BioGecko

Vol 12 Issue 03 2023
ISSN NO: 2230-5807

The evaluation of the relationship between the uterine arterial pulsatility index at 28 to 30 weeks of pregnancy and adverse perinatal outcomes

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Abstract

Background: Prenatal death, a prevalent occurrence in underdeveloped countries with poor prenatal outcomes, serves as a measure of health development. Doppler ultrasound is now used in midwifery. Doppler evaluation of placental circulation, for example, can identify unfavourable placental and foetal effects before they become clinical midwifery issues.

Finding out if the uterine artery (UtA) pulsatility index (PI) at 28–30 weeks of gestation can predict poor perinatal outcomes is the goal.

Methodology: From March 2021 to March 2022, 100 pregnant women at 28 to 30 weeks who were admitted to the Basrah Maternity Hospital participated in a prospective study. The study excluded women with multiple pregnancies, chronic hypertension, diabetes mellitus, systemic lupus erythematosus, thrombophilia, foetal growth restriction, pregnancy-induced hypertension, and preterm labour (PTL) in a recent pregnancy. All subjects underwent abdominal ultrasounds to assess UtA-PI with colour Doppler at 28–30 weeks of pregnancy. Morning doppler was conducted by an expert. To detect pregnancy problems such preeclampsia, premature labour, intrauterine mortality, and antepartum haemorrhage as well as to record the mode and type of delivery, all pregnant women in the trial were monitored clinically and by ultrasound.

Poor 5-minute Apgar scores (7), ICU hospitalisation within 3 days after birth, low birth weight, neonatal deaths, caesarean sections and their causes, and meconium amniotic fluid were among the outcomes for newborns. At last, SPSS data were input.

Keywords; **the uterine arterial,Birth, pregnancy, the placenta**

Result

100 pregnant women were enrolled in this study, and their average ages, weights, and heights were 29 + 2.1 years, 76 + 1.1 kg, and 1.6 + 1.7 metres, respectively.

At 31+2.29 weeks, 43% of women were multipara and 57% were primigravidae.

This study's Doppler ultrasonography findings of 100 pregnant women revealed 40 (or 40%) with high UtAPI (mean age = 31+2.34 years) and 60 (or 60%) with normal UtA-PI (mean age = 30+2.22 years), which was not statistically significant. Low UtA-PI groups gave birth at 36.49 2.51 weeks, while high UtA-PI groups gave birth at 37.93 1.96 weeks (P = 0.002). Negative maternal outcomes were experienced by 2 normal cases and 9 high UtA-PI patients (P = 0.047). In the group with a high UtA-PI, CS was crucial for the delivery mechanism.

Unfavourable perinatal outcomes were predicted with 73.3% specificity and 37.5% sensitivity using UtA-PI. In the current study, there were no stillbirths, 2 cases of 5-min Apgar scores 7, aberrant umbilical arterial, or severe perinatal outcomes associated with high UtA-PI, but SGA in the high UtA-PI group had the greatest prevalence for both caesarean and regular deliveries (P 0.001). Four incidences of preclampsia were present. In the high UtA-PI group, there were one (5%) and two (7.5%) cases with gestational ages that were 37 weeks and >37 weeks, respectively (P > 0.05).

Introduction

1. Placental Development

The development of the placenta as a nutrient- and oxygen-transporting organ depends on implantation and trophoblastic invasion. There are two stages of placental remodelling. Between 8 and 12 weeks of gestation, tropoblastic cells begin to enter the spiral arteries [1,2]. After 14 weeks, the spiral artery myometrial segments are more deeply invaded by trophoblasts. The spiral arteries lose their smooth muscle and elastic coating, resulting in low resistance and high capacitance in the uteroplacental circulation [3, 4]. At 16–18 weeks, placental remodelling is complete. Oxidative stress and hypoperfusion are results of improper placental implantation. Anomalies in trophoblastic differentiation may lead to gynecomastia, preeclampsia, and FGR. Preterm labour, placental abruption, and second-trimester losses can all result from defective implantation [5, 6]. Recent studies have shown that insufficient placentation causes circulating vasoactive chemicals to be imbalanced, which results in maternal vascular maladaptation and systemic endothelial dysfunction. The placenta releases its contents. These biochemical markers, which demonstrate abnormal placentation, are being employed in early gestation screening tests for complications in subsequent pregnancies. Biomarkers include PAPP-A, PlGF, activin-A, and inhibin-A [7-9].

