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Research Article

The Efficacy of Doppler Indices in Third Trimester of IUGR Pregnancies

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Abstract

Objective: To identify the usefulness of Doppler indices in the third trimester for intra-uterine growth-restricted pregnancies.

Materials and Methods: It was an observational case-control study of singletons with intra-uterine growth restriction (fetal weight <10th percentile). Intra-uterine growth restricted fetuses (cases) and normal (controls) were examined for the umbilical artery. Time intervals between progressive Doppler abnormalities and configurations of worsening were related to umbilical artery Doppler status and gestational age. This study was conducted from August 2015 to January 2016 at Gilani Ultrasound Center Lahore Pakistan. A total of 60 pregnant females were studied with normal and abnormal umbilical artery Doppler ultrasound.

Results: Doppler indices measurements of umbilical artery in intra-uterine growth restriction fetuses in the third trimester showed higher values as compared to normal fetuses. 30 females had normal umbilical artery Doppler indices and waveforms and 30 females showed (either thinning, absent or reversed Diastolic flow Doppler waveform) with higher indices.

Conclusion: Fetal umbilical artery Doppler ultrasound is an effective tool in the detection of early intra-uterine growth restriction fetuses.

Keywords: Intrauterine growth restriction; Umbilical artery; Doppler indices (Pulsatility index, resistive index, S/D ratio)

1. Introduction

Intrauterine growth restriction is a sonographic estimated fetal weight which is <10th percentile for gestational age [1]. Bloodstream in the umbilical cord is typically high flow and low resistance with the increased end-diastolic flow as gestational age advances [2]. Color Doppler evaluation plays an imperative role in pregnancy and widely acknowledged functional methods of evaluating fetal wellbeing. Flow velocity waveforms provide essential information from the early stages of pregnancy to term. Umbilical arterial Doppler waveforms reflect the status of the placental course, and an increase in end-diastolic stream that is seen with advancing gestation is a direct result of an increase in the number of tertiary stem villi that takes place with placental maturation [3]. Diseases that obliterate small muscular arteries in placental tertiary stem villi result in a progressive decrease in end-diastolic flow in the umbilical arterial Doppler waveforms until absent, and then reverse flow during diastole is noted [4]. Reversed diastolic flow in the umbilical arterial circulation represents an advanced stage of placental compromise, and is associated with more than 70% of placental arterial obliteration [5]. The absent or reversed end diastolic flow in the umbilical artery is commonly escorting with severe intrauterine growth restriction and oligohydramnios [6]. The cerebral circulation is normally a pronounced impedance circulation with the continuous forward flow throughout the cardiac cycle [7]. The middle cerebral artery is the most accessible, cerebral vessel to ultrasound imaging in the fetus, and it brings more than 80% of cerebral blood flow [8]. In fetal hypoxemia, central redistribution of blood flow occurs, resulting in increased blood flow to the brain, heart, and adrenals, and a lessening inflow to the peripheral and placental circulations. This blood flow redistribution is known as the brain-sparing reflex, and plays an important role in fetal adaptation to deprivation [9]. Arterial Doppler abnormalities, at the level of the umbilical and middle cerebral arteries (brain-sparing reflex), confirm the presence of hypoxemia in intra-uterine growth restriction fetuses, it represents early cautioning signs [10]. The aim of this study was to Doppler velocimetry has enhanced our diagnosis that the occurrence of such abnormal late stage changes of vascular adaptation by the (intra-uterine growth restriction) fetuses appears to be the best predictor of perinatal mortality, and morbidity independent of gestational age and weight.

2. Materials and Methods

Study was conducted after approval from institutional review board. 60 cases of normal and suspected intra-uterine growth restriction visited us during study interval were included. Toshiba Nemio-30 with convex transducer having frequency 3. 5-5 MHZ used for scanning the patients. Before the examination procedure was explained to each patient and informed consent was obtained. The abdomen-o-pelvic area was uncovered, transmitting gel was applied. The transducer was placed over the Para uterine region and free-floating umbilical cord was found on real-time gray scale ultrasound then applied color Doppler and Pulsed Doppler. The superlative setting was pragmatic on pulsed Doppler to avoid aliasing. The sample volume was selected at mid cord level and the waveform was gained at least 2-3 times per patient. Doppler indices were deliberate. Pregnant ladies with singleton pregnancies in the third trimester of pregnancies with certain last menstrual dates were recruited. All fetuses with differences of less than 3 standard deviations in their biometric parameters were included. The indices (PI, RI and SD ratio) were recorded and diastolic flow on the spectral waveform as decreased, absent or reversal of flow. Collected

information was entered into the statistical package of the social sciences for analyzed.

