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ROLE OF UMBILICAL ARTERY DOPPLER INDICES IN CASES OF PREECLAMPSIA AND MATERNAL AND PERINATAL OUTCOME

Obstetrics & Gynaecology

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KEYWORDS

Pre eclampsia, Doppler ultrasonography, Umbilical artery RI, Umbilical artery RI & S/D.

INTRODUCTION

Preeclampsia is a disease that is unique to pregnancy and causes significant maternal, fetal and neonatal morbidity and mortality worldwide. Doppler ultrasonography is a unique, noninvasive, quick and safe method to assess feto-placental circulation and detect abnormal vascular resistance and identify the fetus at risk for compromise and predicting its perinatal outcome. The quantitative and qualitative analysis of uteroplacental flow and fetal circulation can predict placental and fetal dysfunction well before the clinical manifestation of obstetric complication. [1] The application of Doppler velocimetry has been well established regarding intrauterine growth restriction, fetal hypoxia, hypertension, fetal anaemia and cardiac malformations.

AIM AND OBJECTIVE

To evaluate the role of Doppler velocimetry in predicting fetal and maternal outcome in patients with pre-eclampsia using doppler indices of umbilical artery at the time of presentation.

MATERIALS AND METHODS

A single centric, 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

Inclusion criteria

1. The LMP and Gestational Age of the patient confirmed by Ist Trimester Scan.
2. Patients with a single live Pregnancy.
3. Subjects to undergo NT (Nuchal Translucency Scan) and Double Marker Test done between 11 to 13 weeks..
4. Uterine Artery Doppler Ultra Sonography at 18 to 22 weeks, with Anomaly Scan.
5. A clinically diagnosed case of preeclampsia or Hypertension-BP of more than 140/90mm Hg as detected after 20 weeks of gestation.
6. Patients willing to follow up.
7. Patients willing to give written informed consent and participate in the study.

Exclusion criteria

1. Patients with age > 40 years.
2. Patients with multifetal Pregnancy
3. Patients with prior history of Preeclampsia
4. Patients with pre-conceptional Body mass index (BMI) > 35 kg/m square- BMI before pregnancy.
5. Patients with pregnancies in a case of Pre-existing Hypertension, epilepsy. severe Anemia. cardiac Cases.
6. Patients not willing to participate in the study

DISCUSSION

Hypertensive disorders of pregnancy are one of the greatest maternal health problems worldwide. These disorders comprise of pre-existing hypertension and gestational hypertension, which then can progress into preeclampsia, eclampsia. Pre-eclampsia (PE) is a disorder of pregnancy characterized by the onset of high bloodpressure and often a significant amount of protein in the urine. This Multisystem disorder occurs in approximately 3% to 8% of pregnancies and can progress to eclampsia with life-threatening seizures.[2] The fundamental cause of preeclampsia is thought to be the abnormal utero-placental circulation resulting from the failure of second wave of trophoblastic invasion into spiral arterioles.[3] The second wave of endovascular trophoblast migration normally occurs from about 16 weeks gestation onwards. This will result in increased resistance to flow within the uterine arteries and decreased placental perfusion. The addition of Doppler flow studies of maternal and fetal vessels has provided a tool where the maternal and fetal unit can be assessed. Doppler velocimetry of the umbilical artery, middle cerebral artery and uterine circulation strongly correlate with pregnancy outcome. The umbilical arterial circulation is normally a low impedance circulation, with an increase in the amount of end-diastolic flow with advancing gestation. Umbilical arterial Doppler waveforms reflect the status of the placental circulation, and the increase in end-diastolic flow that is seen with advancing gestation is a direct result of an increase in the number of tertiary stem villi that takes place with placentalmaturation[4]. 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[5] 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. The notation of absent or reversed end-diastolic flow in the umbilical artery is commonly associated with severe intrauterine growth restriction (IUGR) and oligohydramnios. [6] Doppler can detect IUGR at a very early stage and help salvage a compromised fetus. Therefore the present study was conducted to evaluate the role of umbilical artery Doppler velocimetry in predicting fetal maternal outcome in pre eclampsia patients.The fetal umbilical artery (UA) was studied with patient in a recumbent positionResistance index (RI) and systolic/diastolic ratio of this artery were obtained as soon as patient diagnosed with preeclampsia. These values were considered abnormal when they lie beyond the 95th percentile for gestational age. Similarly, the absence/reversal of end diastolic flow in umbilical artery were also noted. Umbilical artery was studied at mid level where the free floating portion of the loop of the cord was identified.

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.

Total 50 cases were studied. The average age of participants in our study was 26.26 ± 6.97 years with majority of participants were in the age group of 18-25 years (62%). Primigravidae were in majority (60%) in our study as compared to multigravidae who were 40%. Majority of the participants had severe preeclampsia (64%) in our study, as compared to 36 % who had mild pre eclampsia. A result similar to our study was reported by **Praveen Aabidha** [9] where 67.74 % patient had severe pre eclampsia. 56 % of our study participants delivered at term whereas 44% had pre term delivery and cesarean section was the most common mode of delivery in 52% participants. Study conducted by **Pacher J** [10] to determine the most favorable delivery for patients with

preeclampsia between the week 37 and 41 of gestation reported elective cesarean section to be the most common mode of delivery.

