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Establishment of the Role of USG Findings and Colour Doppler Values for Localization of Placenta in Pre-Eclampsia Patients

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Abstract: ***Background: Pre-eclampsia is a multisystem disorder that complicates 3%–8% of pregnancies in Western countries and constitutes a major source of morbidity and mortality worldwide. The uterine artery is identified with the use of colour Doppler ultrasonography. Pulsed-wave Doppler ultrasonography is then used to obtain waveforms. Various indices can be calculated and assessed. Hence; we planned the present study to establish the role of Colour Doppler values for localization of placenta in Pre-eclampsia patients. Materials & methods: A total of 50 patients were scanned at 18-22 week and were followed up till delivery. Determination of location of placenta and uterine artery Doppler was done by ultrasound machine at 18-22 weeks in all the cases at the time of scan. Grey scale ultrasound and colour doppler was performed. All the data were entered in Microsoft excel sheet. Statistical analysis was done using diagnostic tests such as sensitivity, specificity and predictive values. Chi- square test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant. Results: The overall incidence of pre-eclampsia was 14 percent. Significant results were obtained while assessing the distribution of patients in relation to Doppler findings and occurrence of pre-eclampsia. In the present study, the overall sensitivity of Doppler in detection of pre-eclampsia was 42.86 percent while overall specificity of pre-eclampsia was 90.70 percent. Conclusion: By identification of the high risk patients & anticipating preeclampsia patients, early monitoring can be started thereby reducing the morbidity and improving the outcome of pregnancy. Also, the patients with abnormal doppler study at 18-24 weeks can be started with prophylactic low dose treatment therapy to reduce the severity of preeclampsia.***

Keywords: Doppler, Pre-Eclampsia

1. Introduction

Pre-eclampsia is a multisystem disorder that complicates 3%–8% of pregnancies in Western countries and constitutes a major source of morbidity and mortality worldwide. Preeclampsia has been dubbed a disease of theories. Its concept has transformed throughout the century from a disease specific to the kidney leading to chronic nephritis to a state of toxemia caused by circulating toxins.[1, 2]Pre-eclampsia and intrauterine growth restriction remains important causes of maternal and neonatal complications and death. These 2 conditions are felt to be the result of abnormal placenta formation involving abnormal trophoblast invasion of spiral arteries and a reduction in vascular resistance in the uteroplacental circulation. Uterine artery Doppler ultrasonography may be performed via the transvaginal or transabdominal route in the first or second trimester. Uterine artery waveforms are reported to be readily obtainable in more than 95% of patients. The uterine artery is identified with the use of colour Doppler ultrasonography. Pulsed-wave Doppler ultrasonography is then used to obtain waveforms. Various indices can be calculated and assessed.[3- 6] Hence; under the light of above mentioned data, we planned the present study to establish the role of Colour Doppler values for localization of placenta in Pre-eclampsia patients.

2. Materials & Methods

The present study was conducted with the aim of establishing the role of Colour Doppler values for localization of placenta in Pre-eclampsia patients. A total of 50 patients were scanned at 18-22 week and were followed up till delivery. Determination of location of placenta and uterine artery Doppler was done by ultrasound machine at 18-22 weeks in all the cases at the time of scan. The end point of the study was the development of preeclampsia as per criteria described previously in literature. Grey scale ultrasound and colour doppler was performed. Any co-relation of radiological findings with clinical and surgical findings will be documented and analysed.

Inclusion criteria

- History of preeclampsia or eclampsia in previous pregnancy
- Preeclampsia or pregnancy-induced hypertension (PIH) current.

Exclusion criteria

- Patient with congenital anomaly of fetus, multiple gestations

All the data were entered in Microsoft excel sheet. Statistical analysis was done using diagnostic tests such as sensitivity, specificity and predictive values. Chi- square test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

3. Results

Mean gestation age of the patients of the present study was 20.15 weeks. Out of 50 patients, pre-eclampsia developed in 7 patients. Therefore; the overall incidence of pre-eclampsia was 14 percent. Among the 7 patients with pre-eclampsia, abnormal Doppler findings was found to be present in 3 patients while normal Doppler findings was found to be present in 4 patients. Significant results were obtained while assessing the distribution of patients in relation to Doppler findings and occurrence of pre-eclampsia. In the present study, the overall sensitivity of Doppler in detection of pre-eclampsia was 42.86 percent while overall specificity of pre-eclampsia was 90.70 percent. Overall accuracy was found to be 84 percent.

