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Assessment of Role of Uterine Artery Color Doppler in Prediction of Preeclampsia in First Trimester Scan

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ABSTRACT
The study's goal is to better understand how uterine artery colour Doppler can be used to detect preeclampsia during a first trimester scan. Vital signs and general examination findings were recorded. Between 10 and 14 weeks, patients underwent a Doppler ultrasound examination. At the location where they appeared to cross the external iliac artery, both uterine arteries were located using colour Doppler. In both uterine arteries, the resistance index (RI), pulsatility index (PI) and existence or absence of diastolic notch were evaluated. The mean UtA-PI values were significantly linearly associated to gestational age and decreased across the interval studied (R^2 0.04, $p<0.001$). The frequency of bilateral notching also considerably reduced with gestational age. Effective early onset detection With maternal history and uterine artery doppler, PE can be detected However, with the addition of biochemical markers, the detection rate significantly rises in the first trimester of pregnancy. Improved first-trimester PE prediction requires more accessible and affordable preeclampsia biochemical tests.

INTRODUCTION

Its complex etio-pathogenesis is thought to involve interactions between a number of environmental, genetic and immunologic variables. It is characterised by proteinuria and hypertension, either pathological or not edoema and it is a substantial source of morbidity and mortality in both pregnant women and foetuses[1]. 2-3% of pregnancies may be affected by PE., is responsible for 10-15% of maternal or foetal fatalities and accounts for a similar percentage of preterm deliveries that are clinically indicated globally[2]. There is a link between severe PE and foetal development restriction, which is more pronounced if the disease starts early in pregnancy. There is substantial evidence for the usage of of uterine artery (UtA) Doppler ultrasound as a helpful, non-invasive tool to evaluate uteroplacental perfusion in the second trimester and forecast the progression of pre-eclampsia, foetal growth limitation, placental abruption and stillbirth[3-8]. However, early pregnancy is currently the subject of scientific research. There is some evidence to support the idea that identifying the population most at risk during the first and first half of the second trimester of pregnancy would make it possible to examine the potential outcomes of various preventative measures[9]. As a result of defective the maternal spiral arteries' normal development from small muscle vessels in the non-pregnant uterus is disrupted by trophoblastic invasion to large non-muscular channels in the gravid uterus, aberrant placentation is associated to the basic pathophysiology of PE. Some researchers have divided PE into two different disease categories called early-onset and late-onset PE. While late-onset PE manifests at or following 34 weeks of pregnancy, early-onset PE shows up before this point[10-11]. They differ in terms of heredity, clinical aspects, biochemical markers and maternal and foetal outcomes, although having similar presenting signs [12]. Prenatal screening for PE is very important because it is a frequent condition that increases the risk of morbidity and mortality in both the mother and the foetus. A lot of study has recently been done to forecast PE towards the end of the first trimester of pregnancy.

The research of the developing placental vasculature has been revolutionised by uterine artery (UtA) Doppler velocimetry, which has revealed that impedance to flow in the uterine arteries reduces with gestational age in a healthy pregnancy[13]. However, this flow impedance is enhanced in established pre-eclampsia and IUGR even before the disease's clinical symptoms appear[14,15].

Doppler ultrasound is therefore being used in this study to concentrate on how it can be used in the first trimester to screen for pregnancy issues at an early stage, when intervention may be viable for a healthy pregnancy outcome.

The purpose of this study is to determine whether colour Doppler can accurately predict preeclampsia and intrauterine growth restriction during a pregnant woman's first trimester.

MATERIALS AND METHODS

In order to determine the role of uterine artery doppler in the 12- to A prospective research on the 14-week preeclampsia scan and its relationship to IUGR prediction was conducted.

Inclusion criteria: All women who visited the prenatal clinic between 12 and who were between 12 and 14 weeks along and who had a uterine artery Doppler ultrasonography. The study's cases included people of all ages.

Exclusion criteria:

- Carrying a foetus with a congenital abnormality as determined by sonography
- Women who have any type of systemic ailment, such as diabetes mellitus, chronic hypertension, or renal dysfunction
- Several pregnancies
- Individuals whose prior scan reports revealed a recognized congenital uterine abnormality

Patients: Over a 14 month period, the study was conducted in a hospital. An early transvaginal ultrasound scan, which included a UtA Doppler assessment, was offered to pregnant women receiving regular prenatal care between 12 and 14 weeks into the pregnancy. About 250 singleton pregnancies in total were assessed. Each woman gave informed consent and the hospital ethics committee approved the procedure. The latest menstrual cycle was used to calculate gestational age and the length of the crown-rump region was used to confirm it. Chromosome or structural abnormalities, as well as prior use of aspirin, heparin, or antihypertensive medications, were considered exclusion criteria. Age, parity, ethnicity and clinical risk factors for hypertension during pregnancy were documented for the mother.

