

## Correlation between Venous Doppler and Perinatal outcome in High Risk Pregnancies

Alhusain Rawia<sup>1</sup>, Olabi Ashraf<sup>1</sup>, Arslan Mohammed Walhan<sup>2</sup>

<sup>1</sup>Obstetrics and Gynecology, Faculty of Medicine/ Aleppo University, Syria.

<sup>2</sup>Dept. of Radiology, Faculty of Medicine/ Aleppo University, Syria

### Abstract

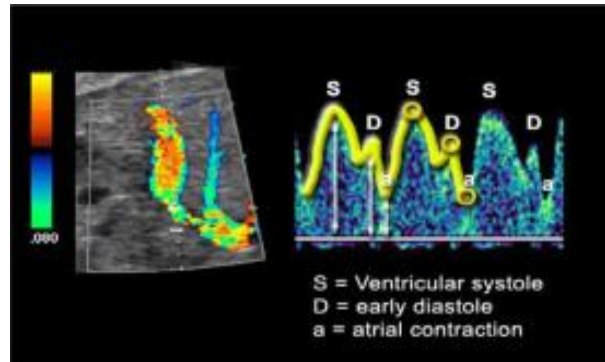
**Objective:** To study the role of venous Doppler in predicting neonatal well-being and its correlation Apgar score in high risk pregnancies. **Methods:** A total of 215 singleton high risk pregnancies were studied after 28 weeks, venous Doppler (ductus venosus and umbilical vein) was performed. The Apgar score was performed 1 minute and 5 minutes after birth. P-value less than 0,05 was considered being significant. **Results:** Among the 215 infants, 145 (67.44%) were with healthy outcome, 55 (25.58%) were NICU admission and 15 (6.98%) were still birth. Sensitivity and specificity of abnormal Doppler in predicting perinatal outcome is 20 % and 100% respectively.

**Keywords:** Apgar score, umbilical vein, ductus venosus.

### INTRODUCTION

The study of fetal color Doppler ultrasound has made it possible to delineate vessels like the umbilical artery, middle cerebral artery, ductus venosus and umbilical vein with greater ease and accuracy, resulting in quicker and more accurate examination and offers the potential to evaluate uteroplacental and fetal blood flow serially and to understand the pathophysiology of complicated pregnancy. Venous Doppler flow measurements have also been reported to allow more detailed analysis of the fetal circulatory and cardiac condition especially in the presence of abnormal arterial Doppler waveforms<sup>(1)</sup>. Ductus venosus (DV) flow plays a fundamental role in fetal hemodynamics, and in utero, it allows approximately 20–30% of the umbilical venous blood to bypass the liver and rapidly reach the central circulation and helps maintain a stable flow of blood toward the brain, heart and adrenal glands<sup>(2)</sup>. The DV acts as the first partition determining the proportion of umbilical venous blood that is diverted to the heart and the typical ductus venosus waveform includes a peak during ventricular systole, a second peak during ventricular diastole and a nadir during the atrial contraction in late diastole<sup>(3)</sup>. Doppler examination of the ductus venosus (DV) flow velocity waveform has been widely used for fetal surveillance. In clinical practice, the observation of increased pulsatility due to decreased velocity during atrial contraction (a-wave) can be considered a sign of fetal compromise<sup>(4,5)</sup>. The characteristic DV waveform is shown in Fig. 1 with a peak velocity during systole (S), end-systolic blood velocity (ES), peak velocity during diastole (D) and velocity corresponding to atrial contraction (A)<sup>(6)</sup>. When the screen showed at least three

consecutive wave forms of similar height the image was frozen and DV PI, RI, S/D ratio were estimated.



**Figure.1: Normal DV waves**

## **MATERIAL AND METHODS**

This was a prospective cross sectional study conducted in Obstetrics and Gynecology University Hospital of Aleppo during January 2017 to February 2019. Study population consisted of pregnant women who have admitted in high risk pregnancy ward in OBGYN University Hospital of Aleppo, and are in 28 weeks of gestational age or more. All patients selected for this study underwent history taking and examination at admission. The routine antenatal blood and urine investigation were done. The gestational age was based on the last menstrual period (LMP) and early ultrasound before 13 weeks. Doppler waveforms of umbilical vein and ductus venosus are obtained as described. Data collected included caesarean section rate, vaginal delivery rate, birth weight, Apgar scores and admission to neonatal intensive care unit, perinatal mortality and subjected to statistics analysis with different parameters. Statistical analysis was done with SPSS-24 programme. Variables are described first, then compared with using Chi-square test. P-value less than 0,05 was considered significant.

## **RESULTS AND DISCUSSION**

In present study, 215 patients with various high-risk factors were subjected to foetal doppler study and their perinatal outcome and other various parameters were studied. Based on the risk factors, the cases were distributed as follows; 69 cases had hypertensive disorders of pregnancy, 37 cases had foetal growth restriction, 97 cases had oligohydramnios, 19 cases had polyhydramnios, 16 cases had diabetes, 12 cases had Rh- negative pregnancy, 30 cases had premature rupture of membranes and 29 cases had postterm pregnancies. Many of the pregnant women have more than one risk factor.

