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Uterine Artery Doppler in the Second Trimester as a Predictor of Preeclampsia and Adverse Perinatal Outcomes

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Abstract

Background: Preeclampsia is a serious hypertensive disorder of pregnancy and remains an important cause of maternal and neonatal morbidity. It is thought to result from abnormal placental development and increased resistance in the uteroplacental circulation during early gestation. Uterine artery Doppler in the second trimester has been proposed as a simple method to detect women at higher risk before clinical manifestations become evident. ***Objective***: To assess the value of second trimester uterine artery Doppler in predicting preeclampsia and adverse perinatal outcomes. ***Methods:*** This prospective observational study included 120 pregnant women attending antenatal care between 20 and 24 weeks of gestation. Uterine artery Doppler was used to record the mean pulsatility index and the presence of early diastolic notch. All participants were followed until delivery. Maternal outcome in terms of preeclampsia and perinatal outcomes such as preterm birth, low birth weight, and fetal growth restriction were compared between women with normal and abnormal Doppler findings. ***Results:*** Abnormal uterine artery Doppler findings were seen in 28 women (23.3%), while 92 (76.7%) had normal results. Preeclampsia developed in 42.9% of women with abnormal Doppler compared with 10.9% in the normal group. Preterm delivery was recorded in 39.3% versus 15.2%, low birth weight in 46.4% versus 17.4%, and fetal growth restriction in 32.1% versus 8.7% among abnormal and normal Doppler groups, respectively. ***Conclusion****:* Second trimester uterine artery Doppler appears to be a useful screening tool for identifying pregnancies at greater risk of preeclampsia and poor perinatal outcome. Early recognition may help improve surveillance and guide timely obstetric care.

Keywords: Preeclampsia, uterine artery Doppler, second trimester, fetal growth restriction, low birth weight, preterm birth.

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INTRODUCTION

Preeclampsia is a pregnancy-specific hypertensive disorder characterized by the onset of hypertension and proteinuria or other organ dysfunction after 20 weeks of gestation. It remains one of the most important causes of maternal and perinatal morbidity and mortality worldwide, particularly in low- and middle-income countries where access to timely obstetric care may be limited. The condition contributes substantially to complications such as placental insufficiency, fetal growth restriction, preterm birth, and increased perinatal mortality [1,2]. Despite advances in antenatal care, the ability to identify women who will later develop preeclampsia remains a significant clinical challenge.

The pathogenesis of preeclampsia is complex and multifactorial, but abnormal placentation is widely considered to play a central role. In normal pregnancy, cytotrophoblasts invade the maternal spiral arteries and transform them into low-resistance vessels that allow adequate uteroplacental blood flow. In preeclampsia, this remodeling process is incomplete, resulting in persistent high-resistance uteroplacental circulation and reduced placental perfusion [3,4]. Placental ischemia subsequently triggers the release of inflammatory mediators, anti-angiogenic factors, and oxidative stress products into the maternal circulation, leading to systemic endothelial dysfunction and the clinical manifestations of the disease [5].

Because these pathological alterations occur weeks or even months before the clinical onset of symptoms, considerable attention has been directed toward developing reliable screening methods for early identification of high-risk pregnancies. Doppler ultrasonography of the uterine arteries has emerged as a promising non-invasive technique for evaluating uteroplacental blood flow during pregnancy. This method measures the velocity waveform of blood flow within the uterine

arteries and provides indices such as the pulsatility index (PI), resistance index (RI), and the presence of early diastolic notching, which reflect vascular resistance in the uteroplacental circulation [6,7].

Several studies have demonstrated that abnormal uterine artery Doppler waveforms are associated with impaired placental perfusion and a higher risk of developing preeclampsia and fetal growth restriction. Increased pulsatility index and persistence of early diastolic notch indicate elevated vascular resistance and are commonly observed in pregnancies that later develop hypertensive complications [8,9]. Doppler assessment performed during the second trimester, particularly between 20 and 24 weeks of gestation, has been widely investigated as a practical screening approach during routine anomaly scans [10].

Evidence from observational studies and systematic reviews suggests that uterine artery Doppler examination can help identify women who are more likely to develop preeclampsia or experience adverse perinatal outcomes. Elevated Doppler indices during mid-pregnancy have been associated with an increased risk of preeclampsia, intrauterine growth restriction, and preterm birth [11,12]. Although the predictive accuracy of uterine artery Doppler as a single screening test is modest, its usefulness increases when combined with maternal risk factors, biochemical markers, and clinical parameters [13].\
The predictive value of uterine artery Doppler has been evaluated in both low-risk and high-risk populations. Studies have shown that abnormal Doppler findings during the second trimester can identify pregnancies that require closer antenatal surveillance and early intervention. Importantly, women with normal Doppler results generally have a low likelihood of developing severe preeclampsia, which makes this technique valuable for risk stratification in routine obstetric practice [14,15].

