Original Article
MVP Journal of Medical Sciences, *Vol 7(2), 232-239, July-December 2020*
ISSN (Print) : 2348–263X
ISSN (Online) : 2348-2648
DOI: 10.18311/mvpjms/2020/v7i2/24674

Correlation of Doppler Findings with Perinatal Outcome Among Patients with Pregnancy Induced Hypertension

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Abstract

Background: Hypertensive conditions are the most widely recognized medical complications during pregnancy. **Aims and Objectives:** In the current study, an attempt was made to understand the significance of Doppler studies in pregnancy induced hypertension and to correlate with the perinatal outcome and to offer better strategies of prevention and early detection and management. **Methods**: The study comprised of 138 patients admitted in a tertiary care centre at or beyond 28 weeks of gestation with pregnancy induced hypertension (PIH). To determine and monitor a favorable or worsening fetal wellbeing status, follow up Doppler studies were performed though the results of only last Doppler ultrasound within one week of delivery were used for analysis. Patients were followed up till delivery. The maternal and perinatal outcome was studied thereafter. **Results**: Umbilical Artery (UA) Doppler findings disclosed 26.8% had abnormal umbilical artery S/D ratio, 31.1% had abnormal umbilical artery Recoiling Index (RI) and 2.90% had abnormal umbilical artery Pulsatality Index (PI). Perinatal mortality in the abnormal umbilical artery PI category was found to be the highest (100%) compared to abnormal umbilical S/D artery ratio (66.7%)to be the highest (100%) compared to abnormal umbilical S/D artery ratio (66.7%) and umbilical artery RI ratio (66.7%). In the estimation of adverse perinatal outcome, the predictive accuracy of the umbilical artery S/D ratio in the prediction of adverse perinatal outcome was found to be 73.91%while that of UA RI ratio was 68.12% and the UA PI was 61.59%.Itwas found that in prediction of adverse perinatal outcome, the Umbilical artery PI had higher specificity (97.65%) than the UA S/D ratio (88.24%) and UA RI (80.00%). Fetal middle cerebral artery Doppler studies revealed that 15.2% patients had abnormal MCA S/D ratio, 13.0% had abnormal MCA RI and 15.21% had abnormal MCA PI of which maximum perinatal mortality was seen in abnormal MCA S/D ratio (66.7%) followed by MCA PI (33.3%). Most specific predictor of adverse perinatal outcome was Cerebroplacental ratio (MCA PI/UA PI be (97.65%) The cerebroplacental index has the highest specificity (97.65%)and positive predictive value (93.55%) in predicting adverse perinatal outcome, compared to that of Umbilical artery pusatility index (97.65% and 1.60%) and MCA Pulsatility Index (91.76 and 84.62%) in the present study.**Conclusion**: The present study noted the prominance of Doppler ultrasound studies in PIH patients, detecting compromised fetuses in utero and taking fitting action in a timely manner.In the present study, the predictive accuracy of the umbilical artery S/D ratio in predicting adverse perinatal outcome was found to be high relative to UA RI and UA PI. In addition, the umbilical artery PI had the highest specificity compared to other Doppler parameters. Absent end diastolic flow and Reversal of end diastolicflow were associated with significant perinatal

Keywords: Doppler, Pregnancy Induced Hypertension (PIH), Perinatal Outcome

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morbidity and mortality. All the babies with absent end diastolic flow required admission to NICU while babies with a Reversal of end diastolic flow had higher mortality.

1. Introduction

Hypertensive conditions are the most widely recognized medical complications during pregnancy. Despite several attempts made at early diagnosis, prevention and treatment, this spearheads to a majority of adverse perinatal and maternal outcome.

The occurance of several hypertensive pregnancy conditions fluctuates widely from 5% to 15%. Preeclampsia is a pregnancy specific syndrome that can nearly affect almost any organ system. It is defined as systolic blood pressure of 140 mmHg or higher and/or diastolic blood pressure of 90 mmHg or higher on at least 2 occasions 4 to 6 hours apart after 20 weeks gestation with proteinuria ≥ 300 mg/24 hours or ≥ +1 on dipstick[1].

In management of pregnancy induced hypertension cases, simple methods like daily fetal kick count, non-stress test and fetal biophysical profile are used for monitoring of fetal wellbeing. To identify intrauterine growth restriction, oligohydramnios, placental calcifications and infarcts, an obstetric ultrasonography is performed.

The fetomaternal and uteroplacental circulation can be studied with the dawn of the Doppler technology. It is one of the most rigorously assessed non-invasive test of fetal well-being. Altered uteroplacental flow may hamper the fetal development and may contribute to fetal hypoxia resulting in adverse perinatal outcome due to preeclampsia[2,3]. For haemodynamic monitoring of the fetal wellbeing, Doppler studies provides a repetitive, non-invasive tool. It can assist in early recognition of fetal compromise and help in the timing of delivery.

In the current study, an attempt was made to understand the significance of Doppler studies in pregnancy induced hypertension to correlate with the perinatal outcome and to offer better strategies of prevention and early detection and management.

