

## Original Research Article

# Umbilical artery doppler and biophysical profile score: a study of their efficacy in pregnancy induced hypertension and intrauterine growth retardation

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### ABSTRACT

**Background:** Accurate diagnostic tests to identify fetuses at risk for in-utero death or injury have long been an important goal for obstetricians and perinatologists. Umbilical Artery Doppler and biophysical profile score are two tests available for antepartum fetal surveillance.

**Methods:** The study consisted of 100 patients with either presence of PIH (30) or IUGR (28) or both (42). Testing was begun was at 33 weeks. UAD was performed; S/D, RI and PI indices were calculated. Fetal BPS was determined.

**Results:** Fetal weight was estimated to be less than 2kg in last scan was 23.52% cases in pih/ iugr group versus 6.4% in controls whereas incidence of oligohydramnios was 29.5% versus 91.17% respectively, and number of babies admitted to NICU was 11.47% versus 70.58% respectively

**Conclusions:** Doppler and biophysical studies can greatly help in arriving at an appropriate strategy for management.

**Keywords:** Biophysical profile, Doppler, Umbilical artery

### INTRODUCTION

The development and perfection of accurate diagnostic tests to identify fetuses at risk for in-utero death or injury has long been an important but elusive goal for obstetricians and perinatologists. Societal and consumer demands have spurred the development of accurate diagnostic tests to determine immediate fetal health and future risk. Intrapartum still births are fourteen times more in developing than developed countries.<sup>1</sup> Continuous or pulsed wave Doppler scan of fetal umbilical artery has been increasingly used to identify increased placental vascular impedance.<sup>2</sup> BPS is based on the principle that the greatest accuracy in differentiation of normal from compromised fetus is achieved when multiple fetal and environmental parameters are considered together.<sup>3</sup>

The fetal BPS is a combination of acute (non-stressed test, fetal breathing movements, fetal tone, fetal body movements) and chronic (amniotic fluid volume and placental grading) markers of fetal condition. Reduced counts of tertiary stem villous arteries especially in PIH result in decreased placental perfusion by fetal circulation and consequently increased impedance to vascular flow which serves as the pathophysiological rationale for Doppler velocimetry studies.<sup>4</sup> Perinatal asphyxia greatly reduces the probability of neonatal survival at any age, which necessitates the need for a highly accurate determination of fetal condition.<sup>5</sup>

### METHODS

The study consisted of 100 patients attending our antenatal clinic. The criteria for selection included either

presence of PIH (30) or IUGR (28) or both (42). PIH was defined as rise in systolic blood pressure recording greater than 30 mm Hg or diastolic BP greater than 15mm Hg over first trimester recording. IUGR was diagnosed clinically on per abdomen examination and confirmed by ultrasound scan with estimated fetal weight for that gestational age. Paired measurements of fetal BPS and UAD flow velocimetry were made concurrently at 33-34 weeks GA. If required, a follow up scan was done. On basis of results obtained, they were then divided into three groups:

- Group A: Normal UAD and BPS
- Group B: Abnormal UAD and normal BPS
- Group C: Abnormal UAD and abnormal BPS.

All patients with abnormal BPS also had abnormal UAD. The gestational age at which testing was begun was at 33 weeks. Routine fetal morphometric data were obtained; an anatomic screen for structural and functional anomalies was done. UAD was performed on a free loop of cord with use of pulsed Doppler equipment with a 3.5MHz curved duplex transducer. Output power was kept at 50mw/cm<sup>3</sup>. The S/D, RI and PI indices were calculated by built in microcomputer. We used the reference ranges of Doppler umbilical artery ratios from the standard reference table. Fetal BPS was determined by an experienced observer and 6 variables (non-stress test, fetal respiratory movements, amount of liquor and placental grading) were scored as 2, 1 or 0. By convention, an equivocal score was defined as 8/12, and abnormal score 6/12. Assignment of equivocal or abnormal scores was made only after a minimum of 30

minutes of continuous ultrasonic observation. Statistical analysis was performed by obtaining planning values for statistical significance by applying chi square test. A value of 'p' <0.05 was required for statistical significance.

The primary outcome variables for this trial were the number of newborns with growth retardation, the incidence of neonatal morbidity reflected by number of days that newborn remained in NICE. Secondary outcome variables were the incidence of caesarean deliveries and number of newborns with Apgar score <6 for 5 minutes.

**RESULTS**

The mean gestational age at diagnosis of PIH in group A, B and C was 33.2, 31.8 and 29.6 respectively. Mean GA at diagnosis of IUGR was 33.4, 30.4 and 28.2 weeks respectively. Number of cases diagnosed before 30 weeks gestation was 16 i.e. 47.04% in group B as compared to only 1 i.e. 3.22% cases in group A. This was highly significant (p <0.001). Fetal weight was estimated to be less than 2 kg in last scan performed prior to delivery in only 6.4% cases in group A as compared to 23.52% cases in group B. In group C, 4 fetuses (80%) were estimated at less than 2 kg (p <0.001). Mean GA at delivery in group C and B was significantly lower than that for group A (p <0.05). The rates of cesarean section in 6 out of 7 cases in group B was fetal distress whereas it was 3 out of 10 in group A (p <0.001). The single case of vaginally delivery in group C required forceps application due to fetal distress with thick meconium.