3. Results

In this study total 60 pregnant females were recruited and Doppler indices measurements were obtained.

N=60	Normal/IUGR	Mean	Std. Deviation
Age in years	Normal	26. 07	4. 051
	IUGR	26. 13	4. 637
Gestational age in weeks	Normal	33. 4333	2. 37753
	IUGR	33. 69	3. 25866
Pulsatility Index (PI)	Normal	0. 897	0. 2062
	IUGR	1. 824	1. 47869
Resistive Index (RI)	Normal	0. 5827	0. 09176
	IUGR	0. 8517	0. 22485
Systolic to Diastolic ratio (S/D)	Normal	2. 426	0. 41359
	IUGR	3. 8013	0. 66226

Table 1: Mean values of Doppler indices of normal n IUGR.

		IUGR-Normal			**Total**
		absent diastole flow	decrease diastole flow	Normal	
G-Age (Binned)	<= 30. 00	2	2	2	6
	30. 01 - 33. 00	4	5	11	20
	33. 01 - 36. 00	2	7	11	20
	36. 01 - 39. 00	4	3	6	13
	39. 01+	0	1	0	1
Total		12	18	30	60

Table 2: Normal and IUGR cross tabulation with G. A.

		IUGR- Normal			**Total**
		absent diastole flow	decrease diastole flow	Normal	
PI (Binned)	<= 1. 00	0	0	23	23
	1. 01 - 2. 00	12	15	7	34
	4. 01 - 5. 00	0	1	0	1
	6. 01+	0	2	0	2
Total		12	18	30	60

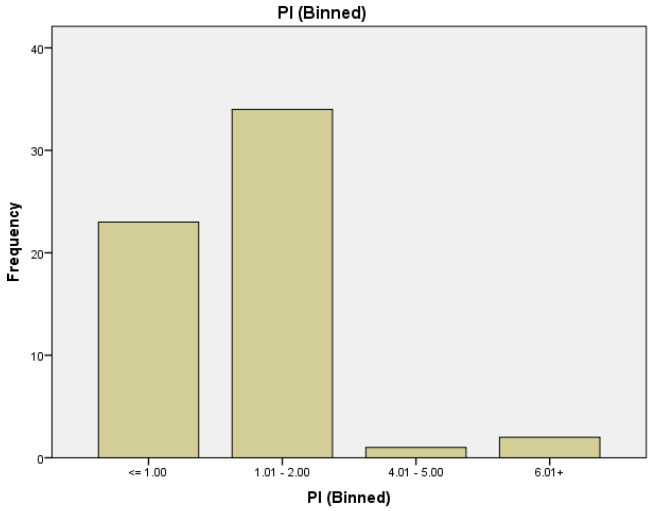
Table 3: PI values of Normal and IUGR Fetuses.

		Norm-IUGR			Total
		absent diastole flow	decrease diastole flow	Normal	
RI (Binned)	<= . 50	0	0	3	3
	. 51 - 1. 00	10	14	27	51
	1. 01+	2	4	0	6
Total		12	18	30	60

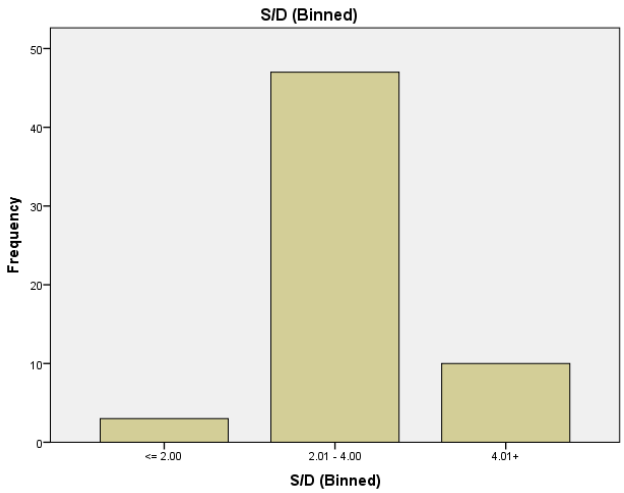
Table 4: RI indices of normal and IUGR fetuses.

		Norm-IUGR			Total
		absent diastole flow	decrease diastole flow	Normal	
S/D (Binned)	<= 2. 00	0	0	3	3
	2. 01 - 4. 00	3	17	27	47
	4. 01+	9	1	0	10
Total		12	18	30	60

Table 5: S/D ratio of normal and IUGR Fetuses.