2. Aims and Objectives

- To study and analyse the Pulsatility Index (PI) in umbilical artery and middle cerebral artery using color Doppler ultrasound in patients with pregnancy induced hypertension.
- To correlate Doppler findings with the perinatal outcome in cases of pregnancy induced hypertension.

3. Materials and Methods

Study type/design: Observational study.
Study settings: The study was done in Departments of Obstetrics and Gynaecology and Radiology at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra.
Duration of study: From August 2017 to December 2019.
Sample size: A total of 138 cases were taken into consideration.
Inclusion criteria: Singleton pregnancy at or more than 28 weeks clinically diagnosed as pregnancy induced hypertension.
Exclusion criteria:

- Multiple gestation.
- Congenital anomalies of the fetus.
- All antenatal cases with chronic hypertension.
- All antenatal cases with abnormal Doppler findings without pregnancy induced hypertension.
- Intrauterine death at the time of first Doppler examination.
- Patients who did not be follow up.

After IEC approval, written informed consent was obtained from all the patients. Detailed history and clinical examination was done. Routine and PIH investigations such as complete blood count with platelets, liver function tests, PT-INR, renal function test (serum creatinine, blood urea nitrogen, serum uric acid, serum electrolytes, complete urine analysis for microscopy for albumin, sugar, WBCs, RBCs and casts, 24 hour urine protein), LDH, ophthalmic examination (Fundus) were carried out for all these patients. Detailed ultrasound examination with Doppler studies was done. To determine and monitor a favorable or worsening fetal wellbeing status, follow up Doppler studies were performed though the results of only last Doppler ultrasound prior to one week of delivery were used for analysis. Patients were followed up till delivery. The maternal and perinatal outcomes such as mode of delivery, meconium stained amniotic fluid, APGAR at 5 min <7, NICU admission and perinatal mortality were studied thereafter.

4. Results

Table 1. Severity of Preeclampsia among study participants

Severity of preeclampsia	Numbers	Percentage
Mild	107	77.5%
Severe	31	22.5%
Total	138	100.00%

Table 2. Perinatal outcome among study participants

Outcome		Number	Percent
Mode of Delivery	Spontaneous vaginal delivery	55	39.9%
	Instrumental vaginal delivery	6	60.1%
	LSCS	77	55.8%
Birth Weight	<1.5 kg	13	9.5%
	1.5-2 kg	18	13%
	2-2.5 kg	38	27.5%
	>2.5 kg	69	50%
Meconium stained liquor	Present	20	14.5%
	Absent	118	85.5%
APGAR at 5 mins	<7	22	15.9%
	>7	116	84.1%
NICU admission	Required	26	18.8%
	Not required	112	81.2%
Perinatal death		4	2.9%

Table 3. Distribution of various Colour doppler findings among study participants

		Abnormal	Normal	Total
Umbilical artery	PI	04	134	**138**
MCA	PI	21	117	**138**

Table 4. Association of umbilical artery PI with pregnancy outcome

UA PI		Outcome		Total	Chi-square value	P-value
		Bad	Good			
Abnormal	Count	2	2	4	0.234	P=0.629 NS
	Percent	3.8%	2.4%	2.9%		
Normal	Count	51	83	134		
	Percent	96.2%	97.6%	97.1%		
Total	Count	53	85	138		
	Percent	100.0%	100.0%	100.0%		

Table 5. Correlation of umbilical artery PI with adverse pregnancy outcome

UA PI compared with perinatal outcome crosstabulation						
Study Parameter		UAPI		Total	Chi-square value	P-value
		Abnormal	Normal			
LSCS for fetal distress	N	1	18	19	2.65	P=0.434 NS
	%	5.3%	94.7%	100.0%		
Meconium stained Amniotic Fluid	N	0	20	20		P=0.639 NS
	%	0.0%	100.0%	100.0%		
APGAR at 5 minutes	N	1	20	21		P=0.873 NS
	%	4.8%	95.2%	100.0%		
NICU admission	N	2	24	26		P=0.081 NS
	%	7.7%	92.3%	100.0%		
Perinatal mortality	N	0	4	4		P=0.726 NS
	%	0.0%	100.0%	100.0%		

As shown in table 1, of the 138 patients included in the study, 77.5% patients had mild preeclampsia and 22.5% had severe preeclampsia.

As shown in Table 2, 31 (22.5%) patients had birth weight <2 kgs, MSL was present in 20 (14.5%), APGAR <7 in 22 (15.9%), NICU admission was required for 26 (18.8%) babies and 4 (2.9%) had perinatal deaths.

As shown in Table 3, abnormal PI of umbilical and middle cerebral arteries was seen in 4 and 21 patients respectively.

As shown in Table 4, out of total 53 cases with adverse perinatal outcome, 2 (3.8%) cases were having abnormal UA Pulsatility Index and 51 (96.2%) cases have normal UA PI. The association of umbilical artery PI and adverse perinatal outcome was not significant.