2. Role of Doppler study in obstetrics

Doppler placental circulation testing looks for pre-eclampsia, intrauterine growth restriction, and infant mortality, which are all implications of impaired placentation. Assessment of the foetal circulation is crucial to the pathophysiology and therapeutic therapy of many abnormal pregnancies [10]. When sound waves collide with a moving object and reflect back at a frequency proportional to its velocity and direction, doppler shift happens. Blood flow is measured by Doppler [6].

Flow waveform speed Numerous indices can be used to describe flow waveforms. Each classifies the waveform using its measurement. Both information and simplicity are balanced. These indices are present in most scanners:

1. The peak systolic flow and end diastolic flow were compared using the systolic-diastolic flow index S/D ratio (figure 1).
2. Pourcelot's index or the resistive index (RI).
3. PI. Calculating the PI takes longer than calculating the RI or S/D ratio since it needs measuring the waveform mean height. Without end diastolic flow, it describes a greater variety of waveform forms[6].

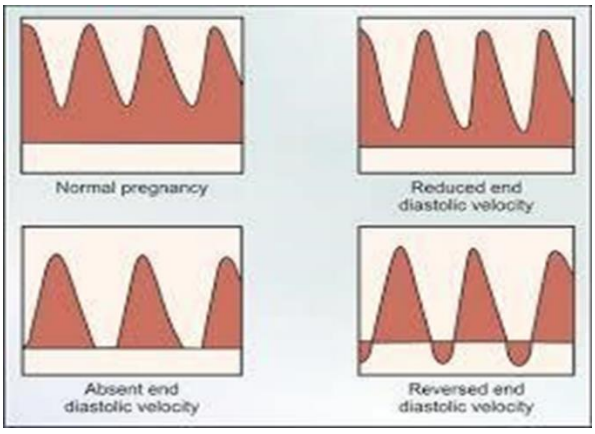

Figure 1 Flow waveform

The presence or absence of a characteristic, such as enddiastolic flow and a post-systolic notch, which denote greater uterine vascular resistance and poorer uterine circulation, can also be used to describe the flow waveform in addition to these indices6.

3. Changes in Uterine Artery Doppler Waveform in Pregnancy

Uterine blood flow rises from 50 ml/min to 500 ml/min over the course of a term.Doppler waveforms from the uterine artery show high diastolic flow rates and turbulent flow.

Prenatal hypertension, preeclampsia, and foetal deformities are associated with a diastolic notch and increased flow resistance.At 16 to 20 weeks, hypertension increased uterine vascular resistance, raising the risk of preeclampsia.[6].

ovarian artery Doppler waveform analysis has been extensively studied as a predictor of preeclampsia and foetal growth restriction in the second trimester. Recent months have seen an increase in the vessel's Doppler interrogation. Using a variety of measurement techniques and impedance indices, uterine artery Doppler velocimetry has been connected to unfavourable pregnancy outcomes. [3]. Preeclampsia with early onset is better predicted by Doppler uterine artery probing than with late onset. As an independent marker, it has a sensitivity of 40-70% in predicting preeclampsia and foetal growth limitation in low-risk pregnant women. Over 90% of cases of early-onset preeclampsia can be diagnosed using multiparametric prediction models that include the uterine artery pulsatility index, maternal characteristics, and biochemical markers. The ideal test combination will be identified in subsequent studies, and it will be verified in additional patient populations. [2].

Preeclampsia/eclampsia was listed as the second-leading cause of direct maternal deaths in the UK (0.83 per 100,000 births) in the most recent Centre for Maternal and Child Enquiries (CEMACE) report on maternal mortality ("Saving Mothers' Lives" 2006-2008) [1].

Preeclampsia and FGR are responsible for 6% and 10%, respectively, of perinatal deaths. In contemporary antenatal care, preeclampsia, restricted foetal growth, placental abruption, and stillbirth are tracked depending on risk. Prenatal monitoring is one of the management strategies being researched in order to reduce negative effects.