Graph 1



Graph 2

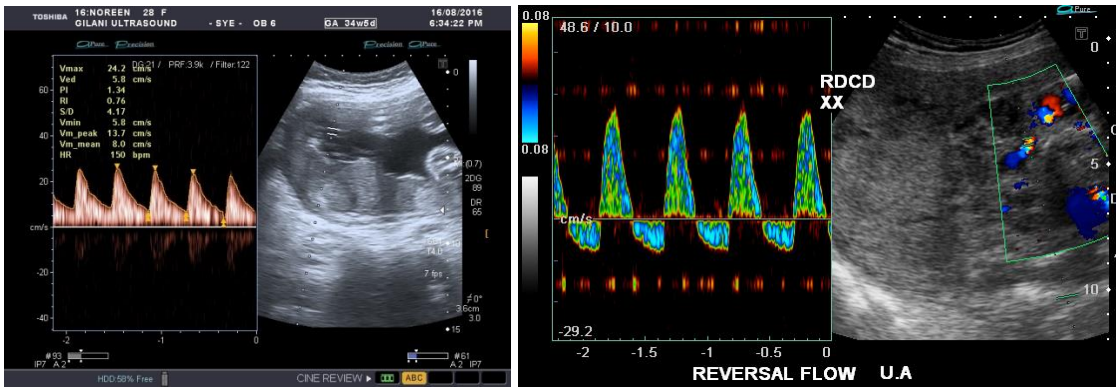


Figure 1: Image(A), Show the high S/D ratio with increased PI,RI at 34. 5 weeks. Image (B), Umbilical artery shows the reversal diastolic flow.

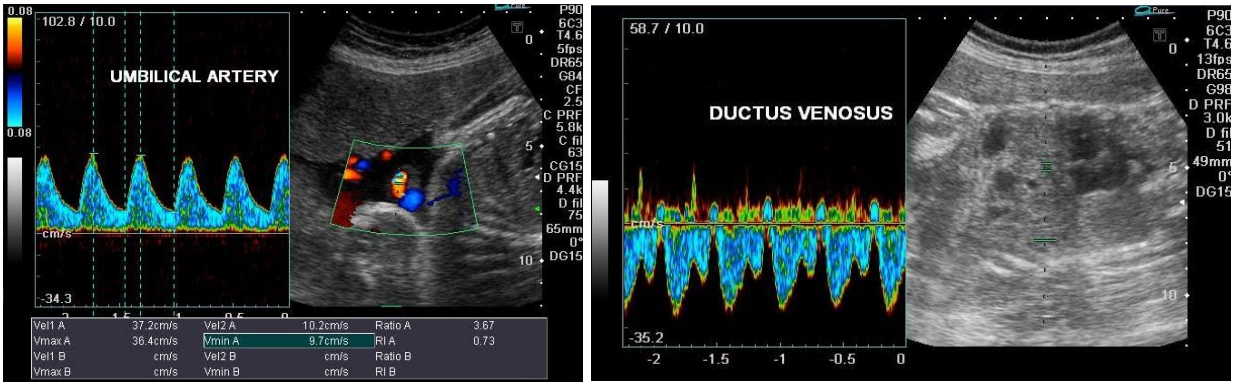


Figure 2: Image (A), High S/D ratio 3. 67 with thinning of diastolic flow. Image (b), shows the ductus venosus.

