ROLE OF MIDDLE CEREBRAL ARTERY DOPPLER INDICES IN CASES OF PREECLAMPSIA AND IN FETAL OUTCOME

Gynecology

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ABSTRACT

INTRODUCTION: Hypertensive disorders of pregnancy contribute greatly to maternal and perinatal morbidity and mortality globally, particularly in developing countries. Pre-eclampsia is characterized by hypertension and significant proteinuria during pregnancy. Doppler ultrasonography is an important noninvasive and quick technique that can detect Intrauterine growth restriction (IUGR) at an early stage and reliably predict any adverse perinatal outcome in hypertensive pregnancies. Doppler velocimetry of the umbilical artery and middle cerebral artery strongly correlate with pregnancy outcome. In this study we have done Doppler indices of middle cerebral artery at the time of presentation of pre-eclampsia.

KEYWORDS

Pre eclampsia, Doppler ultrasonography, Middle cerebral artery RI

AIM AND OBJECTIVE

To evaluate the role of Doppler velocimetry in predicting fetal outcome in patients with pre-eclampsia in singleton pregnancies using doppler indices of Middle cerebral artery at the time of presentation.

MATERIALS AND METHODS

A single centric observational descriptive study was conducted for a period of 18 month from June 2017 to November 2018 using Siemens ACUSON S2000 color Doppler diagnostic system with curvilinear probe array with frequency 3.5MHz. 50 pre-eclampsia patients were enrolled into the study. Prior institutional ethics committee clearance was obtained for study. Informed consent was obtained from subjects for inclusion of their test result in study. Reference studies were used.

DISCUSSION

Hypertensive disorders are among the most common problem encountered during pregnancy. It accounts for approximately 6–8% of all the pregnancies. (1) It is the leading cause of maternal morbidity and mortality. These disorders comprise of chronic hypertension, gestational hypertension which can progress into pre-eclampsia and eclampsia. Pre-eclampsia is High Blood Pressure of 140/90mmHg or more on two separate occasions measured at least four hours apart, arising de novo after 20 weeks gestation in a woman with previously normal blood pressure accompanied by proteinuria, defined as urinary excretion of $\geq 300\text{mg}/24\text{hrs}$ and / or evidence of end organ involvement.

Doppler techniques have been the focus of interest and research activity in obstetrics since the initial report of signals from the umbilical artery by Fitzgerald and Drumm.(2) The middle cerebral artery is the most accessible cerebral vessel to ultrasound imaging in the fetus, and it carries more than 80% of cerebral blood flow.(4) The cerebral circulation is normally a high-impedance circulation with continuous forward flow throughout the cardiac cycle. This is the reverse of flow within the umbilical cord toward the placenta. In the presence of fetal hypoxemia, central redistribution of blood flow occurs, resulting in an increased blood flow to the brain, heart and adrenals, and a reduction in flow to the peripheral and placental circulations. This blood flow redistribution is known as the brain-sparing reflex and plays a major role in fetal adaptation to oxygen deprivation (5) The right and left middle cerebral arteries represent major branches of the circle of Willis in the fetal brain. The circle of Willis, which is supplied by the internal carotids and vertebral arteries, can be imaged with color flow Doppler ultrasound in a transverse plane of the fetal head obtained at the base of the skull (6) Middle cerebral artery Doppler waveforms, obtained from the proximal portion of the vessel, immediately after its origin from the circle of Willis, have shown the best reproducibility. The fetal middle cerebral artery (MCA) was studied with patient in a recumbent position Resistance index (RI) of this artery was obtained as soon as patient diagnosed with preeclampsia. These values were

considered abnormal when they lie below the 5th percentile for gestational age. The patients were followed by serial Doppler assessment and the result of the last Doppler examination within 10 days of delivery was considered in the subsequent correlation with perinatal outcomes. Maternal outcome was noted in terms of mode of termination of pregnancy, maternal complications, maternal end result. Perinatal outcome noted in form of associated complications to baby like hypoxic ischemic encephalopathy (HIE), intraventricular hemorrhage, sepsis, NEC, Admission to NICU, APGAR score at 1 min and 5 min, perinatal mortality.

DOPPLER INDICES

Doppler indices of middle cerebral artery (MCA) reported 16% patients had abnormal MCARI. The sensitivity and specificity of MCA in determining abnormal fetal outcome our study was 100 % and 32% respectively. In normal fetus, there is little diastolic flow in MCA and S/D ratio is greater than 4. In asymmetric IUGR there is increased diastolic flow, a pattern believed to reflect brain sparing phenomena described in experimental models of fetal hypoxia. Monika singh in her study (7) reported sensitivity of 80% and specificity of 95% in determining abnormal fetal outcome. Hemlata Dhand (8) in her study reported sensitivity of 71% and specificity of 92 % in determining adverse fetal outcome. Singh SK (9) reported sensitivity of 60% and Specificity of 63.6% of MCA RI in determining IUGR and the study also reported MCA PI had a sensitivity of 66.6% in determining APGAR < 7 at 5min and a specificity of 78.7% in determining NICU admissions. Study conducted by Devi J (10) reported 17.39% sensitivity and 92.59 % specificity in determining perinatal outcome. While study conducted by Goyal et.al.(11) had MCA RI sensitivity of 28.46% and specificity of 71.42%.

RESULTS

A) MIDDLE CEREBRAL ARTERY RI

Gestational Age	Normal Reference Value	No Of Participants	Participants With Normal RI	No Of Participants With Abnormal RI
28	0.661	1	0	1
29	0.66	1	0	1
30	0.657	2	1	1
31	0.652	1	1	0
32	0.645	2	1	1
33	0.636	3	2	1
34	0.625	7	5	2
35	0.612	2	1	1
36	0.597	3	3	0
37	0.579	12	12	0
38	0.560	14	14	0
39	0.539	2	2	0
TOTAL		50	42	8

B) MIDDLE CEREBRAL ARTERY AND FETAL OUTCOME

Middle cerebral artery RI	Fetal outcome		Total
	Normal	Abnormal	
Normal	25	17	42
Abnormal	0	8	8

RESULTS AND CONCLUSION

1. The sensitivity and specificity of Middle cerebral artery (MCA) in determining abnormal fetal outcome in our study was 100% and 32% respectively.
2. Doppler indices of MCA reported 16% patients had abnormal MCARI.
3. The sensitivity and specificity of MCA in determining abnormal fetal outcome was 100% and 32% respectively, while accuracy was 66%.
4. 86% fetuses were alive after delivery, whereas 10% fetus had neonatal death and 4% were stillborn in our study.
5. No maternal mortality was reported in our study.

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