

Original Article

Sensitivity of uterine artery Doppler in early detection of preeclampsia and fetal growth restriction.

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Background: Intrauterine growth restriction and pre-eclampsia are significant factors in maternal and neonatal morbidity and mortality. Preeclampsia must therefore be identified early in order to enhance maternal and perinatal outcomes. Our study's goal is to use uterine artery doppler imaging to early detect pre-eclampsia and intrauterine growth limitation. **Materials and Methods-** From June 2021 to July 2022, 120 expectant women with singletons and gestations between 16 and 24 weeks were chosen for a study in the Obstetrics and Gynecology department at Shri BM Patil Medical College & Research Center, Karnataka. Routine biometry and Doppler examination of the uterine arteries were performed. **Results:** Out of 120 cases examined, 23 patients had abnormal uterine artery doppler results, and of these, 19 (82.60%) had preeclampsia, 10 (43.47%) had intrauterine growth restriction, 7 (30.43%) had babies that needed to be admitted to the NICU, and 3 (13.04%) had intrauterine foetal fatalities. Pre-eclampsia was detected with 83 percent and 85 percent sensitivity and specificity, while intrauterine growth

restriction was detected with 43 percent and 97 percent sensitivity and specificity. **Conclusion:** Notching in the uterine artery, elevated PI, and RI for the early detection of pre-eclampsia and intrauterine growth restriction, doppler analysis can be a useful screening tool.

Keywords: Pre-eclampsia, Intrauterine growth restriction, Uterine artery doppler.

Introduction:

Intrauterine growth restriction and pre-eclampsia continue to be significant causes of maternal and neonatal morbidity and mortality.^[1-3] Pre-eclampsia in mothers can lead to coagulopathy, liver and kidney failure, and stroke. 1 Adults who experienced IUGR in utero are more likely to develop cardiovascular disease, hypertension, and type 2 diabetes.^[4,5] Weight below the gestational age 10th percentile is a common way to define intrauterine growth limitation.^[6-8] Placental insufficiency is typically the cause of growth limitation. Sometimes it is impossible to determine what is causing a growth restriction. No of the cause, foetuses with growth restrictions have a poor prognosis and a higher chance of intrauterine foetal death, neonatal morbidity, and neonatal death. Therefore, to enhance the outcome, early detection and appropriate surveillance are needed. This can be done by non-invasively examining the uteroplacental circulation by taking a sample of the uterine arteries. Inadequate uteroplacental blood flow is caused by defective placenta development, which is a feature of pre-eclampsia and intrauterine growth restriction.^[9] This inspired the idea to incorporate Doppler ultrasonography into routine ultrasound screening in order to measure the velocity of uterine artery blood flow.^[10] The uterine artery's blood flow is 50 ml/min when a woman is not pregnant and rises to roughly 700 ml/min during the third trimester. Uterine artery waveforms exhibit high end diastolic velocity and continuous forward flow by the middle of the second trimester. Increased resistance and decreased placental perfusion can result from abnormal trophoblastic invasion failing. Uterine artery flow has a high degree of pulsatility in both early pregnancy and the non-pregnant state, with a high systolic and low diastolic flow. It's possible that there is a physiological early diastolic notch.^[9, 11-12] By 24 weeks of pregnancy, this normally goes away. Beyond this, there may be notching, which indicates greater uterine artery resistance. The absence of a rise in end diastolic flow or the presence of notching at the beginning of diastole may indicate pregnancy-induced hypertension, pre-eclampsia, abruptio placenta, or intrauterine growth restriction.^[11] Diastolic flow might not exist or might even be in the opposite direction in very severe placental malfunction. Absence of flow or flow reversal are concerning and may indicate foetal death or

indicate a very high likelihood of a foetus developing abnormally neurologically. Pre-eclampsia and intrauterine growth restriction must be accurately predicted in order to use resources wisely for monitoring and preventive care, which will enhance maternal and perinatal outcomes.^[13, 14] As a result, it is debatable whether uterine artery Doppler ultrasonography ought to be utilised as a diagnostic tool. In order to determine how well all uterine artery Doppler indices can foretell pre-eclampsia and intrauterine growth limitation, we did this investigation.

Materials and Methods:

120 pregnant women who attended the Obstetrics and Gynecology department at Shri BM Patil Medical College & Research Center, from June 2021 to July 2022 were the subjects of an observational study conducted over the course of a year. 120 singleton pregnancies between 16 and 24 weeks of gestation were included in the study. Women having numerous pregnancies and foetuses with congenital anomalies were not included in the study. Trans-abdominal examination of the uterine arteries was performed. Soon after the iliac vessels crossed, each uterine artery was sampled. Color Doppler is used to identify specific blood vessels and sample the blood velocity within those vessels. It provides a map of blood flow that is superimposed on the typical 2D image. The Doppler waveform—a graph of blood velocity against time—is produced by spectral Doppler. In order to identify changes in blood flow resistance, this waveform is analysed. Values for the Resistive Index, the Pulsatility Index, and the presence or absence of diastolic notching were recorded. Up to birth, these patients were monitored, and maternal and neonatal outcomes were recorded.

