.8%, respectively. Fetal growth discordance in twins can be accurately predicted by ultrasound examination performed up to 28 days before birth. There is a good correlation between fetal weight estimated between 0 and 7 days and actual birthweight.

The increase in mean maternal age associated with the widespread use of assisted reproductive technologies has contributed to an elevated number of multiple pregnancies in recent decades. Russel et al. (2003) found multiple pregnancies increased by 59%, from 19.3 to 30.7 per 1000 live-births, in an epidemiological evaluation of the period 1980 to 1999. Multiple pregnancies are associated with a higher risk of fetal and neonatal morbidity and mortality than singleton pregnancies — in particular, twin pregnancies present a six-fold increase in risk of neonatal mortality, delivery before 28 weeks and birthweight below 1000 g (Alexander & Salihu, 2005; Umstad & Lancaster, 2005).

Some complications, such as twin-to-twin transfusion syndrome, discordance for fetal malformation, and twin growth discordance, are specific to multiple pregnancies. In fact, weight discordance of more than 20% has been associated with a higher risk of perinatal morbidity and mortality and developmental handicap (Amaru et al., 2004; Erkkola et al., 1985). Blickstein and Keith (2004) have demonstrated a higher neonatal mortality rate in discordant twins with at least one fetus with a birthweight below the 10th centile compared to those in the 50th centile (34.4 in 1000 vs. 10.3 in 1000, respectively). Accurate prenatal prediction of twin growth discordance is important in order to increase fetal surveillance, and predict those cases with a higher risk of neonatal complications.

Studies on ultrasound prediction of weight discordance in twin pregnancies have presented conflicting results (Caravello et al., 1997; Gernt et al., 2001; Hill et al., 1994). Sensitivities range from 43% to 92.8% and specificities from 68% to 97% (Table 1). Some studies have also demonstrated that prediction accuracy is related to the degree of discordance, being better in the group with greater weight discordance (Chang et al., 2006).

The aim of this study was to evaluate the ability of ultrasound examination, carried out at different intervals before delivery, to estimate actual birthweight discordance in twin pairs.

Materials and Methods

Between December 1998 and December 2004, 472 twin pregnancies were examined by ultrasound at the Obstetrics Department of São Paulo University Medical School. The gestational age ranged from 26 weeks to 39 weeks and 6 days. Cases with fetal malformations (n = 43), twin-to-twin transfusion syndrome (n = 24), fetal death (n = 5), or unknown outcome (n = 179) were excluded. The study group included 221 twin pregnancies.

Ultrasound examination was performed transabdominally using a 3.5–5.0 MHz curvilinear array

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Table 1

Studies Reporting on Ultrasound Prediction of Intertwin Birthweight Discordance

Authors	*n*	Ultrasound parameters	Discordance (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Storlazzi et al. (1987)	43	AC	20	80.0	85.0	62.0	93.0
Divon et al. (1989)	58	AC+FL	15	78.0	87.0	73.0	90.0
Chamberlain et al. (1991)	85	AC+FL	20	54.5	92.9	66.6	88.6
Hill et al. (1994)	203	AC+FL	20	92.9	85.7	72.0	96.9
Blickstein et al. (1996)	65	AC+FL	20	50.0	92.8	66.6	86.7
Caravello et al. (1997)	242	AC+FL	25	43.0	68.0	11.0	93.0
Gernt et al. (2001)	192	BPD+AC+HC+FL	25	55.0	97.0	82.0	91.0
Chang et al. (2006)	605	BPD+AC+HC+FL	20	61.0	95.0	73.0	93.0
Present study (7 days)	96	BPD+AC+HC+FL	20	93.6	79.4	89.2	87.1

Note: PPV = positive predictive value; NPV = negative predictive value; AC= abdominal circumference; FL = femur length; HC = head circumference; BPD = biparietal diameter.

transducer (CoreVision, Toshiba Corporation, Tokyo, Japan). Fetal weight was estimated using the four parameters formula (head and abdominal circumferences, biparietal diameter, and femur length) described by Haddlock et al. (1985). Fetal weight discordance was calculated as the difference between Fetus A and Fetus B divided by the weight of the larger twin, and this result was expressed as a percentage. Discordance of fetal weight was defined as 20% or greater.

Ultrasonographic prediction of intertwin discordance was examined at four different intervals before delivery: 0 to 7 days (n = 96), 8 to 14 days (n = 66), 15 to 21 days (n = 58) and 22 to 28 days (n = 59), with a total number of 279 ultrasound examinations.

Actual birthweight was checked from maternity records (n = 151) and from direct patient interview (n = 70). Prediction of intertwin birthweight discordance greater than 20% by antenatal ultrasound examination was determined; sensitivity, specificity, positive and negative predictive values were calculated for ultrasound examinations carried out at 0 to 7 days, 8 to 14 days, 15 to 21 days and 22 to 28 days before delivery. The correlation between the estimated fetal weight (EFW) and actual birthweight was assessed by the intraclass correlation coefficient.