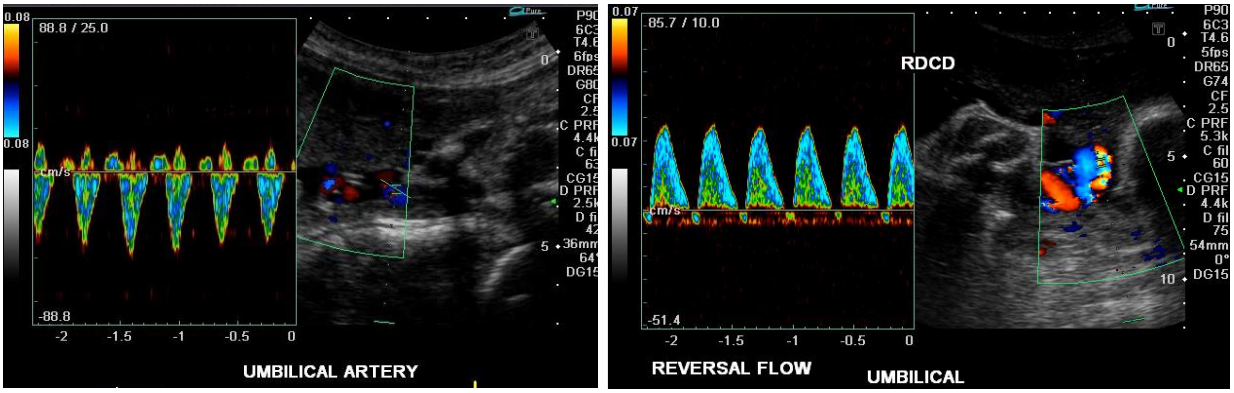


Figure 3: Image (A), shows the reversal of flow. Image (B), shows the absent and mild reversal of flow.

4. Discussion

In all intrauterine growth restricted fetuses with weight or Abdominal circumference less than 10th percentile for gestational age Umbilical artery Doppler should be performed [11]. Among Doppler parameters usually PI and S/D ratio are used and both are satisfactory to deal with intra-uterine growth restriction. When end-diastolic flow is absent than S/D cannot be measured and PI should be used [12]. The risk for perinatal morbidity and mortality is high in intra-uterine growth restricted fetuses [13]. The severity of umbilical artery flow abnormalities and gestational age determines how intra-uterine growth restriction starts and how it will proceed [14]. Fetuses with lateral placentas have a 4 times more risk for intra-uterine growth restriction as compared to anterior or posterior placentas [15]. In this study we found an inverse relation of Doppler indices with advancing gestational age of normal fetuses. This is similar to reported by studies of Gupta, et al. [16], Ganesh Acharya, et al. [17], Pharuhas Chanprapaph, et al. [18], Major Satyabrat Kumar, et al. [19], and Sachin Kumar Singh, et al. [20]. Shivani Singh, et al [21] reported high Doppler indices in intra-uterine growth restriction fetuses as compared to normal. In their study mean RI was 0. 75, 0. 81, 0. 70, 0. 77 and mean S/D was 3. 47, 3. 48, 3. 21, 3. 19 at 30, 33, 36 and 39 weeks respectively in intra-uterine growth restriction fetuses. In our study the RI was 0. 51-1. 00 and S/D ratio was 2. 01-4. 00 of IUGR fetuses at 30-39 weeks of gestation. Ranjan K. Sahoo, et al. , in India reported high Doppler indices in intra-uterine growth restriction group as compared to normal group [22]. In a study conducted by Merina Gayawali, et al. [24] in Nepal 72 out of 140 subjects suspected with intra-uterine growth restriction showed abnormal umbilical artery Doppler findings, 57 of these with S/D ratio greater than 324. This study is strongly related to our study that the S/D ratio was greater than 3 of 20 intra-uterine growth restriction fetuses. Sattar MA et al. , [25] found high values of Doppler PI, low Biophysical profile score and low AFI in intra-uterine growth restriction suspected fetuses group as compared to the normal group. Their findings of Doppler's results are similar to our results. In their study the mean values of PI in intra-uterine growth restriction group were 1-1. 425. In my study the PI values of intra-uterine growth restriction fetuses lie between1. 0-2. 0. Azmat, et al. , showed 38 fetuses with absent end diastolic flow and 12 fetuses with reversed end diastolic flow out of 50 intra-uterine growth restriction fetuses [23]. Noha et al. , conducted a study on sixty high risks intra-uterine growth restricted fetuses and found absent end-diastolic flow in 10 fetuses and reversed end-diastolic flow in 8 fetuses. They also

observed umbilical vein monophasic pulsation in 8 fetuses and triphasic flow in 2 fetuses [26]. In our study of 30 intra-uterine growth restricted fetuses we found 18 fetuses having decreased end diastolic flow and 12 fetuses having absent end diastolic flow. The results of our stud are comparable with studies [23, 26]. The results of our study confirmed the importance of Doppler ultrasound in fetuses with suspicion of intra-uterine growth restriction. Doppler can confirm whether a suspected intra-uterine growth restricted fetus is an actual case of intra-uterine growth restriction or a normal fetus, it will also describe the severity of intra-uterine growth restriction according to the status of end diastolic flow.

5. Conclusion

This study has provided evidence that Doppler indices (PI, RI, and S/D ratio) in intra-uterine growth restricted fetuses are directly proportional to gestational age while in normal fetuses they are inversely proportional. The findings of this study are similar to previous studies. These findings will help to reduce mortality and morbidity in IUGR suspected fetuses by timely diagnosis and management.

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