Results:

120 prenatal cases between 16 and 24 weeks of gestation made up the subjects of the current study. Of these, 58.33 percent of the women were first-time mothers. The presence of uterine artery notching, an increased PI > 1.45, and an increased RI were all indicators of an abnormal Doppler scan. 19.17 percent of the 120 participants in our study had Doppler readings that were abnormal [Table 1 & Table2]. Pre-eclampsia was detected in 82.60% of individuals with abnormal Doppler results. Ten (43.47%) foetuses were undersized for gestational age and had IUGR; seven (30.43%) required NICU hospitalisation. In 3 (13.04 percent) of the instances, intrauterine mortality occurred [Table 3]. Pre-eclampsia detection's sensitivity and specificity were 83 and 85 percent, respectively, whereas IUGR's were 43 and 97 percent. Pre-eclampsia and IUGR both had high positive predictive values, at 58 and 74.6 percent, respectively. Pre-

eclampsia and IUGR each had a negative predictive value of 97 and 86.5 percent, respectively [Table 4].

Discussion:

The results of this study show that transabdominal ultrasonography at 16–24 weeks of gestation can be used to evaluate the uteroplacental circulation. A Doppler flow study can be used to determine the physiology of the fetomaternal unit. This gives the physician crucial information for their next course of action during pregnancy. In order to avert difficulties, early detection of pre-eclampsia and intrauterine growth limitation requires Doppler examinations of the uterine arteries. The main causes of difficulties for both mothers and newborns are preeclampsia and intrauterine growth restriction.^[1, 15] Irregular uterine arteries Preeclampsia and IUGR are among the unfavourable pregnancy outcomes linked to doppler at 16 to 24 weeks. Doppler analysis can therefore be helpful for identifying high risk pregnancies, for appropriate antenatal surveillance, and for enhancing perinatal outcomes. Doppler analysis of uterine arteries can be used to perform a non-invasive evaluation of uteroplacental circulation.^[16] In our investigation, the Doppler analysis involved determining if the diastolic notch, PI, and RI values were present or absent. Pre-eclampsia affected 15.83 percent of the 120 women, which is greater than a research by Irion et al. and comparable to Gupta Shashi et al. (4 percent).^[17,18] The prevalence of preeclampsia was 18 percent in a study by Zimmermann et al.^[19], which is practically the same as the prevalence in our study. Doppler examination of the uterine arteries between 20 and 23 weeks has been shown to have good diagnostic value in a research by Becker R et al.^[20]. Ten babies born to preeclamptic mothers had intrauterine growth restriction, and three incidences of intrauterine death were recorded. NICU admission was necessary for 30.43 percent of babies born to pre-eclamptic mothers. In our investigation, IUGR had sensitivity and specificity of 43 percent and 97 percent, respectively, while uterine artery Doppler had sensitivity and specificity of 83 percent and 85 percent, respectively, in predicting pre-eclampsia. According to Valenisise et al study^[21], which is roughly comparable to ours, the sensitivity and specificity to detect pre-eclampsia were 89 percent and 93 percent, and for IUGR, they were 67 percent and 95 percent, respectively. It has been observed that uterine artery notching, an elevated pulsatility index (PI), and an increased resistance index (RI) are good indicators of pre-eclampsia and intrauterine growth limitation, respectively. According to a study by Cnossen et al.^[22], this is accurate.

Therefore, in light of the fact that aberrant doppler studies are linked to outcomes like pre-eclampsia, intrauterine growth restriction, and perinatal death, it can be concluded that uteroplacental circulation can be evaluated noninvasively by uterine artery doppler studies. Pre-eclampsia and intrauterine growth limitation can be accurately predicted by increased pulsatility index (PI), persistence of uterine artery notch, and increased resistive index (RI). In order to detect pre-eclampsia early and prevent perinatal morbidity and mortality, second trimester ultrasonography should also incorporate routine biometry and doppler analysis of uterine arteries.

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Table 1: Distribution of parity

Gravida	Number of women	Percentage
G1	70	58.33%
G2	39	32.5%
G3 and more	11	9.17%
Total	120	100%

Table 2: Uterine artery Doppler abnormality.

Abnormal uterine artery Doppler	Frequency	Percentage
Present	23	19.17%
Absent	97	80.83%
Total	120	100%

Table 3: Women with aberrant uterine artery Doppler and pre-eclampsia outcomes (n=23).

Outcome	Number of women	Percentage
Pre-eclampsia	19	82.60%
IUGR	10	43.47%
NICU admission	7	30.43%
Intrauterine fetal death	3	13.04%

Table 4: Uterine artery function Pre-eclampsia and intrauterine growth limitation are predicted by doppler.

Outcome	Sensitivity	Specificity	PPV	NPV
Preeclampsia	83%	85%	58%	97%
IUGR	43%	97%	74.6%	86.5%