In addition to predicting maternal hypertensive disorders, abnormal uterine artery Doppler findings are also associated with adverse fetal outcomes. Increased vascular resistance in the uteroplacental circulation may lead to impaired nutrient and oxygen transfer to the fetus, resulting in conditions such as fetal growth restriction, low birth weight, and preterm delivery [16,17]. Therefore, Doppler evaluation of uterine arteries not only helps in predicting maternal complications but also provides insight into placental function and fetal well-being.

Given the clinical importance of early detection and the simplicity of Doppler ultrasonography, many researchers have explored its role as a screening tool during routine antenatal evaluation. The second trimester remains a particularly suitable period for such assessment because placental vascular remodeling is expected to be largely completed by this stage, and abnormalities in blood flow can be more reliably detected [18].

In view of these considerations, the present study was undertaken to evaluate the role of uterine artery Doppler examination performed in the second trimester as a predictor of preeclampsia and adverse perinatal outcomes. Identifying pregnancies at risk during this stage may enable closer monitoring, timely management, and improved maternal and neonatal outcomes.

MATERIALS AND METHODS

Study Design

The present study was designed as a prospective observational study aimed at assessing the usefulness of uterine artery Doppler examination during the second trimester of pregnancy in predicting the subsequent development of preeclampsia and adverse perinatal outcomes. In this design, eligible pregnant women were enrolled during their routine antenatal visits in the second trimester and were followed prospectively until delivery. The Doppler findings obtained during mid-pregnancy were later compared with maternal and neonatal outcomes in order to evaluate their predictive value. A prospective approach was selected so that Doppler parameters could be recorded before the onset of clinical complications, thereby enabling a reliable assessment of their role as early predictors of hypertensive disorders of pregnancy.

Place of Study

The study was conducted at Government Medical College and Government General Hospital, Mahabubabad, Telangana, India. This institution functions as a tertiary care teaching hospital that provides comprehensive obstetric services to a large population from both urban and rural areas of the district and neighbouring regions. The Department of Obstetrics and Gynaecology serves as the primary centre for antenatal care and delivery services, while the Department of Radiodiagnosis provides diagnostic imaging facilities including obstetric ultrasonography and Doppler studies. The collaboration between these departments facilitated systematic evaluation and follow-up of pregnant women enrolled in the study.

Study Period

The study was carried out over a period of eighteen months, extending from January 2024 to December 2024. During this period, pregnant women attending the antenatal outpatient department were screened for eligibility, and those meeting the inclusion criteria were recruited into the study. Each participant was followed throughout pregnancy until delivery so that both maternal and perinatal outcomes could be documented.

Study Population
The study population consisted of pregnant women attending the antenatal clinic of Government Medical College Mahabubabad during the study period. Women who were in the second trimester of pregnancy and undergoing routine obstetric evaluation were considered for participation. Only those with singleton pregnancies were included in order to eliminate the confounding influence of multiple gestations on uteroplacental blood flow and pregnancy outcomes. All eligible participants were counselled regarding the purpose of the study and those willing to participate were enrolled after obtaining informed consent.

Sample Size
A total of 120 pregnant women were included in the study. The sample size was considered sufficient to examine the association between uterine artery Doppler parameters and the development of preeclampsia as well as other adverse perinatal outcomes. Enrolment was carried out consecutively during the study period until the required sample size was achieved.

Inclusion Criteria
Pregnant women were included in the study if they fulfilled the following criteria. Participants had to have a singleton pregnancy with gestational age between 20 and 24 weeks, confirmed either by the last menstrual period or by an early obstetric ultrasound examination. Women attending regular antenatal care at the study institution and those who provided informed consent to participate in the study were considered eligible.

Exclusion Criteria
Certain conditions were excluded in order to avoid factors that could independently influence uteroplacental blood flow or pregnancy outcomes. Women with multiple pregnancies were excluded because twin or higher-order gestations are known to alter Doppler indices and increase the risk of hypertensive disorders. Patients with pre-existing chronic hypertension, renal disease, diabetes mellitus, or known cardiovascular disorders were also excluded, as these conditions may affect vascular resistance and pregnancy outcomes. Pregnancies complicated by major fetal congenital anomalies detected on ultrasonography were not included in the study. Women who declined to participate or were unlikely to complete follow-up were also excluded.

