The complications of hemolysis, hepatic dysfunction, and thrombocytopenia are long-recognized sequelae of severe preeclampsia–eclampsia but were first termed the HELLP syndrome (hemolysis, elevated liver enzymes, and low platelets) by Weinstein. Since that report, several other authors have also documented adverse fetal outcomes associated with the HELLP syndrome, including intrauterine growth restriction (IUGR) and an increased perinatal mortality rate.

Umbilical artery Doppler velocimetry has been a useful screening tool for assessing the risk of IUGR and intrauterine growth restriction. It is often used to predict fetal well-being and guide management decisions.

OBJECTIVE: Our aim was to study the utility of umbilical artery Doppler velocimetry in the management of women with the HELLP syndrome.

STUDY DESIGN: Fetuses of women with the HELLP syndrome underwent ultrasonographic evaluation at initial presentation. An abnormal umbilical artery Doppler study was defined as a systolic/diastolic ratio >5.0. The systolic/diastolic ratios were correlated with outcome variables including laboratory findings, latency, mode of delivery, and birth weight.

RESULTS: Fifty women were enrolled into the study. Eighteen of the fetuses (36%) had abnormal waveforms, with 8 fetuses demonstrating either absent or reversed end-diastolic umbilical artery blood flow. The mean umbilical artery systolic/diastolic ratio was significantly higher for fetuses with intrauterine growth restriction or who were small for gestational age than for those without these diagnoses (P = .001, for each). No correlation was observed between the systolic/diastolic ratio and the laboratory findings at admission, the degree of hypertension at admission, or the latency to delivery (all, P > .05). No woman with a fetus at a viable gestational age having abnormal Doppler waveforms had a successful vaginal delivery.

CONCLUSION: Abnormal umbilical artery Doppler velocimetry is associated with a higher risk of fetal growth restriction and a high likelihood of cesarean delivery. These values were not correlated with the severity of maternal disease.

Key words: HELLP syndrome; hemolysis, elevated liver enzymes, and low platelets; severe preeclampsia; Doppler; umbilical artery

The utility of umbilical artery Doppler investigation in women with the HELLP (hemolysis, elevated liver enzymes, and low platelets) syndrome

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Patients and methods

Women with the HELLP syndrome, as defined by Sibai (platelet count, <100,000/mm³; aspartate aminotransferase value, ≥70 U/L; and lactate dehydrogenase value, ≥600 U/L), who were cared for at Central Baptist Hospital between January 1994 and March 2000, were candidates for inclusion if they underwent fetal biometric examination and Doppler velocimetry of the umbilical artery.

Ultrasonography was performed at admission, with patients in the supine position. Umbilical artery waveforms were recorded from free-floating loops in the midportion of the cord. A sample from 5 consecutive cycles was obtained during fetal apnea and rest. A diagnosis of absent end-diastolic artery flow or reversed end-diastolic flow required repeated observation.

Our management protocol for women with severe preeclampsia–HELLP syndrome consists of attempts to stabi-
lize hypertension and to infuse magnesium sulfate for seizure prophylaxis. Corticosteroids are administered for both fetal and maternal indications, according to our protocol cited elsewhere. Delivery is planned on the basis of maternal and fetal status.

Dating parameters were reviewed and gestational age was assigned on the basis of the last menstrual period unless the first sonogram differed by >7 days in the first trimester, >10 days from 14 to 20 weeks’ gestation, and >14 days from 21 to 28 weeks’ gestation. IUGR at the time of admission to the hospital was defined as an ultrasonographic estimated weight at <10th percentile by the nomogram of Hadlock et al. Small for gestational age (SGA) was defined as a birth weight <10th percentile according to Brenner et al. Any systolic/diastolic (S/D) ratio >5.0 was defined as abnormal. Fetuses with absent end-diastolic flow or reversed end-diastolic flow were assigned an S/D value of 10 for analysis. Parametric data were compared between S/D ratios and laboratory data by means of regression analysis. One-way analysis of variance and the t test were used where applicable between groups. This study was approved by the Institutional Review Board of Central Baptist Hospital.

