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Prediction Of Pre-Eclampsia And Fetal Growth Restriction By Uterine Artery Doppler At 11-13 Weeks Of Gestation.

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ABSTRACT

Preeclampsia is a medical condition in pregnancy characterized by high blood pressure and proteinuria after 20 weeks gestation. The consequences of Preeclampsia can be serious both for the mother and the fetus, especially when the disease is severe. The purpose of this study is to assess the ability of uterine artery pulsatility index in the prediction of pre- eclampsia and fetal growth restriction. To Predict Pre-Eclampsia by uterine artery doppler at 11-13 weeks of gestation. And To Predict fetal growth restriction by uterine artery doppler at 11-13 weeks of gestation. This was a hospital based cross sectional longitudinal study that was conducted among pregnant women who came for routine antenatal checkup at 11 weeks – 13weeks to the ultrasound OPD in the Department of Radiodiagnosis. Uterine artery Doppler Pulsatility Index (PI) was measured by either Transabdominal or Transvaginal color Doppler and an abnormal uterine artery doppler was considered abnormal if the pulsatility index was more than 95th percentile for the respective gestational age and the presence of notching in the uterine artery waveform. Among 31.5% of the women showed abnormal doppler indices, 21.9% of the women developed pre-eclampsia and 12.3% of the fetuses had restricted growth. Uterine artery doppler in the first trimester is a valuable tool in prediction of adverse out-comes of pregnancy and would help the clinicians to anticipate the complications of the pre- eclampsia before they manifest.

Keywords: pre-eclampsia, uterine artery, Doppler, fetal growth restriction

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INTRODUCTION

The complications of the hypertensive disorders can be observed in about 5 to10% of all pregnancies which can be attributed as a deadly trio along with infection and hemorrhage. It greatly contributes to maternal mortality & morbidity rates to a significant extent [1]. Preeclampsia [PE] as a condition is recognised as a multisystem disorder as it poses a major threat for the fetal growth as well as the mother. The clinical definition of PE is the presentation of the blood pressure level that lies above 140/90 alongside with the protein excretion in urine during latter half of the pregnancy [2-4].

The uterine artery doppler indices is the most effective screening tool for preeclampsia. During pregnancy, the spiral arteries go through a lot of morphological changes. It starts off with the invasion of the spiral arteries by the trophoblasts. It then replaces the endothelium and muscle layer and is integrated into the vessel wall. In the absence of maternal vasomotor control, the tiny spiral arteries begin to convert into vessels with a larger diameter with low resistance and high compliance.

This uterine vascular change is required to guarantee a significantly increased blood supply to the intervillous area. Preeclampsia is hypothesized to occur as a result of defective invasion of the spiral arteries by the trophoblast, which prevents them from converting from small muscular vessels to large non-muscular vessels [4].

Aim

To predict pre-eclampsia and fetal growth restriction by using uterine artery doppler indices at 11-13 weeks of gestation.

Objectives

- To assess the usefulness of pulsatility index at 11 to 13 weeks of gestational age in prediction of pre-eclampsia and prediction of fetal growth restriction.
- To evaluate the ability of uterine artery doppler notching in the prediction of Pre-eclampsia and fetal growth restriction at 11-13 weeks of gestational age.
- To assess the prevalence of pre-eclampsia and fetal growth restriction.
- To assess the ability of pulsatility index in predicting pre-eclampsia and fetal growth restriction in high risk population.

MATERIALS AND METHODS

A hospital based cross sectional longitudinal study was conducted between January 2021 and January 2022.

Ethical committee approval was obtained from the institution.

The study recruited all antenatal patients attending the Obstetrics OPD at 11-13weeks of gestation and sent for ultrasound to the department of Radiodiagnosis at Melmaruvathur Adhiparasakthi Institute of Medical Science and Research and who satisfied the inclusion criteria.

During this time period, 146 women were recruited.

New born information was taken from the neonatal ward and the maternal register book.

Inclusion Criteria

All normotensive pregnant women attending OPD up to first two weeks of second trimester. Singleton pregnancy.

Exclusion Criteria

Women with congenital anomalous babies, multiple gestation, cardiac disease. Gross obesity precluding transabdominal scanning.

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Operational Definition

PE is diagnosed when the systolic blood pressure is more than hundred and forty and the diastolic blood pressure is more than ninety mmHg. It is measured twice, 4 hours apart and must be observed in conjunction with proteinuria of at least 300 mg per day or at least 1+ on dipstick testing.

When one or more of the following conditions are present, severe preeclampsiais diagnosed:

- At least two readings of blood pressure which must be more than or equal to 160/110 mm Hg, each taken four hours apart.
- Oliguria and proteinuria of 5 g / day, or at least 3+ on dipstick.
- Ocular disturbances.
- Epigastric pain.
- Impaired LFT.
- Thrombocytopenia

Fetal growth restriction: Defined as the condition in which the new-born has birth weight less than 10% for gestational age.