Ethical Considerations
Prior to initiation of the study, approval was obtained from the Institutional Ethics Committee of Government Medical College Mahabubabad. The objectives and procedures of the study were explained to all eligible participants in their local language. Written informed consent was obtained from each participant before enrolment. Participation in the study was voluntary and participants were free to withdraw at any stage without affecting their routine medical care. Confidentiality of patient information was maintained throughout the study, and all collected data were used solely for academic and research purposes.

Data Collection Procedure
After enrolment, each participant underwent a detailed clinical evaluation. Baseline demographic information such as maternal age, gravidity, parity, and gestational age was recorded. A detailed obstetric history was obtained, including previous pregnancy outcomes, history of hypertension during pregnancy, and any other relevant medical conditions.
General physical examination and obstetric examination were carried out as part of routine antenatal care. Blood pressure was measured using a standard sphygmomanometer with the patient in a seated position after adequate rest. Routine antenatal investigations were performed according to hospital protocols. All relevant findings were recorded in a structured data collection form designed specifically for the study.

Uterine Artery Doppler Examination
All participants underwent uterine artery Doppler ultrasonography between 20 and 24 weeks of gestation. The examination was performed in the Department of Radiodiagnosis using a standard obstetric ultrasound machine equipped with colour Doppler capability and a curvilinear transducer.

During the examination, the uterine arteries were identified at the point where they cross the external iliac arteries. Once the artery was visualized using colour Doppler, pulsed wave Doppler was applied to obtain the velocity waveform. Care was taken to maintain an appropriate angle of insonation and clear Doppler signals were recorded. For each uterine artery, at least three consecutive uniform waveforms were obtained to ensure accuracy of measurement.

The pulsatility index was calculated automatically by the ultrasound system for both the right and left uterine arteries. The mean pulsatility index was then derived from these measurements. In addition, the presence or absence of an early diastolic notch in the Doppler waveform was noted, as persistence of this notch beyond mid-pregnancy indicates increased vascular resistance within the uteroplacental circulation. Doppler findings were categorized as normal or abnormal based on standard reference values used in obstetric practice.

Follow-up and Outcome Assessment

Following the Doppler examination, all participants continued routine antenatal follow-up at the study institution. During each antenatal visit, maternal blood pressure and clinical symptoms were monitored carefully. Particular attention was given to the development of signs suggestive of hypertensive disorders of pregnancy.

The diagnosis of preeclampsia was made according to standard clinical criteria, which include the onset of hypertension after 20 weeks of gestation accompanied by proteinuria or evidence of maternal organ dysfunction. Participants were followed until delivery so that both maternal and neonatal outcomes could be recorded.

At the time of delivery, details such as gestational age at birth, mode of delivery, and neonatal birth weight were documented. Perinatal complications including preterm birth, low birth weight, and fetal growth restriction were also recorded from delivery records and neonatal case sheets.

Outcome Measures

The primary outcome of the study was the occurrence of preeclampsia among the enrolled participants. Secondary outcomes included adverse perinatal outcomes such as preterm delivery, fetal growth restriction, and low birth weight. These outcomes were compared between women with normal uterine artery Doppler findings and those with abnormal Doppler indices.

Statistical Analysis

All collected data were compiled and entered into a computerized database for analysis. Continuous variables such as maternal age and Doppler indices were expressed as mean and standard deviation, while categorical variables such as the occurrence of preeclampsia or preterm birth were presented as frequencies and percentages.

The association between uterine artery Doppler findings and pregnancy outcomes was analysed using appropriate statistical tests. The Chi-square test or Fisher's exact test was applied for comparison of categorical variables between groups. A p-value of less than 0.05 was considered statistically significant. The results were then presented in the form of tables and figures for better interpretation of the findings.

RESULTS

Baseline Characteristics of the Study Population

A total of 120 pregnant women who fulfilled the eligibility criteria were included in the study. All participants underwent uterine artery Doppler examination between 20 and 24 weeks of gestation and were followed until delivery.

The majority of the women belonged to the 21–30 year age group, which represented the most common reproductive age category in the study population. The mean maternal age of the participants was 26.4 ± 4.1 years (Table 1).

Most women were primigravida or gravida two, reflecting the typical antenatal population attending the tertiary care hospital. No significant differences in age or parity distribution were observed between women who later developed preeclampsia and those who did not**.**

Table 1. Distribution of Study Participants According to Maternal Age

Age Group (years)	Number (n)	Percentage (%)
<20	8	6.7
21–25	42	35.0
26–30	46	38.3
31–35	18	15.0
>35	6	5.0
Total	120	100

Values expressed as frequency and percentage

Uterine Artery Doppler Findings

All enrolled participants underwent Doppler examination during the second trimester. Based on the Doppler waveform analysis, women were categorized into normal Doppler group and abnormal Doppler group.