Results

Fifty women were included in the analysis. Consistent with other reports, there was a marked risk of IUGR (42%), preterm delivery, and cesarean delivery (64%). Eighteen women (36%) demonstrated abnormal Doppler velocimetry, with 8 fetuses having absent or reversed end-diastolic flow.

Similar to other reports, we found a significant inverse correlation between gestational age and umbilical artery S/D ratios (r = 0.620; P = .0001). The mean umbilical artery S/D ratio was also abnormally elevated in fetuses with the diagnosis of IUGR (no IUGR, 3.5 ± 2.1; vs IUGR, 6.3 ± 2.7; P = .001). SGA infants also demonstrated higher S/D ratios in utero (no SGA, 3.8 ± 2.3; vs SGA, 6.5 ± 2.7; P = .001).

Umbilical artery Doppler findings in patients with the HELLP syndrome were compared with patient symptoms and physical findings. No association was identified between abnormal umbilical artery Doppler findings and initial maternal blood pressure at admission (systolic and diastolic blood pressure: P = .239 and .504, respectively), degree of proteinuria (P = .299), or history of chronic hypertension (P = .887). A statistically significant correlation was found, however, between increasing pregnancy weight gain and abnormal Doppler findings (r = 0.307; P = .036).

Laboratory values assessed at admission included hematocrit, platelet count, aspartate aminotransferase, total bilirubin, lactate dehydrogenase, and creatinine. None of these test results at admission were significantly correlated with worsening umbilical artery Doppler findings. Furthermore, the maximum or nadir values of these laboratory values were not significantly correlated with the Doppler result.

The average latency period from Doppler investigation to delivery was 2.2 ± 2.1 days (range, 0-9 days). Umbilical artery S/D ratios were not associated with a difference in latency period from admission to delivery (r = 0.201).

In this series 32 women with the HELLP syndrome underwent induction of labor, with 13 cesarean deliveries indicated for nonreassuring fetal heart rate tracings. Of these 13 fetuses, 9 (69%) had abnormal Doppler findings. One cesarean delivery was performed for failed induction. Eighteen patients underwent cesarean delivery, without a trial of labor, for breech presentation (n = 10), extreme fetal prematurity (n = 6), and declining of vaginal birth after cesarean delivery (n = 2). Two of these patients had nonreassuring fetal heart rate tracings, as well as breech presentation, as the indication for cesarean delivery. Of these 18 patients, 8 (44%) had abnormal Doppler findings. Only 1 patient with abnormal Doppler velocimetry underwent successful vaginal delivery with the fetus at a previable gestational age (21 weeks).

Comment

Pregnancies complicated by either preeclampsia or IUGR, or both, show an inadequate maternal vascular response to placentation, characterized by retained musculoelastic architecture of myometrial segments of the spiral arterioles and a decrease in the number of well-developed arterioles. Placental abnormalities have also been identified in women with abnormal umbilical artery Doppler findings, including a smaller cross-sectional area of terminal villi. Our findings question whether the third spacing at the uteroplacental interface may also play a role in abnormal Doppler velocimetry, because increased maternal weight gain was associated with this finding.

No prior investigation has reported findings of Doppler velocimetry exclusively for women with the HELLP syndrome, but a recent report does evaluate this population in a subset of patients with gestational hypertension. Our study corroborates previous investigations linking IUGR and intrapartum distress to elevated umbilical artery S/D ratios.

The limitations of Doppler velocimetry should also be mentioned. We showed that laboratory markers of the HELLP syndrome, initial or maximum systolic or diastolic blood pressure, proteinuria, and a history of chronic hypertension were not correlated with abnormal umbilical artery Doppler findings. This measure was also not predictive of the latency to delivery, meaning that some patients with abnormal waveforms may safely undergo expectant management provided the results of other evaluations of the fetus are reassuring.
In conclusion, umbilical artery Doppler velocimetry is a useful adjunct in the management of women with the HELLP syndrome and should be used routinely as part of the armamentarium for fetal surveillance. Abnormal umbilical artery S/D ratios help identify fetuses with IUGR. No successful vaginal deliveries occurred in our population having viable fetuses with abnormal umbilical artery Doppler waveforms. Therefore abnormal findings on umbilical artery Doppler velocimetry in women with the HELLP syndrome predict the mode of delivery and may facilitate avoidance of unnecessary compromise.

REFERENCES