Uterine artery Doppler recordings were taken at 11 to 14 weeks. After ten minutes of bed rest, the woman was evaluated in a semi-recumbent posture utilising real- time ultrasonography on a Phillips Affinity 70 & Voluson GE machine with a transabdominal probe with frequency of 5 MHz. The uterine artery is visible just adjacent to the bifurcation as it enters into the uterus and can be identified by moving the probe medially and angling it slightly towards the symphysis pubis.

It is recommended to position the uterine artery sample gate of the pulsed wave doppler at the bifurcation, at the point of maximum colour brightness and once the waveform is obtained, the frequency range on the apparatus is changed until the waveform occupies around 2/3rd of the screen height. The doppler gain is decreased until the ideal balance is reached.

In a transvaginal scan the tip of the probe is placed at the level of fornix of the cervix and similar procedure to that of the transabdominal scan is carried out with the exception that the probe is tilted laterally to view the paracervical plexus. The right and left uterine arteries should each be measured separately and the average of both should be considered to determine the risk.

Abnormal uterine artery doppler was considered as

Persistent diastolic notch is a V shaped deflection towards the baselineduring early diastole is consider abnormal.

Persistent high impedance-PI more than 95th percentile for thegestational age based on the study done by Gomez et al.

Both of the above.

GA WEEKS	5th centile	50th centile	95th centile
11 weeks	1.18	1.79	2.70
12 weeks	1.11	1.68	2.53
13 weeks	1.05	1.58	2.38
14 weeks	0.99	1.49	2.24

Analysis Plan

The data collection is tabulated using Microsoft excel 2007 and analysed by statistical package for social sciences (SPSS) version 20 for windows. The categorical variables are given proportion and the continuous variables are given in the mean and standard deviation. Sensitivity, specificity, positive

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predictive value, negative predictive value of pulsatility index and notching were calculated from contingency tables.

Table 1: Obstetric History Distribution

Parity	N	%
Primi	68	46.5
Gravida 2	52	35.6
Gravida 3	24	16.4
Gravida 4	2	1.36

Table 2: Distribution As Per Gestational Weeks

		Frequency	Percent
Ga In Weeks	11	27	18.49
	12	73	50
	13	46	31.5

Table 3: Distribution As Per Doppler Indices

		Frequency	Percent
Doppler Study	Abnormal	46	31.5
	Normal	100	69.5
	Total	146	100.0

		Preeclampsia		
		Yes	No	Total
Pi	Abnormal	6	18	24
	Normal	10	39	49
	Total	16	57	73

		Preeclampsia		
		Yes	No	Total
Pi	Abnormal	5	12	17
	Normal	5	24	29
	Total	10	36	46

Table 4: Comparison Of Pre-Eclampsia And Pi Values 11-13Weeks Of Gestational Age

		Preeclampsia			
		Yes	No	Total	P Value
Pi	Abnormal	12	34	46	**0.028***
	Normal	20	80	100	
	Total	32	114	146	

***P Value Of < 0.05 Is Significant.**

Table 5: Pi Vs Fetal Growth Restriction In 11-13 Weeks

		Fetal Growth Retardation			P Value
		Yes	No	Total	
Pi	Abnormal	8	38	46	0.047*
	Normal	10	90	100	
	Total	18	128	146	

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Table 6: Severe Preeclampsia Vs Abnormal Pi

Pi	Severe Preeclampsia Present	Severe Preeclampsia Absent
Abnormal	5	41
Normal	2	98

Preeclampsia				
Gestational Weeks	**Sensitivity %**	**Specificity %**	**PPV %**	**NPV%**
11 Weeks	16.7	81	20	77.3
12 Weeks	37.5	68.4	25	79.6
13 Weeks	50	66.7	29.4	82.8
11-13 Weeks	37.5	70.2	26.1	80
Fetal Growth Retardation				
Ga	**Sensitivity %**	**Specificity %**	**PPV %**	**NPV%**
11 Weeks	25	82.6	20	86.4
12 Weeks	40	68.3	16.7	87.8
13 Weeks	75	66.7	17.6	96.6
11-13 Weeks	44.4	70.3	17.4	90