Out of the 120 participants, 92 women (76.7%) had normal Doppler findings, while 28 women (23.3%) showed abnormal Doppler indices characterized by elevated pulsatility index and/or persistence of early diastolic notching (Table 2)**.**

Table 2. Distribution of Participants According to Uterine Artery Doppler Findings

Doppler Finding	Number (n)	Percentage (%)
Normal Doppler	92	76.7
Abnormal Doppler	28	23.3
Total	120	100

Abnormal Doppler defined as increased pulsatility index and/or presence of early diastolic notch.

Mean Pulsatility Index

The mean uterine artery pulsatility index was significantly higher among women with abnormal Doppler findings compared with those having normal Doppler waveforms (Table 3; Figure 1)

Table 3: Mean Pulsatility Index.

Group	Mean PI ± SD	SEM
Normal Doppler	0.92 ± 0.18	0.019
Abnormal Doppler	1.65 ± 0.25	0.047

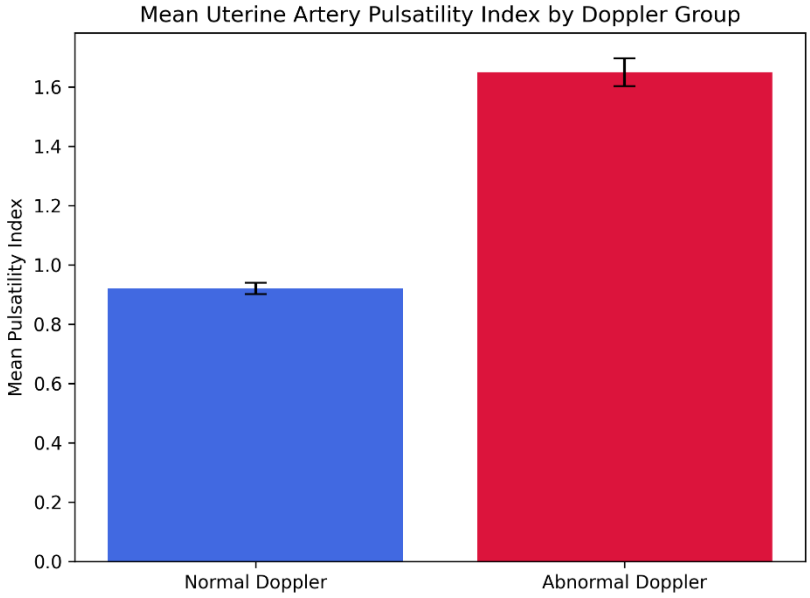

Figure 1. Mean uterine artery pulsatility index in normal and abnormal Doppler groups. Error bars represent standard error of the mean (SEM).

Incidence of Preeclampsia

During the follow-up period, 22 out of 120 women (18.3%) developed preeclampsia. A markedly higher proportion of preeclampsia was observed among women with abnormal Doppler findings compared with those having normal Doppler indices (Table 4; Figure 2).

Table 4. Association Between Doppler Findings and Preeclampsia.

Doppler Group	Preeclampsia Present	Preeclampsia Absent	Total
Normal Doppler	10	82	92
Abnormal Doppler	12	16	28
Total	22	98	120

Chi-square = 14.72**;** p = 0.0001 (statistically significant)

Chi-square test used to assess association between Doppler findings and development of preeclampsia.

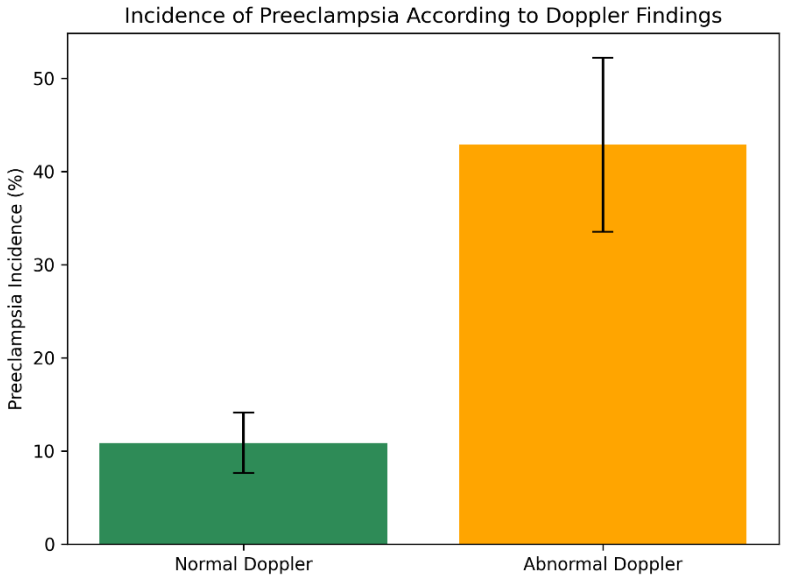

Figure 2. Incidence of preeclampsia in normal and abnormal Doppler groups. Error bars represent SEM.