**Table (1): General statistical study of study groups**

	mean	Standard deviation
Age	28.24	7.86
Gestational age	36.25	2.28
Apgar min 1	8.25	1.93
Apgar min 5	8.69	2
Birth weight	3052.42 g	485.24 g

On the doppler study, the cases were distributed as normal (195) which constituted 90.7%, abnormal (20) which constituted 9.3%

**Table (2): Demographics distribution in study**

Age group	Normal doppler		Abnormal doppler	
	number	%	number	%
<20	33	15.34	4	1.86
20-30	74	34.41	8	3.72
31-40	68	31.62	7	3.25
>40	20	9.3	1	0.46
Total	195	90.7	20	9.3

Out of 20 high risk cases with abnormal Doppler, 8 (3.72%) cases were from 20-30 yrs age group.

**Table(3): Distribution of cases according to Doppler study**

	Normal doppler		Abnormal doppler	
	number	%	number	%
disorders of	54	78.26	15	21.74
foetal growth restriction	28	75.67	9	24.33
oligohydramnios	75	77.31	22	26.69
polyhydramnios	16	84.21	3	15.79
diabetes	14	87.5	2	12.5
Rh-negative pregnancy	7	58.33	5	41.67
rupture of	28	93.33	2	6.67
postterm pregnancies	24	82.75	5	17.25
<b>Mode of delivery</b>				

Vaginal	74	34.41	3	1.4
caesarean section	121	56.27	17	7.9
<b>Perinatal outcome</b>				
Healthy	145	67.44	0	0
NICU	44	20.46	11	5.1
Stillbirth	6	2.79	9	4.18
<b>Apgar 1 minute</b>				
<7	40	18.6	15	6.97
≥7	155	72.09	5	2.32
<b>Apgar 5 minute</b>				
<7	37	17.2	15	6.97
≥7	158	73.48	5	2.32
<b>Birth weight</b>				
<2500	18	8.37	8	3.72
2500-4000	168	78.13	12	5.58
>4000	9	4.18	0	0

While out of 195 high risk cases with normal Doppler, 74 (34.41%) were delivered vaginally and 121 (56.27%) required caesarean section, which is statistically significant ( $p=0.01$ ). Normal Doppler, 145 (67.44%) were with healthy outcome, 44 (20.46%) were NICU admission and 6 (2.79%) were still birth. It was statistically significant ( $p<0.0001$ ).

**Table (4): Sensitivity and specificity of Doppler study**

<b>Doppler studies</b>	
Sensitivity	20%
Specificity	100%
Positive predictive value	100%
Negative predictive value	76.7%
Accuracy	78%

Sensitivity and specificity of abnormal Doppler in predicting perinatal outcome is 20% and 100% respectively.

## DISCUSSION

During the period of study (January 2017 to February 2019), 215 patients were diagnosed with high risk factors, which can affect uteroplacental or fetoplacental circulation resulting in increased maternal and perinatal morbidity or mortality. In our study high risk pregnancy with abnormal doppler in comparison to high risk pregnancy with normal doppler there are more number of caesarean sections than vaginal deliveries which is statistically significant ( $p=0.01$ ). In high risk pregnancy with abnormal Doppler in comparison to normal Doppler there are more number of sick babies than healthy babies and there are more number of still births which is statistically significant ( $p<0.0001$ ). In high risk pregnancy with abnormal Doppler in comparison to high risk group with normal Doppler, there are more number of low birth weight babies in comparison to normal weight, which is statistically significant ( $p =0.001$ ). The sensitivity and specificity of abnormal Doppler in predicting perinatal outcome is 20% and 100% with respectively. The positive predictive value is 100% and

negative predictive value is 76.7%

## CONCLUSION

Foetal Doppler studies are an important method of foetal surveillance especially in high risk pregnancy. Foetus in high risk pregnancy is at risk of hypoxia and FGR. The present study indicates the value of abnormal Doppler in the diagnosis of low birth weight babies who may require early delivery and high-risk pregnancies which may be associated with poor perinatal outcome. With abnormal Doppler, mother is also at risk of increased morbidity due emergency caesarean section.

## REFERENCES

- [1] Pennati G, Bellotti M, Ferrazzi E. Hemodynamic changes across the human ductus venosus: a comparison between clinical findings and mathematical calculations. *Ultrasound Obstet Gynecol* 1997;9:383–91.
- [2] Kiserud T, Rasmussen S, Skulstad S. Blood flow and the degree of shunting through the ductus venosus in the human fetus. *Am J Obstet Gynecol* 2000;182:147–53.
- [3] Kiserud T. Physiology of the fetal circulation. *Semin Fetal Neonatal Med* 2005;10:493–503.
- [4] Kiserud T, Eik-Nes SH, Blaas HG, Hellevik LR, Simensen B. Ductus venosus blood velocity and the umbilical circulation in the seriously growth-retarded fetus. *Ultrasound Obstet Gynecol* 1994;4:109e14.
- [5] Baschat AA, Güclü S, Kush ML, Gembruch U, Weiner CP, Harman CR. Venous Doppler in the prediction of acidebase status of growth-restricted fetuses with elevated placental blood flow resistance. *Am J Obstet Gynecol* 2004;191:
- [6] Rizzo G, Capponi A, Arduini D, Romanini C. Ductus venosus velocity waveforms in appropriate and small for gestational age fetuses. *Early Hum Dev* 1994;39:15–26