Maternal complications

No maternal mortality was reported in our study. Post partum hemorrhage was the most common complication reported in 22% patients in our study followed by eclampsia in 6% and HELLP in 2%. study conducted in India by **Nankali A** [11] among 349 patients reported eclampsia in 6.3% patients and HELLP syndrome in 1 patient. Placental abruption was obstetric complication in 7.7 % (27 cases) and the most frequent maternal complication (37 cases) reported was coagulopathy (10.6 %).

Fetal complications

86% fetuses were alive after delivery, whereas 10% fetus had neonatal death and 4 % were stillborn in our study. No complication was reported in 58% fetus whereas IUGR was the most common fetal complication in 32% fetus. Other complication reported in our study were neonatal sepsis (8%), NEC (8%), Periventricular hemorrhage (6%).

Doppler indices

Determination of Umbilical artery RI, showed 84% patients had abnormal RI and 16% had RI within normal limit. The Umbilical artery RI showed 96% specificity and 28% sensitivity in determining abnormal fetal outcome in our study. Umbilical artery Doppler indices increase in preeclampsia and these changes tend to be greater in severe preeclampsia and worsen the fetal outcome. Results similar to our study was shown in study conducted by **Teena Nagar** [14] where umbilical artery RI in predicting IUGR showed 42.86% sensitivity and 94.62% specificity. **Pradeep Sharma** in his study [15] reported abnormal umbilical artery RI in 55% patients with sensitivity of 50% and specificity of 28.6% in diagnosing IUGR. Umbilical artery S/D ratio in our study revealed, 74% patient had abnormal S/D ratio, with sensitivity of 40% and specificity of 88% in determining abnormal fetal outcome. **Chhakchhuak Lalthantluanga** [15] in his study showed that fetuses with UA Systolic/Diastolic (SD) ratio >3 were associated with poor perinatal outcome in 89.65% with sensitivity and specificity of 80.00% and 82.86% respectively. Our study also revealed 12% patients had absent diastolic flow and 12% had reverse diastolic flow. Absent end diastolic flow velocity in the fetal umbilical artery or aorta has been associated with high mortality,increased risk of necrotising enterocolitis, and haemorrhage.

RESULTS

The present study was an observational prospective study conducted in department of obstetrics and gynecology and department of radiology of a tertiary care centre after obtaining permission from the institutional ethics committee and. In our study 50 patients with pre eclampsia were enrolled and evaluated. The results of our study are as follow:

Table 1 : Umbilical artery RI

Gestation Age	Normal Reference value	No of participants	Participants with abnormal RI	Participants with normal RI
28	0.737	1	0	1
29	0.730	1	0	1
30	0.723	2	0	2
31	0.715	1	0	1
32	0.707	2	0	2
33	0.700	3	0	3
34	0.692	7	1	6
35	0.684	2	0	2
36	0.675	3	0	3
37	0.667	12	3	9
38	0.648	14	3	11
39	0.648	2	1	1
TOTAL		50	8	42

Table 2: Umbilical Artery RI and fetal outcome

UMBILICAL ARTERY RI	FETAL OUTCOME		TOTAL
	Normal	Abnormal	
Normal	7	1	8
Abnormal	18	24	42

Table 3: Umbilical Artery S/D

Gestation Age	Normal Reference value	No of participants	Participants with abnormal S/D	Participants with normal S/D
28	4.36	1	0	1
29	4.22	1	0	1
30	4.10	2	1	1
31	3.98	1	0	1
32	3.87	2	0	2
33	3.77	3	1	2
34	3.68	7	1	6
35	3.59	2	0	2
36	3.51	3	0	3
37	3.43	12	3	9
38	3.36	14	6	8
39	3.22	2	1	1
TOTAL		50	13	37

Table 4: Umbilical Artery S/D and fetal outcome

UMBILICAL ARTERY S/D	FETAL OUTCOME		TOTAL
	Normal	Abnormal	
Normal	10	3	13
Abnormal	15	22	37

The Umbilical artery RI showed 96% specificity and 28% sensitivity while Umbilical artery S/D had sensitivity of 40% and specificity of 88% in determining abnormal fetal outcome.

CONCLUSION-

1. The Umbilical artery RI showed 96% specificity and 28% sensitivity in determining abnormal fetal outcome.
2. Umbilical artery S/D ratio had sensitivity of 40% and specificity of 88% in determining abnormal fetal outcome
3. 86% fetuses were alive after delivery, whereas 10% fetus had neonatal death and 4% were still born in our study.
4. No complication was reported in 58% fetus whereas IUGR was the most common fetal complication in 32% fetus.
5. No maternal mortality was reported in our study

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