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Surveillance of Triplets with Umbilical Artery Velocimetry Waveforms

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Abstract. Doppler arterial velocimetry waveforms was used as a method of antenatal surveillance for triplets. Six sets of triplet pregnancies were studied. Each fetus was identified by real-time-ultrasound scanning and the peak systolic/end diastolic (S/D) ratio was calculated. In one set of triplets two fetuses showed absent end diastolic flow. Both subsequently suffered from necrotising enterocolitis and had major bowel resection. The five other sets of triplets maintained a normal S/D ratio. Three had a normal outcome and two delivered prematurely.

Key words: Triplet pregnancies, Doppler ultrasound, Surveillance of triplets, Necrotising enterocolitis

INTRODUCTION

The stillbirth rate for triplets is four times that of singleton births [2] and the perinatal mortality rate is five times that of singleton pregnancies [8,9]. The significant increase in perinatal morbidity and mortality of multiple pregnancies is chiefly due to premature delivery and growth retardation of one or all fetuses.

The difference in growth rate in multiple pregnancies can be diagnosed by multiple ultrasound measurements which include biparietal diameter, abdominal circumference, and femur length [1]. Measurements of the peak systolic/end diastolic (S/D) ratios also have been used to predict intrauterine growth retardation (IUGR) [4]. To my knowledge, this is the first study on the application of Doppler umbilical artery velocimetry waveforms and vascular resistance as a surveillance method in triplet pregnancies.

PATIENTS AND METHODS

Six sets of triplets were followed in the antenatal clinic at the Liverpool Maternity Hospital. All patients gave their verbal consent to the study. The duration of each patient's pregnancy was confirmed by an early ultrasound scan at 16 wk gestation and the number of fetuses identified. Biparietal diameter, abdominal circumference and femur length were measured every two weeks to estimate growth rate and to diagnose growth retardation.

Prior to, and during the recording of umbilical artery velocimetry waveforms, the patients rested in a semirecumbent position. Umbilical artery velocimetry waveforms were obtained with a linear array scanning model, SAL-50A Toshiba 2.4 MHz, connected to a pulse Doppler unit; model SDL-01A Toshiba with 3.5 MHz probe and A100 Hz thump filter was used. The cursor was then moved to cover the width of the umbilical artery using the range-gate facility on the line presenting the Doppler beam superimposed on the real time image. When good quality Doppler shifted frequencies were obtained by visual reference to the sonographic display of these frequencies and by their audio output, the image was freeze-framed. The peak systolic and end diastolic velocities were then marked and measured and the S/D ratio was calculated. Three different waveform fields were measured and an average was calculated, to ensure accuracy. The Doppler ultrasound information was not available to the clinicians managing the patients.

RESULTS AND CASE REPORTS

Case 1: A 25-year-old primigravida conceived a triplet pregnancy without any medical ultrasound measurements. The mean S/D ratio was 3.4 and 3.3, respectively; the third fetus, however, had a normal S/D ratio of 2.8 at 20 wk gestation. By 30 wk gestation the two fetuses with high S/D ratio showed absent end diastolic flow while the third fetus's S/D ratio was 3. Emergency cesarean section (CS) was performed at 31 wk because of rapidly deteriorating pre-eclampsia. The two fetuses with previously absent end diastolic flow were delivered, a male weighing 1,148 g and a female weighing 1,398 g, respectively. Both fetuses were affected with necrotising entarocolitis and required major bowel resection. The third fetus was healthy weighing 2,150 g.

Case 2: A primigravida aged 34 years with a 10-year history of infertility, conceived a triplet pregnancy following in vitro fertilization. Serial scans demonstrated that one fetus was growth retarded. At 37 wk gestation an emergency lower segment CS was performed because of severe proteinuric pre-eclampsia of sudden onset. Three live female infants were delivered weighing 2,530, 2,450 and 2,700 g, all with good Apgar scores. The scan finding of growth retardation of one fetus was not substantiated. The mean of S/D ratio prior to delivery was 2.6, 2, and 2.75, respectively.

Case 3: A 35-year-old woman conceived a triplet pregnancy following in vitro

fertilization and in-utero transfer of four oocytes. Satisfactory growth rate for all three fetuses throughout the pregnancy was confirmed by ultrasound scan. The woman was delivered at 37 wk gestation by elective CS. Two female and one male infants weighing 2,572, 2,382 and 2,498 g, respectively, were delivered, all with good Apgar scores. The mean S/D ratios prior to delivery were 2, 2.3 and 2.1, respectively.

Case 4: A 29-year-old conceived a triplet pregnancy following ovulation induction with menotrophin (Perganol). Ultrasound scan showed good fetal growth rate. The mother was admitted to hospital for rest because of uterine irritability from 27 wk. At 30 wk, emergency lower segment CS was performed because of premature labour. Three live female infants weighing 1,324, 1,380, and 1,294 g were delivered. The third fetus died on the fourth day from respiratory distress syndrome. The S/D ratios prior to delivery were 2.8, 2.5, and 2.9, respectively.

Case 5: A 30-year-old primigravida, conceived with triplet pregnancy following Perganol therapy. Serial ultrasound scans showed good growth rate. The S/D ratios were 2.2, 2.4, and 2.5, respectively, at 29 wk. Three healthy infants were delivered at 34 wk by CS because of premature labour. All the infants were healthy and had good Apgar scores.

Case 6: A 24-year-old woman, conceived with triplet pregnancy after her general practitioner has prescribed her a different contraceptive pill. She delivered at 27 wk by CS because of premature labour. Three female infants weighed 940, 938 and 813 g and S/D ratios before delivery were 2.8, 3 and 2.6, respectively.

DISCUSSION

In this study of triplet pregnancies the two fetuses with long-standing absence of end diastolic blood flow were associated with severe necrotising enterocolitis which required bowel resection after birth. Giles et al [5] found that in fetuses with an increased S/D ratio there was higher incidence of compromised infants and "small-for-gestational-age".

Previously, the lack of sensistive non-invasive methods has prevented direct examination of fetal hemodynamics as a method of antenatal surveillance. This study was designed to relate antenatal umbilical artery velocimetry waveforms with clinical assessment of fetal growth retardation and growth rate as measured by ultrasound examination. Pulsed Doppler ultrasound demonstrated good sensitivity and specificity in twin pregnancies destined for unsatisfactory outcome when compared with biparietal diameter and abdominal circumference measurements [10].

Previous workers [3,6] found that umbilical arterial velocimetry can define a normal umbilical circulation vs one in which there is increased or decreased vascular resistance. They also demonstrated that umbilical blood flow is decreased and arterial resistance is increased in most cases of growth retardation in singleton and twin pregnancies.

Although the Doppler results obtained during this study were not communicated to the obstetrician caring for the patient, in future, triplet pregnancies complicated with abnormal fetal umbilical waveforms may well provide useful information for the clinician to have available in order to decide upon the best time for delivery. Leveno et al [7] have demonstrated that fetal lung maturation occurs several weeks earlier in twin pregnancies compared to singleton pregnancies and this may also be the case in triplet pregnancies.

In conclusion, umbilical artery velocimetry is a helpful method of fetal surveillance in triplet pregnancies.

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