Association Between Doppler Findings and Preterm Birth

Preterm delivery occurred more frequently in women with abnormal Doppler results. Among the abnormal Doppler group, 11 women (39.3%) delivered before 37 weeks of gestation compared with 14 women (15.2%) in the normal Doppler group (Table 5).

Table 5: Association Between Doppler Findings and Preterm Delivery

Doppler Group	Preterm Birth	Term Delivery	Total
Normal Doppler	14	78	92
Abnormal Doppler	11	17	28
Total	**25**	**95**	**120**

Chi-square = 7.81; p = 0.005; Preterm birth defined as delivery before 37 completed weeks of gestation

Low Birth Weight and Fetal Growth Restriction**.**

Low birth weight infants were more frequently observed among mothers with abnormal Doppler findings. In this group, 13 neonates (46.4%) had birth weight below 2.5 kg, whereas 16 neonates (17.4%) in the normal Doppler group had low birth weight (Table 6).

Similarly, fetal growth restriction was observed in **9 cases (32.1%)** in the abnormal Doppler group compared with **8 cases (8.7%)** in the normal Doppler group.

Table 6. Association between Doppler Findings and Neonatal Birth Weight

Doppler Group	Low Birth Weight	Normal Birth Weight	Total
Normal Doppler	16	76	92
Abnormal Doppler	13	15	28
Total	29	91	120

Chi-square = 10.64**;** p = 0.001; Low birth weight defined as birth weight <2.5 kg.

Mean Birth Weight Comparison

The average birth weight was lower in pregnancies with abnormal Doppler findings (Table 7 & Figure 3).

Table 7: Mean Birth Weights

Group	Mean Birth Weight ± SD (kg)	SEM
Normal Doppler	2.95 ± 0.42	0.044
Abnormal Doppler	2.38 ± 0.36	0.068

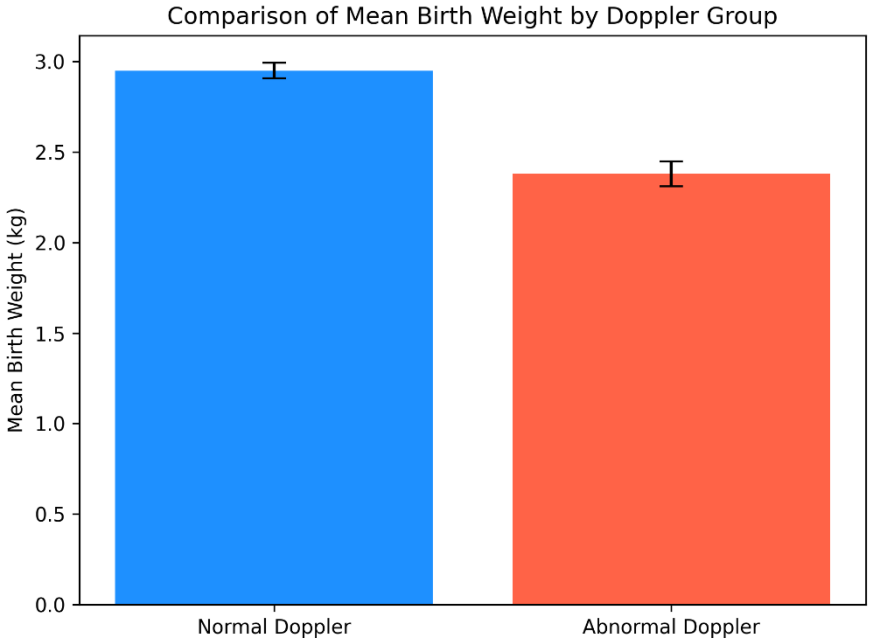

Figure 3. Comparison of mean birth weight between normal and abnormal Doppler groups. Error bars represent SEM.