In both pregnancy and nonpregnancy, the uterine artery can be shown to have very modest end-diastolic velocities and no early diastolic notch. Uterine artery impedance can be affected by the maternal heart rate, the use of antihypertensives, the hormones associated with the menstrual cycle, and persistent hyperandrogenism in polycystic ovarian syndrome. Due to uteroplacental circulation resistance, the uterine arteries exhibit higher pulsatility index (PI) or resistance index (RI). High BMI and racial identity reduce uterine artery PI levels.

Due to a reduction in vascular impedance brought on by trophoblastic invasion, uterine artery PI and RI values decline with gestational age. In a prospective cross-sectional study by Gómez et al. [10, 11], the mean uterine artery PI continued to decline through week 34 of the third trimester.

Before clinical symptoms appear, uterine artery Doppler studies can detect pregnancy issues due to uteroplacental insufficiency. [11]

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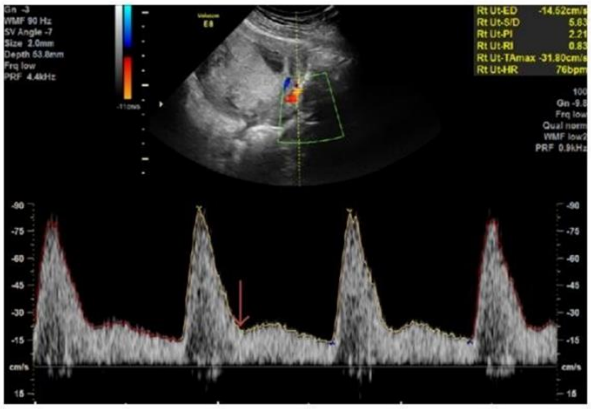
4. Measurement of Uterine Artery Doppler Parameters

Uterine artery impedance can be measured by transabdominal or transvaginal Doppler between 24 and 30 weeks. Due to its modest invasiveness and great interobserver repeatability, transabdominal is preferred. {11}.

4.1 Transabdominal Ultrasound Technique

Curvilinear transabdominal transducers with frequencies of 5 or 3.5 MHz are used. When the paracervical vessels may be seen in a midsagittal uterine and cervical canal slice, the transducer is pushed laterally. Flow of colour Doppler. Urinary arteries run parallel to the cervix. Pulsed wave Doppler collects flow velocity waveforms from the ascending branch of the uterine artery closest to the internal os with the Doppler sampling gate set at 2 mm. The minimal insonation angle (around 30°) is employed to enhance systolic and enddiastolic velocities. PI can be determined using three comparable successive waves. The average reading from both sides, or PI, is known as the mean.

Another Doppler insonation location is the apparent junction of the uterine artery and external iliac artery. The probe is positioned 2 to 3 cm inside the iliac crests and directed towards the uterus' lateral side and pelvic region. Flow of colour Uterine arteries can be found using Doppler. One centimetre above the junction of the uterine artery and external iliac artery, pulsed wave Doppler is used. Doppler velocities are provided from the main trunk of the uterine artery. Similar measurements are made during the second trimester of the uterine arteries [11, 12]. Because the uterine artery crossover with the external iliac artery can be harder to identify with a smaller uterus in the first trimester, it was simpler to access the internal cervical os from its ascending branch using Doppler. A transabdominal uterine artery flow velocity waveform is shown in Figure 2. (13).

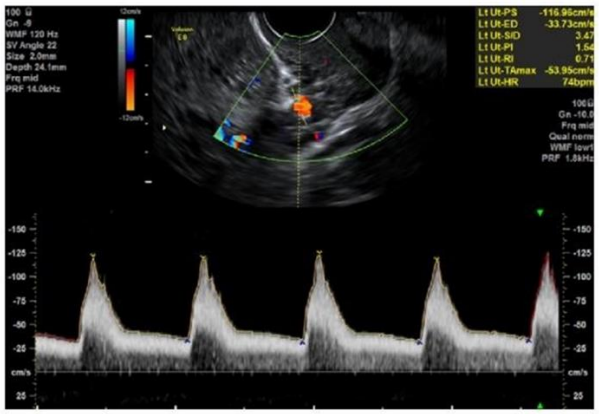


probing of the uterine artery with a transabdominal Doppler at the internal cervical OS level. Waveform of the uterine artery showing elevated PI and an early diastolic notch {11} .

