



A PROSPECTIVE STUDY TO COMPARE THE ROLE OF UTERINE ARTERY DIASTOLIC NOTCH IN COLOUR DOPPLER ULTRASONOGRAPHY WITH ROLL OVER TEST IN PREDICTION OF PRE-ECLAMPSIA IN HIGH RISK PREGNANCIES

Pathology

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ABSTRACT

Objective: To evaluate and compare the role of uterine artery diastolic notch in Colour Doppler USG with Roll over test in prediction of Preeclampsia in high risk women.

Methods: Colour flow pulsed Doppler imaging of both uterine arteries in between 20-24 weeks was performed on 183 high risk antenatal women. The same women were then subjected to Roll over test in between 28-32 weeks of gestation.

Results: The primary outcome was uterine artery diastolic notching showed a higher specificity (98.17%) and positive predictive value (95.12%) than roll over test (specificity 68.81%, positive predictive value 53.42%). Kappa analysis showed moderate agreement for colour Doppler study whereas poor agreement for roll over test. 74(40%) patients developed Preeclampsia. The rate of pregnancy complications, preterm delivery, LBW babies, APGAR score <7, duration of stay in NICU was significantly lower in group with controlled BP and earlier diagnosis of Preeclampsia.

Conclusion: The persistence of diastolic notch in Doppler study is a better screening test than Roll over test in early prediction & management of pre eclampsia

KEYWORDS

Pre eclampsia, Roll over test, diastolic notch in colour Doppler study.

INTRODUCTION

Pregnancy Induced Hypertension (PIH) is one of the most common complications affecting up to 12% of pregnancies.¹ It is one of the leading causes of maternal mortality and morbidity.² Also it contributes to 23% of all viable low birth weight babies.³ The severity and magnitude of the complication have demanded a focus on tests capable of predicting Preeclampsia. Earlier detection of this condition allows for planning the appropriate monitoring and management to improve fetal maternal outcome. A non-invasive cost effective screening test with good sensitivity and specificity is urgently needed.

Doppler ultrasound evaluation⁴, a non-invasive method, of uterine artery impedance in the second trimester has been used as an early screening test for pre-eclampsia. Increased resistance to flow and persistence of diastolic notch have been associated with PIH.⁵

The Roll over test, another non-invasive office procedure is considered positive by an elevation of 20mmHg or more in blood pressure when the women rolls over from lateral decubitus to supine position at 28-32wks of gestation.

In this study both the tests have been compared to evaluate which one is better in prediction of PIH along with the subsequent effects on maternal and fetal outcome.

MATERIALS & METHODS

The study was carried out in the department of Obstetrics & Gynaecology (both inpatient and outpatient) of IPGME & R and SSKM Hospital, Kolkata in collaboration with Department of Radiology. All the pregnant women attending between 20-32 weeks with high risk factors were enrolled. It was a Prospective, Comparative Longitudinal, Analytical study with random sampling techniques carried for a period of 18 months, performed after approval from the institutional, ethical and research committee.

The intended sample size was 200 but 17 antenatal mothers were lost in follow up. Finally, a total of 183 cases were taken for statistical analysis. Data were analyzed using IBM SPSS V20. Sensitivity, Specificity, Positive predictive value (PPV), Negative predictive value (NPV), Cohen's kappa analysis for assessment of agreement & Fisher's exact two tailed test for p value were worked out.

INCLUSION CRITERIA:

The following antenatal women at 20-32 weeks:

- Elderly Primigravida (Age ≥ 35)
- Teenage Pregnancy (Age ≤ 20)

- Previous history of pre eclampsia and eclampsia
- Chronic Hypertension
- Grand Multipara. (≥ 4)
- Polyhydramnios
- Multiple Pregnancy
- Pregnancy with diabetes mellitus

EXCLUSION CRITERIA:

- Low risk pregnancies
- Ante partum haemorrhage

After obtaining informed consent the antenatal mothers were evaluated by detailed history taking, general survey including blood pressure, weight, physical and obstetrical examination. Blood pressure was measured by mercury sphygmomanometer in sitting position with arm at the level of heart, with appropriate sized cuff. Korotkoff V was used to designate diastolic BP. Routine antenatal investigations were done. All the patients were then subjected to Colour Doppler ultrasonography (CD US) in between 20-24 weeks to note the presence or absence of diastolic notch in both uterine artery waveforms. Uterine artery flow velocity waveforms were obtained using a Phillips SD-800 (Phillips Ultrasound, Hertfordshire, UK) or a Hewlett-Packard Sonos 550 (Hewlett-Packard, Geneva, Switzerland) ultrasound machine with a 3.5/5-MHz curvilinear array. The transducer was placed in the lower lateral quadrant of the abdomen angled medially. Color flow pulsed Doppler (CFPD) imaging was employed to identify the uterine artery, at the point where it crossed the external iliac artery. Uterine artery waveforms were obtained from both sides in all the women studied. The presence or absence of a notch was noted in each of the waveforms in both uterine arteries. Two readings were taken from each uterine artery. A notch was considered to be present when there was a clear upturn of the flow velocity waveform at the beginning of diastole (Figure 1 & 2).