Vital signs and general examination findings were recorded. Between 10 and 14 weeks, patients underwent a Doppler ultrasound examination. At the location where they appeared to cross the external iliac artery, both uterine arteries were located using colour Doppler. In both uterine arteries, the resistance index (RI), pulsatility index (PI) and existence or absence of diastolic notch were evaluated. Every patient was routinely observed when their blood pressure was checked and urine albumin was discovered. Only pregnant women with blood pressure readings below 140/90 taken twice after 20 weeks of

gestation, proteinuria readings of one or more on a dipstick, or any symptoms of a severe condition (such as HELLP Syndrome, Eclampsia, pulmonary edoema, or cardiac failure), were considered to be pre-eclamptic. IUGR was recognised when there was insufficient interval growth detected clinically and by ultrasound; when the foetal weight was less than the 10th percentile for that gestational age. IUGR was detected clinically, as well as from the interval growth rate and from ultrasound. The gestational age at delivery, mode of delivery, birth weight, APGAR, foetal outcome, NICU admission and ventilator support were all taken into account when a baby was born. Microsoft Excel was used to enter the collected data and SPSS software (version 17) was used to do the necessary statistical analysis. The presentation of continuous variables was as mean SD. To ensure that not the arcuate artery but the major branch of the uterine artery is being measured, attention should be made to ensure that the peak systolic velocity is higher than 60 cm sec^{-1}[16,17]. According to Gomez reference ranges for PI readings for various gestational weeks were used[18].

RESULTS

The study included a total of 250 prenatal cases that came to our clinic and had uterine artery doppler in the first trimester. These ladies were monitored throughout the length of their pregnancies with an emphasis on preeclampsia diagnosis. Preeclampsia prevalence: Of the study's female participants, 35 had PE. In our study, preeclampsia occurred 14% of the time (Table 1).

The mean UtA-PI values were significantly linearly associated to gestational age and decreased across the interval studied (R^2 0.04, p<0.001). The frequency of bilateral notching also considerably reduced with gestational age. These findings are displayed in Table 2.

About 66 of the 250 women who were monitored through pregnancy and delivered were found to have abnormal mean uterine artery PI levels. They were designated as a high-risk group. About 28 of these ladies experienced PE. Five of the 184 women at low risk for developing PE did so (Table 3).

DISCUSSIONS

Preeclampsia, foetal growth restriction, placental abruption and stillbirth are just a few of the conditions impacting the wellness of the mother and foetus that are monitored for in the context of modern antenatal care. The focus of current research is on early risk prediction that aids in early diagnosis and the development of measures to aid in proper monitoring, follow-up and minimization of the risk of unfavourable outcomes. Prevalence of PE: Preeclampsia occurrence varies widely between countries. Western research indicate that 2-7% of expectant mothers may experience PE[19]. According to the WHO, developing countries experience preeclampsia seven times more frequently than developed nations do[20]. Preeclampsia is prevalent in poor nations in a range of 1.8-16.7%[21]. Preeclampsia occurred in 10.5% of the participants in the current study, which is comparable to the rates found in other studies conducted in hospitals in India by Dhall[22] (11.4%) and Gandhi[23] (10.6%). Our study focused primarily on the use of the Doppler technique, showing a lower UtA RI and PI in normal outcome pregnancies than in complicated cases. This finding suggests that the absence of a normal uteroplacental circulation at this early stage of pregnancy may help predict the later development of some pregnancy complications. The uterine artery Doppler was performed between 12 and 14 weeks of gestation because this was the time of the usual scan for nuchal translucency and early morphological assessment.

A significant portion of the women in the current study could be predicted to have PE. However, there is still plenty of room to improve PE detection.

Table 1: Incidence of preeclampsia

Parameters	No.	Percentage
Preeclampsia	35	14

Table 2: Mean, SD, 5th and 95th percentiles for mean UtA-PI (uterine artery-pulsatility index) and prevalence of bilateral notching between 11 and 14 weeks of gestation

	Pulsatility index				
Weeks	Mean	Standard deviation	5th percentile	95th percentile	Bilateral notch (%)
12	1.96	0.71	0.91	2.99	48.91
13	1.85	0.65	0.92	2.69	31.69
14	1.79	0.59	0.81	2.51	29.46

Table 3: Development of preeclampsia in the women included in the study

	Development of PE	
	Present	Absent
DDDD/ddcc doppler findings		
Positive	28	38
Negative	10	174

Pregnancy-associated plasma protein A (PAPP-A) and placental growth factor (PlGF) have demonstrated substantial utility in boosting the accuracy of the diagnosis along with maternal factors and uterine artery Doppler, among the several biochemical markers for PE prediction that have been identified[16]. This is significant because a recent randomised control trial Giving aspirin (150 mg day^{-1}) to pregnant women at high risk for PE reduced the risk for early onset PE by 62%, according to a study (ASPRE) comprising 26,941 pregnant women. When compared to placebo, significantly lowering maternal and foetal complications[24].

The cost and accessibility of the biochemical markers for PE prediction restrict their utilisation. Additionally, there is little knowledge about the importance of PE screening during the first trimester. It is necessary to make an effort to make the screening inexpensive and widely accessible, as well as to inform the treating physician and women who are sexually active about it. As a result, the burden of PE, particularly early onset PE, will be greatly reduced, leading to better maternal and newborn outcomes.

CONCLUSION

By utilising prophylactic aspirin, high-risk pregnancies for early onset PE can be identified earlier and the required steps can be taken to improve placentation. Utilising maternal history and uterine artery doppler in the first trimester of pregnancy can effectively screen for early onset PE, with the introduction of biochemical markers greatly increasing the detection rate. Preeclampsia biochemical screening needs to be more affordable and accessible in order to improve first-trimester PE prediction. Early detection of hypertension problems and the consequences they can cause may have benefits that make preventative therapies possible before 20 weeks of pregnancy. Nevertheless, it is crucial to recognise the at-risk group at such a young stage of pregnancy. Future studies integrating screening tests and uterine Doppler measurements are necessary. Our research goal currently includes a multivariate study for this reason that incorporates the UtA mean PI together with traditional clinical risk factors and many biochemical indicators.

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