4.2 Transvaginal Ultrasound Technique

4.6–8 MHz transvaginal transducers are used. The transducer is positioned in the anterior vaginal fornix for taking sagittal cervix slices. To view the paracervical vascular plexus, laterally move the vaginal probe. Flow of colourThe uterine artery is located by Doppler at the cervicocorporeal junction. Before the uterine artery splits into the arcuate arteries, measurements are taken.

The mean uterine artery PI at 11-13 + 6 weeks' gestation evaluated transabdominally was 1.83 (95% CI: 1.78-1.89) versus 1.98 (95% CI: 1.93-2.08), according to a prospective research by Plasencia et al. [14]. Utilise the correct reference charts. Transvaginal uterine artery flow velocity waveform is seen in Figure 3.



Doppler imaging of the uterine artery transvaginally at the cervicocorporeal junction. Normal waveforms of the uterine artery.

5. Prediction of Adverse Pregnancy Outcome

Preeclampsia (also known as placental PE) with an early onset is brought on by insufficient trophoblast penetration into spiral arteries, which results in placental ischemia and oxidative stress. This idea is supported by the fact that thrombotic villous tree changes are frequently seen in early-onset preeclampsia or FGR placental histopathology [15,16, 17, 18]. Maternal endothelial dysfunction is assumed to be the root cause of late-onset preeclampsia, sometimes known as "maternal PE," which also shares risk factors with adult cardiac disease such as hypertension, obesity, poor glucose tolerance, and dyslipidemia [19, 20]. According to histopathology, these placentas might be healthy. Doppler scans of the uterine arteries may remain normal [20]. F FGR may result from a defective placenta without preeclampsia [16]. It has long-lasting impacts, increasing a baby's risk of developing coronary artery disease, hypertension, stroke, diabetes, as well as short-term morbidity and mortality in adulthood. Small for gestational age (SGA) has been used interchangeably with "foetal growth restriction" or "intrauterine growth restriction (IUGR)," despite the fact that SGA encompasses a spectrum from constitutionally small healthy infants to those who did not meet their genetic growth potential and required preterm delivery[16].

FGR and preeclampsia, which both originate from uteroplacental insufficiency and faulty placentation, have been examined in numerous populations using first-trimester Doppler monitoring of uterine circulation. [16].

5.1 Doppler Studies in Unselected and High Risk Pregnant Women

Uterine artery Doppler examination performed in the second trimester is more prognostic than that performed in the first. The results of first-trimester studies vary because of variations in vascular impedance techniques, gestational age at screening, preeclampsia prevalence, and FGR criteria. The effectiveness of uterine artery Doppler velocimetry for screening is influenced by the target population's pretest likelihood of sickness [20].

The effectiveness of first-trimester uterine artery Doppler tests in predicting FGR and preeclampsia was evaluated in a recent meta-analysis by Velauthar et al. [21]. Low-risk pregnancies were present in 15 out of 18 studies, which involved 55 974 women. Aberrant flow velocity waveforms (FVW) were identified by uterine artery RI or PI 90th centile and unilateral or bilateral notching. It was not able to combine estimates for preeclampsia prediction since uterine artery notching was only examined twice. Preeclampsia and early-onset preeclampsia were predicted with 26.4% and 47.8% sensitivity by an abnormal uterine artery PI in the first trimester, respectively. 15.4% accurately predicted foetal growth restriction, while early-onset FGR exhibited a 39.2% sensitivity. The sensitivity to placental abruption was 44.4%. Doppler indices in the first trimester had a 14.5% sensitivity for stillbirth prediction.