Table 1: Incidence of Pre-eclampsia

Pre-eclampsia	Number of patients	Percentage of patients
Present	7	14
Absent	43	86
Total	50	100

Table 2: Distribution of patients in relation to Doppler findings and occurrence of pre-eclampsia

Pre-eclampsia	Doppler findings		Total
	Doppler Normal findings	Doppler abnormal findings	
Negative	39	4	43
Positive	4	3	7
Total	43	7	50
Chi- square value	49.28		
p- value	0.00		

Table 3: Efficacy of Doppler in detection of Pre-eclampsia

Statistic	Value
Sensitivity	42.86%
Specificity	90.70%
Positive likelihood ratio	4.61
Negative likelihood ratio	0.63
Positive predictive value	42.86%
Negative predictive value	90.70%
Accuracy	84%

4. Discussion

Preeclampsia is a pregnancy-specific endothelial disease with findings of hypertension and proteinuria. Preeclampsia most commonly occurs after the 20th week of gestation, but it can occur earlier. Signs and symptoms can include swelling, headaches, sudden weight gain, and changes in vision. Currently, patients must show physical signs of preeclampsia before closer monitoring of the pregnancy occurs. The use of uterine artery Doppler has shown promise to help identify those at risk for preeclampsia. Patients with preeclampsia who have undergone evaluation of the uterine artery show specific abnormal Doppler waveform patterns. The spiral arteries undergo a series of morphological changes during normal pregnancy. This vascular transformation in the uterus is necessary to ensure a dramatic increase in blood supply to the intervillous space. The underlying mechanism for the development of PE is thought to be impaired trophoblastic invasion of the maternal spiral arteries and their conversion from narrow muscular vessels to wide non-muscular channels. Doppler ultrasound provides a non-invasive method for the assessment of the uteroplacental circulation. Pathological studies have demonstrated that the prevalence of placental lesions in women with PE is inversely related to the gestation at delivery.[7- 9]Hence; under the light of above mentioned data, we planned the present study to establish the role of Colour Doppler values for localization of placenta in Pre-eclampsia patients.

In the present study, mean gestation age of the patients of the present study was 20.15 weeks. Out of 50 patients, pre-eclampsia developed in 7 patients. Therefore; the overall incidence of pre-eclampsia was 14 percent. Our results were in concordance with the results obtained by previous authors who have also reported very low incidence of Pre-Eclampsia in their study populations. Dhakar V et al reported that the prevalence of pre-eclampsia was 5% and Bewley et al, (4.6%) and Jasovic et al (4%). PE is a very significant disease which complicates from 2% to 5% of pregnancies in Europe and America and can reach up to 10% of pregnancies in developing countries, mainly due to the lack of or inadequacy of emergency care.[9- 12]

Among the 7 patients with pre-eclampsia, abnormal Doppler findings was found to be present in 3 patients while normal Doppler findings was found to be present in 4 patients. Significant results were obtained while assessing the distribution of patients in relation to Doppler findings and occurrence of pre-eclampsia. In the present study, the overall sensitivity of Doppler in detection of pre-eclampsia was 42.86 percent while overall specificity of pre-eclampsia was 90.70 percent. Overall accuracy was found to be 84 percent. Dhakar V et al reported that out of total sample 0f 100 women, 78% found to have normal Doppler and 22% had abnormal Doppler. Our results were in concordance with the results obtained by Dhakar V et al, who reported that overall sensitivity and specificity of Doppler in predicting pre-eclampsia was 40 percent and 91.58 percent respectively.[9] Mirza et al, did study in 268 women, and there were 57 cases with abnormal Doppler. Of these, preeclampsia was diagnosed in 14% cases.[13] A meta-analysis of 74 studies of Pre-eclampsia (PE) (total of 79,547 singleton pregnancies) showed that uterine artery Doppler ultrasonography had a better performance in the second trimester than in the first trimester, and is useful for identifying severe or early-onset PE. Among low-risk women, an increased uterine artery PI in the second trimester has a sensitivity of 78% and specificity of 95% for detecting severe PE (positive likelihood ratio: 15.6; negative likelihood ratio: 0.23).[14]

In a previous study conducted by North RA et al, authors determined the optimal method of measuring uterine artery waveforms with Doppler ultrasound when screening healthy nulliparas for subsequent development of preeclampsia and fetal growth retardation (FGR). Color Doppler ultrasound was used to obtain uterine artery waveforms at 19-24 weeks' gestation in 458 nulliparas. In each uterine artery, the resistance index (RI), the ratio between peak systolic (A) and early diastolic (C) blood flow velocities (AC ratio) (a measure of the early notch in the uterine artery waveform), and placental position were recorded. Although abnormal uterine artery Doppler was associated with an increased risk

of preeclampsia and FGR, the positive predictive values do not support its introduction as a routine screening test in nulliparous women. Sensitivity and specificity of Doppler for assessing pre-eclampsia was reported to be 63% and 89% in the study conducted by Steel SA et al.[15, 16]

5. Conclusion

From the above results, the authors conclude that by identification of the high risk patients & anticipating preeclampsia patients, early monitoring can be started thereby reducing the morbidity and improving the outcome of pregnancy. Also, the patients with abnormal doppler study at 18-24 weeks can be started with prophylactic low dose treatment therapy to reduce the severity of preeclampsia.

Ethics Statement and Conflict of Interest Disclosures

Human subjects: Consent was obtained by all participants in this study.

Conflicts of interest: Nil.

Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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