As shown in Table 5, correlation of adverse perinatal outcome with umbilical artery PI was not significant.

As shown in Table 6, umbilical artery Pulsatility Index is having specificity of 97.65% and diagnostic accuracy of 61.59% in predicting adverse perinatal outcome.

As shown in Table 7, out of total 53 cases with adverse perinatal outcome, 14 (26.4%) cases were having abnormal MCA P.I. and 39 (73.6%) cases have normal MCA PI.

Table 6. Diagnostic validity of umblical artery PI for adverse pregnancy outcome

Measure	Estimate
Sensitivity	3.77%
Specificity	97.65%
Positive Likelihood Ratio	1.60
Negative Predictive Value (*)	61.94%
Diagnostic Accuracy	61.59%

Table 7. Association of middle cerebral artery PI with pregnancy outcome

MCA PI		Outcome		Total
		Bad	Good	
Abnormal	Count	14	7	21
	Percent	26.4%	8.2%	15.2%
Normal	Count	39	78	117
	Percent	73.6%	91.8%	84.8%
Total	Count	53	85	138
	Percent	100.0%	100.0%	100.0%

Table 8. Association of MCA PI with adverse pregnancy outcome

MCA PI compared with perinatal outcome Crosstabulation						
Study Parameter		**MCA PI**		**Total**	**Chi-square value**	**P-value**
		Abnormal	**Normal**			
LSCS for fetal distress	N	5	14	19	4.07	P=0.082 NS
	%	29.4%	70.6%	100.0%		
Meconium stained Amniotic Fluid	N	4	16	20		P=0.944 NS
	%	14.3%	85.7%	100.0%		
Apgar at 5 minutes	N	8	13	21		P<0.0001 S
	%	36.7%	63.3%	100.0%		
NICU admission	N	8	18	26		P=0.007 S
	%	33.3%	66.7%	100.0%		
Perinatal mortality	N	2	2	4		P=0.042 S
	%	50.0%	50.0%	100.0%		

Table 9. Diagnostic value of MCA PI for adverse pregnancy outcome

Measure	Estimate
Sensitivity	26.42%
Specificity	91.76%
Positive Predictive Value	66.67%
Negative Predictive Value	66.67%
Diagnostic Accuracy	66.67%

As shown in Table 8, association of APGAR <7, NICU admission and perinatal mortality with MCA PI was significant.

As shown in Table 9, middle cerebral artery Pulsatility Index is having specificity of 91.76% in predicting adverse perinatal outcome.

5. Discussion

PIH is extremely common cause of feto-maternal mortality. Around 10% of pregnant women are affected. It is commonly seen with uteroplacental insufficiency ensuing fetal hypoxia and intrauterine growth restriction.

Many researchers have studied, deliberated and established the role of Doppler ultrasound to recognize the uteroplacental and fetoplacental circulation in pregnancy induced hypertension. Timely and suitable action can be taken if abnormal vascular resistance patterns in compromised fetuses are detected.

Table 10. Comparison of diagnostic accuracy of Umbilical cord PI

Study/year	Umbilical Artery PI				
	Sensitivity	**Specificity**	**PPV**	**NPV**	**Accuracy**
Gramellini[2] (1992)	64%	90.7%	72.7%	86.7%	83.3%
Yoon *et al*[6] (1994)	89%	86%	86%	89%	-
Ozeren *et al*(1999)	69%	97%	95%	81%	85%
B N Lakhkar[4] (2006)	50%	59%	66.6%	41.9%	-
Smitha[1] (2014)	90.26%	80.57%	82.24%	88.35%	84%
Present study	3.77%	97.65%	1.60%	61.94%	61.59%

The diagnostic accuracy of umbilical artery PI in present study was 61.59% (Table 10).

Table 11. Comparison of diagnostic accuracy of middle cerebral artery PI

Study	MCA Pulsatility Index				
	Sensitivity	**Specificity**	**PPV**	**NPV**	**Diagnostic Accuracy**
Arduini *et al*[11]	68	91	-	-	-
Gramellini *et al*	24	100	100	77.3	78.8
Fong *et al*	72.4	58.1	37.7	85.7	_
Ozeren *et al*	42	69	50	63	58
Smitha *et al*	86.24	50.63	62.23	80.24	64
Present Study	26.42	91.76	66.67	66.67	66.67

The diagnostic accuracy of MCA PI in present study was 66.67% (Table 11).

6. Conclusion

The present study noted the umbilical artery PI had the highest specificity compared to other Doppler parameters.

In this study, the specificity and diagnostic accuracy of Doppler ultrasound indices was high in predicting adverse perinatal outcome in patients of PIH.

Thus, Doppler studies can be useful in decision making in compromised fetus along with other modalities of fetal surveillance and serves as an important yardstick for the obstetricians while dealing with pregnancies complicated with pregnancy induced hypertension.

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How to cite this article: Damle N and Kathaley M. Correlation of Doppler Findings with Perinatal Outcome Among Patients with Pregnancy Induced Hypertension. MVP J. Med. Sci. 2020; 7(2):232-239.