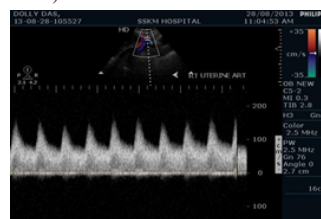


Figure 1 : Normal Doppler Waveform of Left Uterine Artery in second trimester

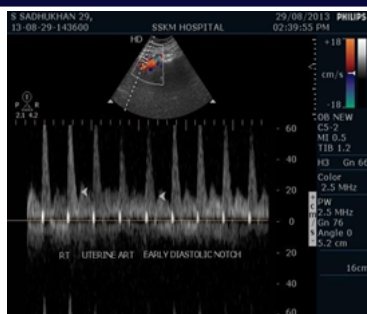


Figure 2 : Doppler Waveform of Right Uterine Artery showing Diastolic Notch in second trimester

Same women were then subjected to roll-over test (ROT) between 28-32 weeks. At the time of study, each participant was placed in the left lateral position, and blood pressure measurements in the right upper arm were repeated at five minutes intervals, until a constant baseline diastolic blood pressure had been established. When the diastolic blood pressure had become constant, the subject was turned to the supine position and the blood pressure was measured immediately and again five minutes later while the participant was still supine. An increase in diastolic BP by 20 mmHg from side to supine position indicates positive roll over test. Results were noted down.

All were then followed up till 7 days postpartum. Number of women developing pre eclampsia and weeks of gestation at that time were noted. Patients who developed pre eclampsia were given therapy at earliest and were investigated thoroughly as per protocol to grade the severity of pre eclampsia and identify complications if any. Their fetus was monitored more intensively by USG and biophysical profile. The patients who had mild Pre eclampsia were monitored weekly and those with severe Pre eclampsia were admitted to hospital for intensive management. Subsequently number of patients who developed complications, gestational age at delivery, birth weight of baby, NICU stay and APGAR score at 5 min were noted.

RESULTS

There were 34 chronic hypertensive, 10 twin pregnancies, 20 polyhydramnios, 16 elderly primigravida, 32 teenage pregnancy, 14 grand multipara, 21 diabetics and 36 with history of PE in previous pregnancy.

Table 1: Table showing presence of uterine artery diastolic notch and development of pre eclampsia

Uterine artery diastolic notch	Developed PE	Not developed PE	Total
Present	39	2	41
Absent	35	107	142
Total	74	109	183

Sensitivity = 52.70% (40.75% to 64.43%)

Specificity = 98.17% (93.51% to 99.72%)

PPV = 95.12% (83.43% to 99.26%)

NPV = 75.35% (67.42% to 82.19%)

Table 2: Table for comparison of roll over test and development of pre eclampsia

Roll over test	Developed PE	Not developed PE	Total
Positive	39	34	73
Negative	35	75	110
Total	74	109	183

Sensitivity = 52.7% (40.75% to 64.43%)

Specificity = 68.81% (59.22 to 77.34%)

PPV = 53.42% (41.37% to 65.19%)

NPV = 68.18% (58.62% to 76.74%)

Table 3: Comparison of uterine artery diastolic notch in Colour Doppler USG and roll over test in prediction of PE

	Diastolic notch in Colour Doppler	Roll over test
Sensitivity	52.70%	52.7%
Specificity	98.17%	68.81%
PPV	95.12%	53.42%
NPV	75.35%	68.18%

Kappa analysis done to see the agreement between presence of diastolic notch and the presence of ROT. Kappa=0.040 (95% CI 0.09 - 0.135) = poor agreement; P=0.551 insignificant)

In this study the mean maternal age was 26.14 ± 5.70 years. More patients were included in teenage and elderly group as per inclusion criteria.

74 out of 183 pregnancy (40.4 %) developed pre eclampsia. Diastolic notch positive was found (Table1) in 39 mothers and 39(not exactly the same women but overlapping was there) had ROT positive. Hence it is seen that sensitivity of both the test is equal (52.7%). But the specificity of Doppler study for notch was much higher (98.17%) compared to roll over test (68.81%). The PPV of Doppler study was greater (95.12%) than that of ROT (53.42%). The NPV of Doppler study was 75.35% compared to 68.18% of ROT (Table2).