**Table 1: Outcome variables in the three study groups.**

Indicators	Group A	Group B	Group C
Gestational age at diagnosis of PIH/IUGR (weeks)	33.3	31.1	28.9
Weight at birth <2 kg (%)	6.4	23.52	80
Presence of oligohydramnios (%)	29.5	91.17	100
Mean birth weight (gram)	2506	2285	1780
Apgar Score <7 at 5 minutes (%)	6.55	29.41	60
Percentage of babies admitted to NICU (%)	11.47	70.58	80

While analyzing observations, it was seen that the incidence of oligohydramnios was 29.5%, 91.17% and 100% in groups A, B and C. This difference between normal and abnormal groups was highly significant (p <0.001). The mean birth weight of babies in groups A, B and C was 2506, 2285 and 1780 respectively. The number of neonatal deaths in groups A, B and C was 0, 1 and 3 respectively. Closer analysis revealed that two of these babies in group C had reversal of end diastolic flow and one had absent end diastolic flow.

The single case in group B had absent end diastolic flow with equivocal BPS. Apgar scores less than 7 at 5 minutes was seen in 6.55%, 29.41% and 60% respectively with p <0.05 for B versus A and p <0.001 for C versus A.

Number of babies admitted to NICU was 11.47%, 70.58% and 80% in groups A, B and C respectively. The shorter duration in group C was due to the fact 3 out of 5 babies expired within one week.

## DISCUSSION

The very term intrauterine growth retardation is unfortunate since it focused obstetrician mind unduly on the size of the baby and not on the problem, uteroplacental insufficiency. This study suggests that there is a set of deterioration of ultrasonographic characteristics in the fetus exposed to chronic asphyxia.<sup>6</sup> The fetal growth is demonstrably retarded, then umbilical artery doppler recording becomes abnormal and finally biophysical profile becomes abnormal.<sup>7</sup>

The use of the three ultrasonographic characteristics in combination appeared to provide a useful guide to fetal risk in high risk pregnancies such as pregnancy induced hypertension and intrauterine growth retardation. Torres PJ in a study concluded that umbilical artery Doppler velocimetry is a useful tool to assess fetal wellbeing in hypertensive pregnancies.<sup>8</sup> If all three were normal or if an estimated fetal weight was the only abnormality, fetal prognosis was excellent.<sup>9</sup> Fetuses with normal biophysical profile score and normal Doppler had good Apgar scores.<sup>10</sup> Jensen et al, found a significant relation between S/D ratio, intrauterine growth retardation and admission to NICU.<sup>11</sup>

A strict correlation was found between abnormal umbilical Doppler velocimetry and increased incidence of perinatal complications in Soregaroli M et al.<sup>12</sup> Hence even in pregnancy induced hypertension patients with normal UAD and BPS, with serial monitoring and in absence of maternal complications and growth of fetal weight after the appropriate trajectory, delivery can be deferred until at least 38 weeks.<sup>13</sup> Both applied tests i.e abnormal BPP and abnormal Doppler combined have good predictive value in abnormal perinatal outcome similar to the conclusion drawn by Turan et al, who stated that two antenatal tests were better than one for predicting fetal acidosis.<sup>14</sup>

In fetuses with low estimated weight and abnormal UAD and normal BPS at presentation, there is risk of subsequent development of an abnormal BPS, as Doppler was found to be more sensitive and an earlier indicator than biophysical profile. Deka et al, that color Doppler was abnormal before the evidence of biophysical profile abnormality by several days to weeks, so Doppler is more sensitive than biophysical profile in high risk pregnancies.<sup>15</sup>

Hence, once pregnancy reaches 34 weeks, delivery should be expedited. A very guarded prognosis of fetuses with severely abnormal doppler and biophysical score should be contemplated. Analysing the results, it appears safe to assume that only 7-8% of fetuses demonstrated to be asymmetrically small for gestational age on real time ultrasound will demonstrate loss of end diastolic frequency at any time during pregnancy. It is associated with a 90% chance of in-utero placental hypoxia.

According to Wang et al, when AREDV occurs prenatally, a close follow-up or expeditious delivery should be contemplated. AREDV in the umbilical artery is associated with intraventricular hemorrhage, bronchopulmonary dysplasia, and perinatal mortality.<sup>16</sup> Reversed end diastolic frequency should be considered a preterminal condition, few if any fetuses will survive without some form of therapeutic intervention.

## CONCLUSION

Doppler and biophysical studies can greatly help in arriving at an appropriate strategy for management. Along with avoiding unnecessary early inductions and cesarean sections in patients with normal UAD and BPS, active management in compromised fetuses would result in lowering fetal and neonatal morbidity and mortality

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