DISCUSSION

In our study, nearly 46 % of the antenatal mothers were of age 21-25 years and 35.6% were of age 26-30 years. The blood pressure examination for these antenatal mothers showed that the mean systolic blood pressure was 114.56 mmHg (SD ± 11.2) and mean diastolic blood pressure was 87.5 mmHg (SD 3.2) among non-pre-eclampsia group and mean systolic blood pressure was 141.6 mmHg (SD ± 9.3) and mean diastolic blood pressure was 75.2 mmHg (SD ± 4.5) in pre- eclampsia group. In our study a total of 46 women had abnormal doppler indices which is more than the 95th percentile out of which 5 (18.5%) were in 11 weeks, 23 (31.5%) were in 12 weeks and 18 (39.2%) were in 13 weeks. Among these patients with abnormal doppler values, 1 woman in 11 weeks, 5 women in 12 weeks and 5 women in 13 weeks developed preeclampsia. Sensitivity of PI for detecting pre-eclampsia at 13 weeks was 50%, while the specificity was 66.7% The positive predictive value was 29.4% and negative predictive value 82.8%. The overall sensitivity of PI for detecting pre-eclampsia at 11- 13 weeks was 37 %, while the specificity was 70.2 %. The positive predictive value was 26.1 % and negative predictive value was 80%. Using Pearson Chi-square test it was found that increase in PI is significantly associated with Pre-eclampsia.

In our study uterine artery doppler has a higher sensitivity in detecting severe pre-eclampsia with a sensitivity of 71.4%, specificity of 70.5%, positive predictive value of 10.9% and negative predictive value of 98%. Our results are similar to the study done by Gomez et al and AM Martin et al. Both of them concluded that uterine artery doppler was able to identify women with severe placental insufficiency than milder form of the disease. The overall sensitivity of PI for detecting fetal growth restriction at 11-13 weeks was 44.4% while the specificity was 70.3%. The positive predictive value was 17.4% and negative predictive value was 90% and increase in PI showed a statistically significant association with fetal growth restriction. In the study done by Gomez et al, it was found that the sensitivity and specificity for predicting fetal growth restriction was 24.3 % and 95.4% respectively and the positive predictive value and negative predictive value was 16.9 % and 97.0%. In another study done by AM Martin et al, it was found that the sensitivity and specificity for predicting fetal growth restriction was 27 % and 95.6% and positive predictive value and negative predictive value was 21.9 % and 91.9%. Pilalis et al, in his study found that the mean uterine artery PI greater than or equal to 95th centile predicted that 23% of women had small for gestation age babies.

While comparing the sensitivity analysis of pre-eclampsia and FGR with doppler study, the

sensitivity and negative predictive value is higher in 13 weeks for both pre- eclampsia and fetal growth retardation in our study [5-7].

In our study 16 participants belonged to the high-risk group out which 9 participants showed abnormal pulsatility index and 7 had normal pulsatility index, Among the 9 participants who had abnormal doppler 7 developed PE and 6 developed FGR and among the 7 who had normal doppler indices 4 developed PE and 2 developed FGR. The sensitivity for PE and FGR was 63% and 66% respectively and specificity for PE and FGR was 60 % and 57%. The sensitivity and positive predictive value for predicting pre- eclampsia and fetal growth restriction is increased in high risk group when compared to that of group.

CONCLUSION

The maximum sensitivity for detecting pre-eclampsia and fetal growth restriction by uterine artery doppler was found at 13 weeks of gestational age. Early uterine artery doppler is better used to identify the severe spectrum of the disease when compared to lower grade placental insufficiency. The prevalence of pre-eclampsia and fetal growth restriction were 22% and 11.6% respectively in the study population. To conclude this study, Uterine artery doppler in the first trimester is a valuable tool in prediction of adverse out-comes of pregnancy.

REFERENCES

[1] Cunningham, Leveno, Bloom Hauth, Rouse,Spong .Williams Obstetrics, Mc Graw Hill 2009, 23rd edition, Chapter 34, Pregnancy Hypertension. Page 706-707.

[2] Onwudiwe N, Yu CK, Poon LC, Spiliopoulos I, Nicolaides KH. Prediction of pre- eclampsia by a combination of maternal history, uterine artery Doppler and mean arterial pressure. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology 2008;32(7):877-83.

[3] Amaral LM, Wallace K, Owens M, LaMarca B. Pathophysiology and Current Clinical Management of Preeclampsia. Curr Hypertens Rep 2017;19(8):61.

[4] Ness RB, Sibai BM. Shared and disparate components of the pathophysiologies of fetal growth restriction and preeclampsia. American Journal Of Obstetrics And Gynecology 2006;195(1):40-9.

[5] Shear RM, Rinfret D, Leduc L. Should we offer expectant management in cases of severe preterm preeclampsia with fetal growth restriction? American journal of obstetrics and gynecology 2005;192(4):1119-25.

[6] Huppertz B. Placental origins of preeclampsia: challenging the current hypothesis. Hypertension 2008;51(4):970-5.

[7] Bringman J, Gibbs C, Ahokas R, Syamal B, Ramsey R, Egerman R. Differences in serum calcium and magnesium between gravidas with severe preeclampsia and normotensive controls. American Journal of Obstetrics & Gynecology 2006;195(6):S148.