Results

The median maternal age was 29.1 years (*SD* = 6.2) and 28.5% of women were nulliparous. The last ultrasound examination was performed at a median gestational age of 33.7 weeks (*SD* = 3.5), and the median gestation at delivery was 35.6 weeks (*SD* = 2.7).

The median EFW at ultrasound examination performed between 0 and 7 days before delivery was 2152 g (*SD* = 590) and the actual birthweight was 2198 g *(SD* = 574). The intraclass correlation coefficient was .8, suggesting a high degree of correlation between fetal weight predicted by ultrasound examination and actual birthweight.

Birthweight discordance ranged from 0% to 55.7% (mean = 13.8%, *SD* = 12.6) and 24.6% of the twin pairs showed a discordance of 20% or more.

For the scans carried out between 0 and 7 days before delivery, the sensitivity for the prediction of birthweight discordance of 20% or more was 93.6%, specificity was 79.4%, positive predicted values were 89.2%, negative predicted values were 87.1%, and accuracy was 88.6%. Table 2 shows prediction performance values for the other intervals.

For the scans carried out between 8 and 14 days, 15 and 21 days, and 22 and 28 days, sensitivity and

Table 2

Ultrasonographic Prediction of Intertwin Birthweight Discordance of 20% or More for Scans Carried Out at Different Intervals of Time Before Delivery

Interval before delivery	*n*	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
0 to 7 days	96	93.6	79.4	89.2	87.1	88.6
7 to 14 days	66	95.8	55.6	85.2	85.2	84.9
15 to 21 days	58	95.6	46.2	86.0	86.0	84.5
22 to 28 days	59	90.9	66.7	88.9	88.9	84.8

Note: PPV = positive predictive value; NPV = negative predictive value.

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accuracy values were 95.8% and 84.9%, 95.6% and 84.5%, and 90.9% and 84.8%, respectively (Table 2).

Discussion

Intertwin weight discordance has several implications for the care of these pregnancies. Some of these cases may require closer antenatal fetal surveillance, the route of delivery may be determined by the size of the fetuses, and some postnatal complications are related to fetal growth restriction and low birthweight. Correlation between intrauterine estimated fetal weight and actual weight at birth is possible from the first trimester of pregnancy onwards (Kalish et al., 2003).

In the present study, a good prediction of actual birthweight discordance was observed in all time intervals examined. This allows an accurate selection of cases that need to be closely monitored during the antenatal period. Gernt et al. (2001) also demonstrated similar good results in prediction of fetal growth discordance in twins, with sensibility, specificity, positive and negative predictive values of 55%, 97%, 82% and 91%, respectively. However, such good prediction was not observed in other studies (Blickstein et al., 1996; Caravello et al., 1997). Caravello et al. (1997) estimated fetal weight from femur length and abdominal circumference ultrasound measurements, and examined the prediction of birthweight discordance of at least 25%; limited accuracy was found, with sensitivity of 43% and positive predictive value of 11%.

Differences in the prediction accuracy of birthweight discordance reported by several studies (Table 1) may be attributed in part to different formulas used for fetal weight estimation. Some studies employed only one or two parameters to estimate fetal weight (femur length and abdominal circumference), and as previously demonstrated by Hadlock et al. (1985), fetal weight is best estimated when considering multiple ultrasound parameters (biparietal diameter, head circumference, abdominal circumference and femur length). Another relevant difference is the gestation at which the ultrasound examinations were carried out. It could be that at early gestation, prediction of weight discordance is good despite the number of ultrasound parameters used to estimate fetal weight.

Another aspect to be considered is that in both this study and another by Gernt et al. (2001), ultrasound examinations were carried out by highly trained specialist examiners in multiple pregnancy clinic settings. These conditions may have improved the accuracy of fetal weight estimation in these studies.

Chang et al. (2006) demonstrated greater predictive values in cases with growth discordance of at least 25%. The hypothesis is that the accuracy of predicting weight discordance is correlated with the degree of discordance. Although greater discordance may be more evident at ultrasound evaluation, adequate prediction in less severe cases is still important for the adequate management of these cases.

In this study, we observed a high degree of correlation between mean birthweight and fetal weight estimated by ultrasound between 0 and 7 days before delivery. This is in agreement with others studies (Chauhan et al., 1996; Gernt et al., 2001).

Our study demonstrates that actual birthweight in twin pregnancies and intertwin weight discordance can be accurately predicted by prenatal ultrasound examination. This is useful in the management of prenatal care, determination of delivery route and risk assessment for neonatal morbidity and mortality.

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