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Original Research Article

Doppler predictors of perinatal outcome in intra-uterine growth retarded fetuses

Varshika Mahesh Hingorani*, Dharita S. Shah, Madhura Ghate, Sachin Patel

Department of Radiology, NHLMMC, Ahmedabad, Gujarat, India

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***Correspondence:**

Dr. Varshika M. Hingorani,

E-mail: hingoranivarshika@gmail.com

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ABSTRACT

Background: The study aims at early detection of intrauterine growth retarded fetuses which are at high risk of perinatal complications. It can help obstetricians take appropriate preventive steps and prevent serious perinatal complications.

Methods: The study undertaken over 100 pregnant women with pregnancy induced hypertension between 28-36 weeks subjected to umbilical artery and uterine artery doppler. The outcome data including gestational age at birth, birth height, APGAR score, admission to NICU, need for positive pressure ventilation and neonatal mortality.

Results: The study shows that 58% mothers with IUGR fetuses were primigravida; gestational age at delivery is 34.2 weeks and 82% of IUGR fetuses were delivered by C-section. Average birth weight of foetus with abnormal doppler was significantly lower and there was high incidence of NICU admission. The study also shows that oligohydroamnios was common with abnormal doppler group.

Conclusions: Umbilical artery doppler velocity in addition to uterine artery velocity doppler should be considered as a primary tool for foetal surveillance in pregnancy induced hypertension patients and for planning management of IUGR fetuses.

Keywords: APGAR, Doppler, Intrauterine growth restricted, Perinatal, Umbilical artery, Uterine artery

INTRODUCTION

Detection of growth restricted fetuses that are at risk for perinatal complications has been an ongoing challenge to obstetricians. Umbilical artery velocimetry is an excellent predictor for Intrauterine growth restricted (IUGR) fetuses at risk of antenatal compromise.^{1,2}

IUGR is a clinical sign of chronic fetal hypoxemia and is associated with meconium aspiration syndrome (MAS), hyaline membrane disease (HMD) and stillbirth in extreme cases. The perinatal mortality rate is 6 to 10 times higher than that for normal fetuses. Many studies have revealed that Color Doppler velocimetry is extensively useful to decrease perinatal morbidity and mortality.³ Normally, blood flowing through the umbilical

arteries has very little impedance. However abnormalities in the waveform are in the form of either low end diastolic flow, absent end-diastolic flow or reversal of flow. Reversed flow is associated with high incidence of perinatal mortality and severe IUGR compared to absent end-diastolic flow.⁴

Usually the blood flowing through uterine arteries do not offer vascular resistance with smooth diastolic flow, however after 26 weeks of gestation, the presence of diastolic notch is suggestive of vascular impedance.⁵

METHODS

This study undertaken over 100 pregnant women From September 2018 to April 2019 (8 months).

Inclusion criteria

- All pregnant women visiting our institute between September 2018 to May 2019 irrespective of maternal age and parity with pregnancy induced hypertension (PIH) between 28-36 weeks of gestation or IUGR clinically
- Patients with blood pressure of 140/90mm Hg and above were considered to be having PIH
- Singleton pregnancy
- Normal foetal anatomy.

Exclusion criteria

- Multiple pregnancy
- Congenital anomalies in baby

Methodology

- Diagnosis of IUGR was made clinically and was confirmed by ultrasonography
- The subjects enrolled for a study were followed up from the point of recruitment up to the 6 weeks postpartum period
- Patients having IUGR were monitored using NST, ultrasonography and Doppler
- Study of various umbilical artery and uterine artery was performed using Color doppler and pulsed doppler ultrasound using Samsung Medison Radiology Series Rs80a Ultrasound Machine with 3.5 MHz transabdominal curvilinear probe. The following vessels were studied with the mother in a recumbent position during foetal inactivity and apnoea
- All patients were subjected to umbilical artery and uterine artery Doppler
- The above vessels were located in the standard plane
- To evaluate umbilical artery, the free floating loop of the umbilical cord was chosen. Doppler analysis for umbilical artery was done in three groups-normal Doppler group (group I), an abnormal

Doppler group subdivided into lower end-diastolic flow (LEDF) (group II) and absent or reversed diastolic flow (AEDF/REDF) (group III)

- Findings at initial study were considered for analysis although, whenever required repeat studies were performed in patients with S/D ratio more than 3 and those with absent or reversed diastolic flow
- The uterine artery was evaluated by identifying the placental site. In case of placenta being unilateral, the uterine artery on that side was studied and when the placenta was central, both uterine arteries were studied
- The velocity waveforms for uterine and umbilical arteries were computed automatically and the mean of the three readings was considered for study
- Delivery was undertaken either vaginally or through cesarean section
- The outcome data including gestational age at birth, birth weight, APGAR score, admission to the neonatal intensive care unit (NICU), the need for positive pressure ventilation and neonatal mortality were collected.

Assessment standards

- S/D ratio, resistance and pulsatility index of umbilical artery and uterine artery for the gestational age according to the standard reference value.

Statistical analysis

- All data was analyzed using the Microsoft Excel software. Statistical analysis of data was done after compiling and tabulation of data.