Cohen's Kappa analysis (Table3) was done for Doppler study which came out to be 0.548 ;95% CI (0.503 to 0.848); p value < 0.001 (highly significant). This shows there was moderate degree of agreement between presence of diastolic notch and subsequent development of PE. Kappa analysis done for ROT came out to be 0.216 95% CI (0.072 to 0.359) with poor agreement; p value = 0.004 (significant).

41 / 183 women had bilateral diastolic notch, out of them 39 developed Pre eclampsia. ROT was positive in 73 patients of which 39 developed Pre eclampsia. Total 109 did not developed Pre eclampsia. 2 patients had IUFD and 1 died on 3rd day.

47 (63.5%) were diagnosed Pre eclampsia ≤ 28 weeks and 27 (36.5%) were diagnosed after 28 weeks. The relationship between early diagnosis of Pre eclampsia vs. late diagnosis and maternal and neonatal outcome was compared.

Among the 47 patients diagnosed with Pre eclampsia ≤ 28 wks., 8 i.e. 17% developed complications, whereas (18/27) i.e., 66.7% did so in the patients diagnosed late (p = <0.001). 40.4% patients in the earlier diagnosed group delivered before 37 weeks and 66.7% in the late diagnosed group delivered beyond 37 weeks (P=0.052).

Table 4 : Table showing relationship between control of BP and development of complications in mother

BP	With complications	Without complications	Total
controlled	9(15.7%)	48(84.3%)	57
uncontrolled	17(100%)	0	17
Total	26	48	74

50 patients had LSCS, 130 had vaginal delivery and 3 assisted vaginal delivery with forceps. The p values in the 2 groups were calculated by applying Fishers exact two tailed test.

The number of patients with complications (Table4) in group with controlled BP was (9/57) 15.7% and in group with uncontrolled BP was (17/17) 100% (p value was <0.001). (22/57) 38.6% of patients delivered before 37 weeks in patients with controlled BP whereas (15/17) 88.2% delivered before 37 weeks in the other group; p <0.001. In patients with controlled BP, (34/63) 53.9% babies were <2.5kg whereas it was (16/16) 100% in the other group (p was <0.001). The difference in APGAR score at 5 min in the two groups was significant (p = 0.002). The relation between control of BP and NICU stay of baby was insignificant (P=0.055).

In the earlier diagnosed group (28/50) 56% babies had birth weight <2.5kg and it was (22/29) 75.8% in the other group. P value was 0.094. 38% of babies had APGAR score <7 at 5 mins in earlier diagnosed group whereas it was 58.6% in the other (p = 0.102)

65% of babies had duration of NICU stay ≤ 1 day in earlier diagnosed group and 35.7% in the other group (P = 0.020). The results of this study suggest that uterine artery Doppler may be a useful screening method for the prediction of Pre eclampsia in high-risk women.

DISCUSSION

In spite of differences in methodology, time of screening, site of sampling and definition of abnormal waveform, the result of this study correlated with findings of a few previous studies of high risk populations^{6,7}. Sujata et al⁸ found similar specificity and NPV in their study both by CD US & ROT.

Harrington et al observed a different of value of Doppler study in predicting uteroplacental complications with sensitivity of 95% and specificity of 80% in high risk group in second trimester⁹. The higher prevalence of pre eclampsia in the present series is concordance with other studies of high risk women.^{10,11}

Day by day as the etiopathogenesis of Pre-eclampsia is being studied various markers and tests for its prediction are coming into light. Colour Doppler study of uterine arteries is emerging as a potential marker for prediction of Pre eclampsia in high risk patients. We also studied the usefulness of predicting pre eclampsia with maternal and fetal outcome and role of earlier diagnosis on overall pregnancy outcome.

Specificity and PPV of Colour Doppler study was much more than roll over test. Kappa analysis showed that diastolic notch in Colour Doppler study was a better screening test than roll over test in high risk women.

Earlier diagnosis of pre eclampsia ≤ 28 weeks lead to statistically significant lesser complications than late diagnosed patients.

The rate of complications, preterm delivery, low birth weight babies and APGAR score at 5 minutes were less in the group of preeclampsia patients with controlled BP than patients with uncontrolled BP (significant statistically).

CONCLUSIONS

The study concludes that the Colour Doppler ultrasonography to note persistence of diastolic notch between 20-24 weeks of gestation is superior to roll over test performed between 28-32 weeks as a screening test of Preeclampsia in high risk patients & outline optimal management of pregnancy. Further prospective and blinded larger multicentric studies will be necessary to determine whether this should be integrated into the antenatal care of high-risk women.

Conflict of Interest: There is no Potential Conflict of interest among authors. Ethical clearance was taken before the study.

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