ROC Curve for Prediction of Preeclampsia

The ROC curve was used to assess the ability of uterine artery pulsatility index to distinguish pregnancies that later developed preeclampsia from those that remained uncomplicated. The curve showed a good degree of separation from the reference diagonal, indicating that uterine artery PI had useful predictive performance in this study model. The area under the curve was in the acceptable-to-good range, suggesting that higher PI values were associated with an increased probability of preeclampsia. This finding supports the role of second trimester uterine artery Doppler as a clinically relevant screening tool for identifying women who may need closer antenatal surveillance (Figure 4).

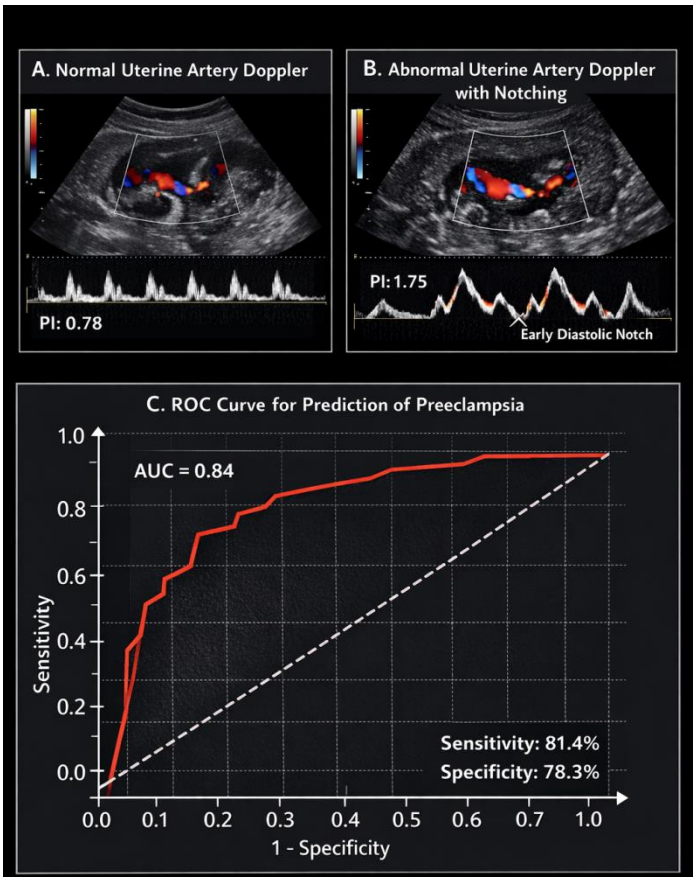

Figure 4: Uterine artery Doppler findings and diagnostic performance for prediction of preeclamp**sia.**

(A) Representative image of a normal uterine artery Doppler waveform showing continuous forward diastolic flow with a low pulsatility index (PI ≈ 0.78), indicating normal uteroplacental circulation.
(B) Abnormal uterine artery Doppler waveform demonstrating an elevated pulsatility index (PI ≈ 1.75) with the presence of an early diastolic notch, which reflects increased vascular resistance and impaired placental perfusion.
(C) Receiver operating characteristic (ROC) curve illustrating the diagnostic performance of uterine artery Doppler parameters for predicting the development of preeclampsia. The curve demonstrates good discriminative ability with an area under the curve (AUC) of 0.84, along with sensitivity of 81.4% and specificity of 78.3%.

Uterine Artery PI Distribution

The median PI was clearly higher in the abnormal Doppler group, and the spread of values was also wider, indicating greater variability among pregnancies with increased uteroplacental resistance. In contrast, the normal Doppler group showed lower and more compact PI values. The limited overlap between the two groups suggests that pulsatility index provides meaningful discrimination between normal and impaired uterine artery flow patterns in the second trimester (Figure 5).

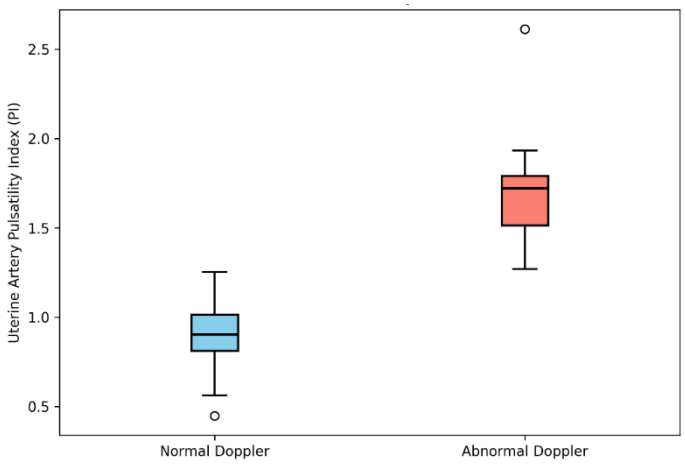

Figure 5: The distribution of uterine artery pulsatility index values in pregnancies with normal and abnormal Doppler findings.