RESULTS

The average age of the patients in the study group was 31.4 years, 58% of mothers with IUGR fetuses were primigravida.

Table 1: Comparison of neonatal outcome characteristics in normal and abnormal doppler groups.

Neonatal outcome characteristics	Normal Doppler (n=56)	Abnormal Doppler	
		LEDF (n=28)	AEDF / REDF (n=16)
Delivery <36 weeks	14 (25%)	20 (71.3%)	16 (100%)
Live/Still birth/death	55/0/0	28/0/0	7/4/6
Average birth wt (kg)	2.12	1.58	1.06
APGAR <7	4 (7.1%)	10 (35.7%)	14 (87.5%)
NICU admission	14 (25%)	22 (84.6%)	12 (100%)

Among IUGR fetuses, 96% had a live birth, 4% were stillborn and 6% had neonatal death. The gestational age at delivery was averaged at 34.2 weeks and 82% of IUGR

fetuses were delivered by cesarean section. Average birth weight of fetuses with abnormal doppler was significantly lower (1.39 kg) (Table 1).

Table 2: Comparison of Doppler study with fetal outcome.

Umbilical artery doppler	No. of patients	Doppler findings	No. of patient	IUGR	IUD	Neonatal death	Normal babies
Abnormal (Group II and III)	44	LEDF	28	16	0	1	11
		AEDF	12	5	3	4	0
		REDF	4	2	1	1	0
Normal (Group I)	56		56	6	0	0	50
Total	100		100	29	4	6	61

Table 3: Doppler characteristics of the study population.

Characteristics	Normal Doppler (n = 56)	Abnormal Doppler	
		LEDF (n = 28)	AEDF / REDF (n = 16)
Mean S/D ratio	2.34	4.64	NA
Mean PI	0.89	1.23	5.73
Oligohydramnios	14 (25%)	18 (64.2%)	14 (87.5%)

The average birth weight for normal group delivered < 36 weeks was 2.123 kg while average birth weight of 1.582 kg was obtained with LEDF and 1.060kg with AEDF/REDF. There was increased incidence of NICU admission with abnormal waveforms. Neonatal mortality was highest in AEDF/REDF group and all stillbirths were common with AEDF/REDF (Table 2). The uterine artery doppler was normal in 86 patients. The normal uterine artery doppler was associated with good fetal outcome in 55 out of 86 patients (64%). While 31 out of 86 patients (36%) with normal uterine artery doppler waveform analysis had a poor fetal outcome (Figure 1). The uterine artery velocimetry was abnormal in 4% of mothers with IUGR; but the fetal outcome was fairly good in these patients (Figure 2).

An abnormal umbilical artery waveform was observed with 44% of patients having IUGR. The mean S/D ratio for the normal group was 2.34 and for LEDF was 4.64. The fetuses with LEDF, AEDF and REDF were 28, 12 and 4 respectively. The mean PI in the normal Doppler group was 0.89; for LEDF was 1.23 and for REDF was 5.73 (Table 3).

Table 4: Labor outcome in study population.

Labor outcome	Normal Doppler		Abnormal Doppler	
	No.	%	No.	%
LSCS	14	25	36	82
Vaginal delivery	42	75	08	18

Oligohydramnios was associated with hypertension and was almost more than twice with an abnormal Doppler group (Table 3). The incidence of cesarean section was

higher among abnormal Doppler group (81.81%) in contrast to 25% with the normal Doppler group (Table 4).

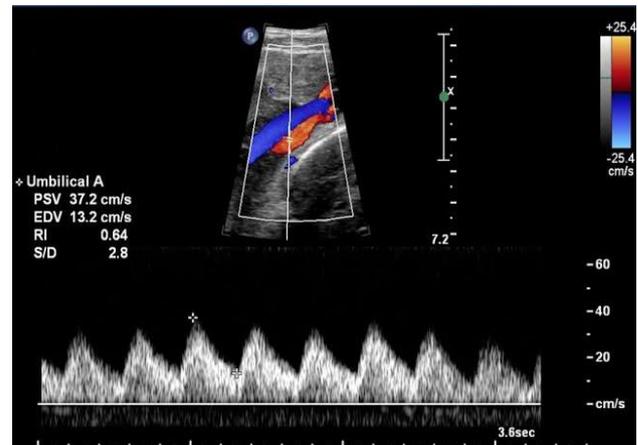


Figure 1: Normal uterine artery Doppler.

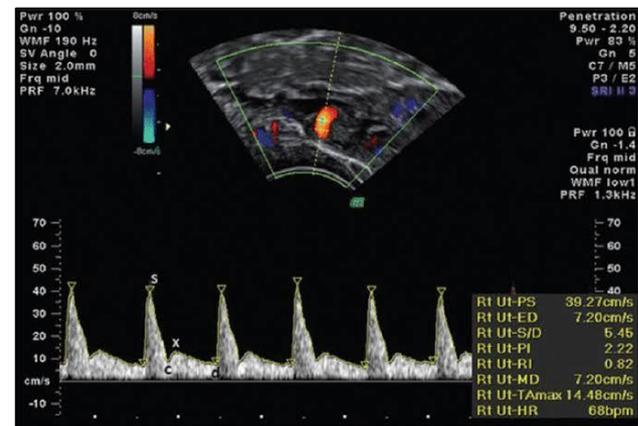


Figure 2: Uterine artery doppler with diastolic notch.

