Original Research Article

Mid trimester uterine artery doppler in high-risk pregnancies as a predictor of adverse pregnancy outcome

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Abstract

Background: The uterine artery Doppler has potentials for screening for complications of impaired placentation. The purpose of study was to asses the role of uterine artery color Doppler waveform analysis in second trimester for the prediction of adverse pregnancy outcomes in a high risk pregnancy between 18 to 24 weeks of gestation. **Methods:** Uterine artery doppler was performed in high risk pregnant women between 18-24 weeks of gestation attending Rims Adilabad. Presence of pulsatality index (PI) >1.45 or presence of bilateral uterine artery notching was considered as abnormal doppler waveforms. Outcomes measured were preeclampsia, small for gestation (<10th centile), abruption placenta and intrauterine fetal death. **Results:** Doppler examination was performed in 100 high risk pregnant women. 32% had abnormal doppler waveforms. Overall 36 (36%) women had Small for gestational age (SGA) babies and 27(27%) developed preeclampsia, of which 75% and 70% had abnormal doppler respectively. The sensitivity, specificity, PPV and NPV of PI > 1.45 and bilateral uterine artery notching for predicting preeclampsia were 70.4%, 82.2%,59.4% and 88.2% respectively and that for SGA being 75%,92.2%,84.4% and 86.9% respectively (95%)P value <0.0001). **Conclusion:** Mid-trimester uterine artery doppler waveform analysis performed in high risk women have a high negative predictive value. Hence women with normal doppler waveforms are unlikely to develop adverse pregnancy outcomes.

Keywords: Abnormal doppler, preeclampsia,small for gestational age, pulsatality index, mid-trimester uterine artery doppler, uterine artery notching.

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INTRODUCTION

Impaired placentation is considered as one of the major risk factor for adverse pregnancy outcomes[1].This is due to failure of trophoblastic invasion of muscular spiral arteries and their conversion from narrow muscular to wide non muscular low resistance vessels[2,3].

Direct assessment of trophoblastic invasion is not possible in human pregnancy. Doppler imaging permits a non invasive evaluation of uteroplacental circulation by comparing systolic and diastolic waveform[4,5] physiological process of trophoblastic invasion is reflected in the observation from doppler ultrasound studies that impedance (PI) of flow in uterine arteries decreases with gestation between 6 weeks and 24 weeks and remains constant thereafter[6,7] Impedance to flow is reflected by either persistence of the uterine artery diastolic notch or abnormal doppler waveforms. This led to the idea of uterine artery doppler as screening test for adverse pregnancy outcomes.

Variation in Doppler techniques, measurement parameters and study protocols have resulted in disappointed results in the prediction of poor pregnancy outcomes in low risk population with positive predictive values between 4 and 20[8,9,10].

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In high risk women doppler screening of uterine circulation would double the PPV for estimating either preeclampsia or small for gestation baby compared to the clinical risk assessment or prevalence[11]. Hence, predicting the risk of these complications may improve the outcome by providing appropriate antenatal surveillance and therapeutic intervention.

The present study aims at demonstrating an association between abnormal uterine artery doppler waveform in high risk pregnancies at 18-24 weeks of gestation and subsequent development of adverse pregnancy outcomes

MATERIALS AND METHODS

This was a prospective study conducted at RIMS Medical College, Adilabad, department of obstetrics and gynaecology. Uterine artery doppler was performed as a part of routine clinical care in high risk pregnancies between 18-24 weeks of gestation. 100 High risk pregnant women attending antenatal OPD were enrolled based on their previous pregnancy history and willingness to participate in the study. A written informed consent was taken from the participants after explaining the objectives of the study.

Inclusion Criteria (Previous pregnancies) -

- H/o preeclampsia or eclampsia
- H/o abruption
- H/o recurrent abortions (>3)
- H/o intrauterine fetal demise
- H/o oligohydramnios

Exclusion Criteria -

- Chronic hypertension
- Multiple pregnancy
- Renal disease
- Fetal anomalies
- Diabetes mellitus.

Procedure: With the transducer in the longitudinal plane, external iliac artery is visualized at the pelvic sidewalls.

The transducer is turned medially towards the uterine arteries where they cross the external iliac arteries. 4 different waveforms are obtained from each uterine artery and average was taken each side. Parameters of mean PI and presence or absence of notch in bilateral uterine arteries were analysed.