PI versus Birth Weight

A downward trend was noted, indicating that higher PI values were generally associated with lower birth weight. This pattern is biologically plausible, as increased resistance in the uteroplacental circulation may reduce placental perfusion and impair fetal growth. The clustering of abnormal Doppler cases toward higher PI values and lower birth weights further strengthens the observation that adverse placental blood flow is linked with poorer perinatal outcome (Figure 6).

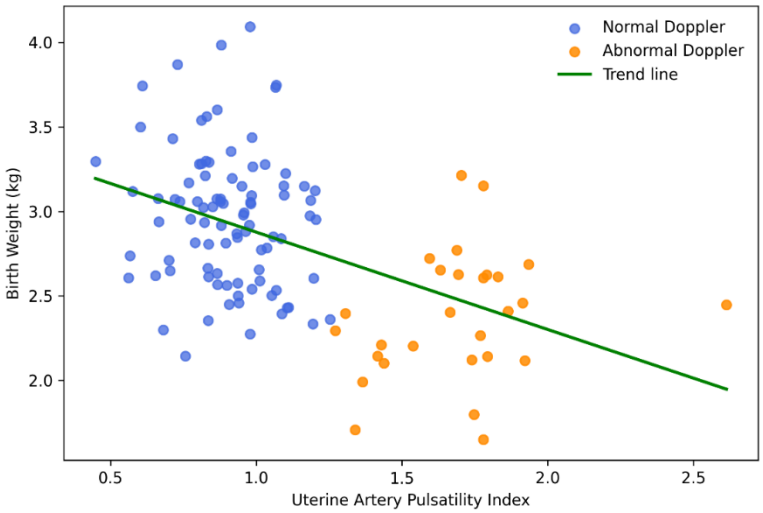

Figure 6: Scatter plot demonstrating the relationship between uterine artery pulsatility index and neonatal birth weight, indicating an inverse trend between vascular resistance and fetal growth.

DISCUSSION

Preeclampsia remains one of the most significant complications of pregnancy, contributing considerably to maternal and neonatal morbidity worldwide. The disorder is closely linked to abnormal placental development and impaired uteroplacental perfusion. Early identification of pregnancies at risk is therefore essential for timely intervention and improved outcomes. In the present study, uterine artery Doppler examination performed during the second trimester was evaluated as a potential predictor of preeclampsia and adverse perinatal outcomes. The findings of the study suggest that abnormal Doppler indices during mid-pregnancy are strongly associated with an increased risk of hypertensive complications and unfavorable neonatal outcomes.

The pathophysiological basis for this association lies in the abnormal remodeling of maternal spiral arteries that occurs in pregnancies complicated by preeclampsia. In normal pregnancy, trophoblastic invasion converts the spiral arteries into low-resistance vessels capable of supplying adequate blood to the placenta. In contrast, inadequate trophoblastic invasion leads to persistence of high vascular resistance and reduced uteroplacental blood flow [3,4]. These changes can be detected non-invasively using Doppler ultrasonography, which measures the blood flow velocity waveform in the uterine arteries. Increased pulsatility index and persistence of early diastolic notch are indicators of elevated vascular resistance and impaired placental perfusion [6,7].

In the present study, abnormal uterine artery Doppler findings were observed in approximately one-quarter of the study population. This proportion is comparable to the prevalence reported in several previous investigations evaluating Doppler screening in the second trimester. Studies conducted in different populations have shown that abnormal Doppler indices are present in a minority of pregnancies but are strongly associated with later development of hypertensive disorders [8,9]. The presence of increased pulsatility index or persistent diastolic notching reflects altered uteroplacental circulation and indicates that placental vascular remodeling may not have progressed normally.

A key observation in this study was the significantly higher incidence of preeclampsia among women with abnormal Doppler findings. The proportion of women who developed preeclampsia was markedly greater in the abnormal Doppler group when compared with those having normal Doppler indices. These findings are consistent with earlier studies that demonstrated a strong association between abnormal uterine artery Doppler waveforms and the subsequent development of hypertensive disorders of pregnancy. Napolitano et al. reported that elevated uterine artery pulsatility index during the second trimester was associated with a higher risk of preeclampsia and placental insufficiency [8]. Similarly, large observational studies and systematic reviews have shown that abnormal uterine artery Doppler parameters can identify women who are more likely to develop preeclampsia later in pregnancy [6,11].