5.2 Sequential Testing in the First and Second Trimester of Pregnancy

The uterine artery PI was assessed in 3107 pregnancies by Plasencia et al. [22] at 11+0 to 21+0 weeks and at 30 to 34 weeks. According to earlier research, uterine artery PIs were above the 90th centile in 77% of patients of early preeclampsia and 27% of instances of late preeclampsia. At 20-34 weeks, a uterine artery PI over the 90th centile was present in 94% of early preeclampsia cases, 74% of late cases, and 37% of non-preeclampsia cases. Early preeclampsia was identified 90.9% of the time with a 5% false positive rate using a predictive testing model that comprised maternal characteristics, first-trimester uterine artery PI, and the change between the first and second trimesters. The 20% of women with the highest risk from first-trimester screening who underwent second-trimester testing had the same detection rate, according to the authors. Three-quarters of high-risk women had contingency screening, and the other high-risk women were selected for further surveillance [22,23]. Similar research was done by Gómez et al. [24]. At 11–14 and 19–22 weeks, uterine artery Doppler recordings were obtained. The mean PI and early diastolic notching were obtained from bilateral measurements of the uterine arteries. Preeclampsia, prenatal hypertension, and FGR pregnancies exhibited greater mean PIs and bilateral notches. A persistently increased uterine artery PI > 95th centile (OR 10.7; 95% CI 3.7-30.9) was the biggest indicator of a poor outcome. Even if the uterine artery PI returned to normal between the first and second trimesters, women still showed a significantly higher risk of pregnancy complications (OR 5; 95% CI 2.1-10.6). Women with bilateral notches ran comparable risks.

5.3 Multiple Gestations

Though the majority of studies have been conducted on singletons, twin pregnancies quadruple the risk of preeclampsia. In Svirsky [25]. twin uterine artery of the second trimester According to Doppler studies, PI levels decrease with gestational age. Twin uterine artery Doppler PI reference ranges should be validated in larger studies prior to practical application [25].

5.4 Preeclampsia

Identification of high-risk pregnant women is aided by clinical history [11, 26]. One-third of preeclampsia cases are found with maternal history screening alone, although it is unsuccessful in nulliparous women, who are at a higher risk. In 8366 singleton pregnancies, Poon et al. [27] investigated the effect of uterine artery Doppler in developing a predictive model for early preeclampsia. With a 10% false positive rate, a model incorporating maternal demographics (age, BMI, and ethnicity) and clinical history (preeclampsia, chronic hypertension, and method of conception) recognised early, late, and gestational hypertension at 47%, 41%, and 31%, respectively. Patients with preeclampsia and pregnancy hypertension had higher values for the lowest, mean, and highest uterine artery PI. Early preeclampsia diagnosis increased to 81%, late preeclampsia to 45%, and gestational hypertension to 35% using first-trimester uterine artery Doppler. Although other authors have found no significant difference in screening sensitivity for the prediction of preeclampsia (28), patient-specific risk for early and late preeclampsia and gestational hypertension could be calculated using a multivariate regression model based on maternal-factor-derived a priori risk and the lowest uterine artery PI value [27]. higher risk when mean arterial pressure is present.

ıriables	ɔtal (N 100)	ɔrmal UTA-PI(60)	JtA- PI> 95th centile	VALUE
G at assessment	)+ 2.29	)+3.34	)+3.22	12
G at time of delivery	3 7+2.2	3 8+2.22	3 6+1.3	6. 002

ISSN NO: 2230-5807

5.5 Fetal Growth Restriction

Preeclampsia and restricted foetal development are brought on by inadequate placentation. As a result, many algorithmic techniques for the latter's early prenatal screening have been investigated. The Foetal Medicine Foundation (UK) developed a predictive model for SGA (birthweight less than 5th%) that included maternal factors and many biomarkers, including mean arterial pressure (MAP), foetal nuchal translucency (NT) thickness, free beta-human chorionic gonadotrophin (beta-hCG), serum pregnancy-associated plasma protein-A (PAPP-A), uterine artery pulsatility index (PI), placental growth factor (PlGF), placental protein 13 (PP1), and others. This approach, which had a 10% false positive rate, identified 73% of SGA that required pre-37-week delivery [30]. Using maternal characteristics, the uterine artery pulsatility index, mean arterial pressure, serum pregnancy-associated plasma protein-A, and placental growth factor, a subsequent study from this centre was able to predict 52.3% of preterm SGA at a 10% FPR. [31].

Patients and methods

100 pregnant women between 28 and 30 weeks who were referred to the Basrah maternity hospital between March 2021 and March 2022 made up the prospective study. These women provided written, explicit consent for the study. The study excluded women with multiple pregnancies, chronic hypertension, diabetes mellitus, systemic lupus erythematosus, thrombophilia, foetal growth restriction, pregnancy-induced hypertension, and preterm labour (PTL) in a recent pregnancy.