Table 5: Comparison between uterine artery and umbilical artery S/D ratio and fetal outcome.

Umbilical	Uterine	Total	Fetal outcome	
			Normal	Abnormal
Normal	Normal	56	50	06
Abnormal	Normal	30	05	25
Normal	Abnormal	04	04	0
Abnormal	Abnormal	10	02	08

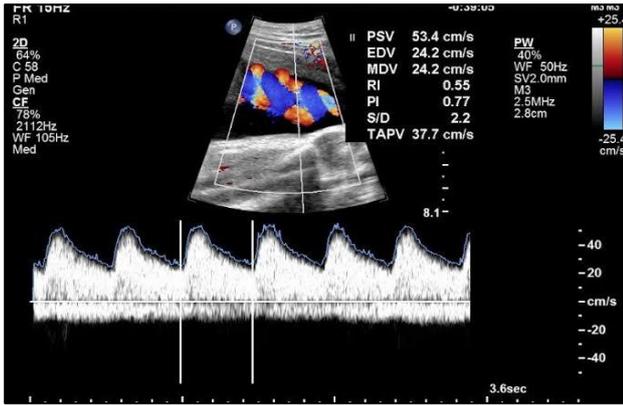


Figure 3: Normal umbilical artery doppler.

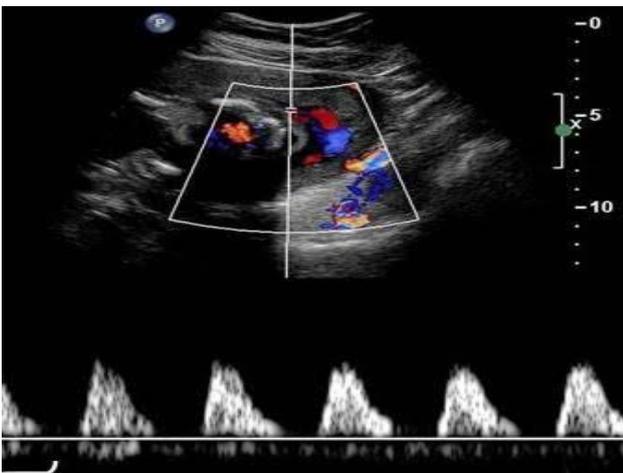


Figure 4: Umbilical artery doppler with absent diastolic flow.

DISCUSSION

The study showed increased S/D ratio in uterine arteries solely in 4% of patients with fairly good fetal outcome; however when both umbilical and uterine artery velocimetry were abnormal the fetal outcome was found to be abnormal in 75 % of the fetuses (Table 5). This is comparable with a study done by Yong.⁵

In this study, the mean umbilical artery PI in the normal Doppler group was 0.893 (Figure 3). The mean umbilical artery PI in the LEDF group was 1.23 and 3.73 in an AEDF / REDF group (Figure 4). This correlates well with a study done by Seyam who demonstrated that PI of umbilical artery was 1.32 in abnormal group and 0.85 in normal group.⁶

Birth weight was higher in normal group and lowest in AEDF/REDF group. As birth weight increases, correspondingly PI of umbilical artery decreases (Table 3). This is comparable with Fleischer et al who documented that fetuses with lower birth weight had higher vascular resistance than those with higher birth weight.⁷

Higher vascular resistance was seen in fetuses with APGAR <7, thus PI of umbilical artery was found to be high. A study by Vergani et al demonstrated that PI of umbilical artery is the sole indicator to predict chances of admission to NICU.⁸ The same is reflected in our study, that fetuses with abnormal velocimetry have early delivery (<36 weeks of gestation) i.e. 25% in group I versus 71.3% in group II, higher NICU admission rate (25% in group I versus 78.5% in group II), low APGAR score (7.1% in group I versus 61% in group II-III). (Table 3).

Various studies have proved similar poor perinatal outcome.^{6,9,10} A perinatal mortality of 40% and 44% had been seen in a study of fetuses with REDF and AEDF by Brodzski et al and Madazli respectively.^{10,11}

Patients with abnormal umbilical artery Doppler study had higher incidence of cesarean section (81% vs 25% in normal group). This coordinated well with findings reported by other authors.¹¹⁻¹³

A good correlation exists with the study of Soregaroli et al, regarding abnormal umbilical artery Doppler and incidence of perinatal complications in IUGR fetuses.¹⁴

The efficacy of Doppler in predicting fetal outcome has been well demonstrated in this study and thus we conclude that umbilical artery Doppler velocimetry in addition to uterine artery velocimetry should always be considered a primary tool for fetal surveillance in PIH patients and for planning management of IUGR fetuses.

CONCLUSION

Umbilical artery doppler velocity in addition to uterine artery velocity doppler should be considered as a primary tool for foetal surveillance in pregnancy induced hypertension patients and for planning management of IUGR foetuses.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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