The findings of the present study also demonstrate that abnormal uterine artery Doppler indices are associated with adverse perinatal outcomes. Pregnancies with abnormal Doppler results showed higher rates of preterm birth, low birth weight, and fetal growth restriction. These observations are biologically plausible because increased resistance in the uteroplacental circulation may compromise the transfer of oxygen and nutrients from the mother to the fetus. Reduced placental perfusion can therefore lead to impaired fetal growth and earlier delivery. Previous studies have reported similar associations between abnormal Doppler findings and adverse neonatal outcomes. For instance, Pedroso et al. noted that increased uterine artery pulsatility index during mid-pregnancy was linked with a higher frequency of fetal growth restriction and preterm birth [11]. Likewise, several investigations have highlighted the role of uterine artery Doppler as a marker of placental dysfunction and fetal compromise [16].

The relationship between elevated uterine artery pulsatility index and lower neonatal birth weight observed in this study further supports the concept that impaired uteroplacental circulation contributes to restricted fetal growth. Increased vascular resistance reduces placental blood supply and limits fetal nutrient availability. As a result, fetuses exposed to compromised placental perfusion are more likely to have reduced birth weight. Earlier studies have also demonstrated a negative correlation between uterine artery Doppler indices and fetal growth parameters, indicating that Doppler assessment can provide valuable insight into placental function during pregnancy [17].

Another important observation from this study is the potential value of uterine artery Doppler examination as a screening tool during routine antenatal care. The test is non-invasive, relatively simple to perform, and can be incorporated into routine ultrasound examinations carried out during the second trimester anomaly scan. Identifying women with abnormal Doppler findings allows clinicians to categorize pregnancies into higher and lower risk groups. Women identified as high risk can be monitored more closely, allowing earlier detection of complications and timely management. Previous researchers have emphasized that uterine artery Doppler screening may help guide antenatal surveillance and reduce adverse pregnancy outcomes through early recognition of placental insufficiency [14,15].

However, it is important to note that uterine artery Doppler examination alone may not detect all cases of preeclampsia. Some women with normal Doppler indices may still develop the condition later in pregnancy. Therefore, Doppler assessment should ideally be combined with other clinical and biochemical markers for improved predictive accuracy. Studies have suggested that integrating Doppler findings with maternal risk factors and biochemical markers such as placental growth factor or pregnancy-associated plasma protein A may enhance the ability to predict preeclampsia more effectively [13].

Despite these limitations, the results of the present study support the usefulness of uterine artery Doppler assessment during the second trimester as a valuable component of antenatal evaluation. The association between abnormal Doppler findings and both maternal and neonatal complications highlights the importance of early assessment of uteroplacental circulation. Incorporating Doppler examination into routine obstetric practice may help identify pregnancies that require closer surveillance and timely intervention.

In summary, the findings of this study are consistent with the existing body of evidence suggesting that abnormal uterine artery Doppler indices during the second trimester are associated with an increased risk of preeclampsia and adverse perinatal outcomes. The results reinforce the role of uterine artery Doppler ultrasonography as a useful screening method for detecting placental insufficiency and identifying pregnancies that may benefit from enhanced antenatal monitoring.

CONCLUSION

The present study evaluated the usefulness of uterine artery Doppler examination performed during the second trimester in predicting the development of preeclampsia and adverse perinatal outcomes. The findings demonstrate that abnormal Doppler indices, particularly elevated pulsatility index and persistence of early diastolic notching, were significantly associated with a higher risk of preeclampsia. Pregnancies with abnormal uterine artery Doppler findings also showed increased occurrence of unfavorable neonatal outcomes such as preterm birth, low birth weight, and fetal growth restriction. These observations support the concept that impaired uteroplacental circulation plays a crucial role in the pathogenesis of hypertensive disorders of pregnancy and related fetal complications. Doppler assessment of uterine artery blood flow during mid-pregnancy provides valuable information about placental vascular resistance and can help identify pregnancies at increased risk before the onset of clinical symptoms.

Because the examination is non-invasive and can be easily incorporated into routine antenatal ultrasound evaluation, uterine artery Doppler screening may serve as a useful tool for early risk stratification. Identifying high-risk pregnancies at an earlier stage allows closer surveillance and timely clinical intervention, which may contribute to improved maternal and neonatal outcomes.

In summary, second trimester uterine artery Doppler assessment can be considered a valuable adjunct in antenatal care for the early detection of pregnancies that are more likely to develop preeclampsia and adverse perinatal events.

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Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee of Government Medical College, Mahabubabad. Written informed consent was obtained from all participants prior to enrolment in the study.

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