Age, parity, health, and obstetric history were all included of the baseline data for the mothers. All subjects underwent an abdominal ultrasound utilising a Chinese-made Mindray DC7 device at 28 to 30 weeks of

pregnancy. Amniotic fluid was measured and evaluated using transabdominal probes. After voiding, UtA-PI was evaluated by abdominal colour Doppler ultrasonography. On the right and left sides of the cervix, the mean UtA-PI concentration from its ascending branch was measured [10]. All ultrasound and colour Doppler measures were performed in the morning by a professional. To identify pregnancy issues such PET, preterm labour, IUD, APH, and mode and type of delivery, all pregnant participants in the trial had clinical and ultrasound monitoring.

Following delivery, the following outcomes were noted: PTL, intrauterine foetal death, hypertension, poor 5-min Apgar score (7), admitted to intensive care unit within 3 days of birth, low birth weight, infant death, caesarean section and its indications, and meconium amniotic fluid.

Last but not least, we entered the data into the Statistical Package for the Social Sciences (SPSS) software version 20 (SPSS, Inc., Chicago, IL, USA) and calculated descriptive statistics using the mean, standard deviation, frequency, and frequency percentage. To compare maternal and pregnancy factors to UtA-PI, we utilised Chi-square, Fisher's exact, and independent t-tests. Sensitivity and specificity were evaluated to determine its predictive value for adverse perinatal outcomes. For all of our analyses, we utilised 0.05.

Table 1 : Maternal and pregnancy characteristics in two groups

Maternal Age(year)	3 0±2.1	2 9±2.22	3 1±2.34	0. 85
Maternal weight (Kg)	7 6± 1.1	7 5±2.23	7 8±3.22	o. 5
Maternal height (cm)	1. 6+1.7	1. 7+2.1	1. 6+1.4	0. 4
Obstetrics history **Parous** **Nillparus**	 4 3 5 7	 3 3 3 4	 1 0 2 3	 0. 05 0. 04
Adverse pregnancy outcome **PET** **Hypertension** **Gestational DM** **IUGR**	11 4 2 3 4	2 0 1 0 1	9 4 1 3 3	0. 047
Mode of delivery **NVD** **CS**	 7 7 2 3	 56 5	 21 18	0.06 0.04 0.02
Neonatal outcome **Apgar score< 5** **Fetal Weight** **Admission to INCU**	 13 2.9+2.4 12	 4 3.5+2.3 3	 9 2.4+1.5 9	0.04

Table 2 : To assess diagnostic value of high uterine artery pulsatility index in prediction of adverse perinatal outcome

Adverse perinatal outcome	sensitivity	pecificity	Positive predictive value	Negative predictive value
UtA- PI> 95th centile	37%	73%	48.4%	63.7%

The assessment of diagnostic value of UtA-PI in the prediction of adverse perinatal outcome indicated that sensitivity and specificity of this index for identification of adverse perinatal outcome were equal to 37.5% and 73.3% respectively.

Table 3 : Comparison of adverse perinatal outcome between normal and high uterine artery pulsatility index groups

PERINATAL OUTCOME	Total (N=100)	Normal(N=60)	UtA>95 centile N= 40	P
Preeclampsia Delivery >37 Delivery<37	 3 1	 1 0	 0 2	**0.003**
SGA SGA AND NVD SGA and CS	29 12 17	2 0 1	27 12 16	**0.001**
PTL	2	0	2	**0.001**
Abruption	2	0	2	**0.001**
PROM	1	0	1	
Meconium liquor	4	0	4	**0.001**
Still birth	0	0	0	
5- min Apgar score< 7	2	0	2	**0.002**

Although there were no stillbirths in the current study and only 2 cases with 5-min Apgar scores below 7, aberrant umbilical arterial, SGA in the high UtA-PI group had the highest incidence for both caesarean sections and vaginal deliveries (P 0.001). PE was found in 4 instances. The gestational ages of one (5%) and two (7.5%) of the four high UtA-PI cases were, respectively, 37 weeks and >37 weeks (P > 0.05). [Table3].

Discussion

Perinatal mortality in developing nations is an indicator of progress in health. Doppler ultrasonography is now used in midwifery examinations. Prior to midwifery issues, blood flow monitoring can identify foetal and placental immaturity [18]. IUGR and oligohydramnios are diagnosed with doppler ultrasound, however high-risk pregnancies are not. High-risk foetuses can be easily detected with Doppler ultrasonography. By 50%, it lowers high-risk perinatal mortality. MCA and UMA Doppler indices can now be used to identify foetal distress [19].