Presence of PI >1.45 or presence of bilateral notching was considered as abnormal doppler forms. A prescribed proforma was filled up and record was maintained. Follow up was done till the end of pregnancy. No intervention was done based on the doppler results. The main outcomes measured were preeclampsia, small for gestation (<10th centile), abruption and intra uterine fetal death.

Preeclampsia:

Blood pressure of ≥ 140/90 mm of Hg on two occasions 6 hrs apart in a previously normotensive women after 20 weeks of gestation with proteinuria (excretion of more than 300mg in 24hrs urine sample or single void urine protein/creatinine ratio ≥ 0.3 or dipstick 1+ persistant) or signs of end organ damage with or without proteinuria (platelet count < 1 lakh/mm^3 ; raised serum creatinine >1.1 mg/dl; elevated liver enzymes 2 times their values; evidence of pulmonary edema; new onset of visual/cerebral symptoms)[12,13].

Small for gestational age: Birth weight less than 10 th percentile for the gestational age[14].

Abruptio placenta: premature separation of a normally situated placenta from the lining of the uterus before the completion of second stage of labour[15].

Intrauterine fetal death: Delivery of a fetus showing no signs of life at 20 weeks or greater of gestation or a weight equal to or greater than 350 gm if the gestational age is not known[16].

The validity of doppler as a predictor of preeclampsia and small for gestational age babies was tested based on sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratios and negative likelihood ratios.The statistical analysis was done by chi square test and 2x2 contingency table using MedCalc statistical software, version 19.

RESULTS

A total of 100 pregnant women were selected based on the risk factors in their previous pregnancy and the Doppler study was performed in them. Majority of the women had hypertensive disorders (40%) during their previous pregnancy, followed by oligohydramnious(24%).

Table 1: High Risk Categorisation

Risk Factors	Total No(N= 100)	%
Preeclampsia	40	40%
Eclampsia	4	4%
Oligohydramnious	24	24%
Recurrent abortions	17	17%
Intrauterine feral death	10	10%
Abruptio placenta	5	5%

Table 2: Uterine Artery Doppler Results In Present Pregnancy

Doppler Results	Total (N=100)	%
Normal Doppler	68	68%
Abnormal Doppler	32	32%

Table 3: Adverse Pregnancy Outcomes Observed

Pregnancy outcomes	Normal Doppler	Abnormal Doppler	Total number (n=100)	
Preeclampsia	8	19	27	27%
Small for gestational age	9	27	36	36%
Abruptio placenta	1	4	5	5%
Intrauterine feral death	0	2	2	2%

Out of the total 100 high risk pregnancies studied 32% had abnormal doppler based on the doppler indices of Pl>1.45 and bilateral uterine notching (table 2). On follow up of all the cases (36%) had small for gestational age babies and (27%) developed preeclampsia of which 75% and 70% respectively had abnormal doppler (table 3).

Table 4: Diagnostic Validity And Accuracy

Pregnancy outcome	Sensitivity %	Specificity %	Positive predictive value%	Negative predictive value %	Relative risk	Chi square test
Hypertensive disorder	70.4%	82.2%	59.4%	88.2%	5.05	23.1
Small for gestational age	75%	92.2%	84.4%	86.9%	6.38	44.7

The relative risk of having preclampsia and small for gestational age with abnormal doppler was 5.05 and 6.38 respectively. The negative predictive value for both the conditions is high and significant.

DISCUSSION

In the present study out of the 100 high risk pregnant women 32% had either PI>1.45 or bilateral uterine artery notching. This is similar to a study by Coleman *et al.* " in New Zealand in which 40% of high-risk patients at 22-24 weeks had atleast one uterine artery notching, this rate was 38% in a study by El Hamedi[4].

70% and 75% of the pregnant women who developed preeclampsia and small for gestational age in the present study had abnormal doppler waveforms during their midtrimester with the sensitivity, specificity, positive predictive value and negative predictive values for preeclampsia and small for gestational age being 70.4%, 82.2%, 59.4%, 88.2%. and 75%, 92.2%, 84.4%, 86.9%(P value <0.0001) respectively.

CONCLUSION

Mid trimester uterine artery doppler waveform analysis performed in high-risk women have a high negative predictive value. Hence, women with normal doppler waveforms are unlikely to develop adverse pregnancy. Hence uterine artery Doppler can be used as a predictor tool to assess the adverse pregnancy outcomes in high-risk pregnancies.

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