In this study, high UtA-PI levels between 28 and 30 weeks of pregnancy were associated with poor pregnancy outcomes and low birth weight. Compared to typical newborns, those with high UtA-PI weighed more than 3500 g. Contrary to dubious assertions, 13% of pregnant participants in the research experienced poor prenatal outcomes.study [25,26].

Low sensitivity (37%) but great specificity (73.3%) were observed in this investigation for high UtA-PI. These studies demonstrated that PI can be used as an appropriate predictor at the second trimester of pregnancy because this criterion has a high specificity and acceptable sensitivity compared to RI. This is in contrast to many studies in which PI as the critical and useful factors in Doppler ultrasound, are identified as appropriate criteria in the prediction of adverse perinatal outcome, high-risk pregnancies, and PE compliance.

In conjunction with this study, Gomez-Roig et al. reported that UtA-PI measurement alone can be recognised as a poor predictor for early detection of bad perinatal outcome caused by IUGR in the third trimester in 156 difficult pregnancies and 344 simple pregnancies. However, its diagnostic value may be satisfactory when paired with serum placental growth factor.

In contrast to the current investigation, Valio et al. discovered that elevated UtA-PI at 30-34 weeks' gestation may, but not always, indicate unfavourable neonatal outcomes [23].

Despite having a poor sensitivity (9.3%-17.6%) for predicting unfavourable perinatal outcomes, Rani et al. discovered that the MCA/UMA PI and RI ratios and UMA RI had the greatest specificity (97%–98%) among

all MCA and UMA Doppler indices [29]. In 110 uncomplicated pregnancies, Hofstaetter et al. discovered that higher UtA scores were associated with lower outcomes. Compared to the unilateral high PI, the unilateral notch more accurately predicted perinatal fate[30].

Unfavourable results have been associated with higher PI readings in other studies, which indicate significant resistance on one side of the uterine circulation [31,32].

Doppler ultrasound can evaluate high-risk pregnancies, and transabdominal ultrasound and assessment of derived indices can measure blood flow in UtAs. Elevated UtA-PI was not determined to be a suitable predictor in this study [33] due to the small sample size or low favourable perinatal outcome.

Rupture of membranes, abnormal amniotic fluid, and PTL were uncommon in this trial and did not differ across groups. SGA was observed in 80% and 4%, respectively, of babies with high and normal UtA-PI levels (P 0.001). Pregnancies with high UtA-PI experienced the PE at gestational age 37 weeks, whereas those with normal UtA-PI did so at 37 weeks [34].

In 37,799 deliveries of singletons, Mitao et al. (2016) discovered a relationship between low birth weight and poor perinatal outcomes. Therefore, by identifying risk factors for low birth weight, prenatal surveillance of high-risk pregnant women can aid in the prevention of severe perinatal outcomes [35].

Aberrant RI or PI has been linked to higher incidences of PE, IUGR, SGA, and prenatal mortality in a number of studies. PE results in decreased organ perfusion and increased UtA-PI during severe vasospasm. Given that several studies have demonstrated that RI, PI, and notch indices at the first and second trimesters can predict PE incidence and UtA-PI status, the conflict and lack of a significant difference between PE incidence and UtA-PI status in the current study may be caused by the study's small sample size and low incidence PE[23,34,36,37].

Conclusion

High UtA-PI in the current study could be identified as an acceptable role in the prediction of adverse perinatal outcome, including SGA or PE.

Recommendation

1. It seems that more studies with larger sample size in this regard are required.
2. It need to have studies for evaluation of its role in early detection of prenatal adverse outcome by examination of pregnant women particularly at second trimester that is more valuable if it is performed with pre diastolic notch assessment, and RI and other Doppler index to identify adverse perinatal outcome and high-risk pregnancies .
3. There is need to apply the Doppler study for uterine arteries as part of obstetrics assessment.
4. Need to have well trained sonographers or obstetrician for Doppler study.
5. Need to more studies in evaluation of UtA-PI in selected obstetrical issue.
6. Combined testing by maternal factors, fetal biometry, UtA-PI and MAP at 30-34 weeks' gestation could identify a high proportion of pregnancies that deliver SGA neonates

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