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ROLE OF FIRST TRIMESTER UTERINE ARTERY DOPPLER AND MATERNAL SERUM BETA HUMAN CHORIONIC GONADOTROPIN IN PREDICTION OF PREECLAMPSIA

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ABSTRACT Failure of trophoblast invasion is caused by a persistent early diastolic notch or uneven blood flow velocity in preeclampsia. Pulsatility index(PI) Resistance index(RI), and early diastolic notch (EDN) indicate a maternal vascular disease. Vascular endothelial growth factors (VEGFs) influence the placental development of Human Chorionic Gonadotropin (HCG). Aim is to assess the role of first Trimester Uterine Artery Doppler and maternal Serum Beta Human Chorionic Gonadotropin (b-HCG) in the prediction of PE. 100 pregnant women were participated , USG doppler done , b hcg levels were done in 11 to 13 weeks and they are followed up in 2nd trimester,.As regard of urinary proteins in 2nd trimester 24 developed preeclampsia showing elevated Uterine artery RI, PI and low levels of b-hCG in 1st trimester.

KEYWORDS : Human chorionic gonadotropin, Preeclampsia, Uterine artery doppler

INTRODUCTION:

Preeclampsia (PE) is defined by proteinuria (300 mg/24 h or protein to creatinine ratio greater than 30 mg/mmol or 2 plus on dipstick testing) and new-onset hypertension (blood pressure 140 mmHg systolic or 90 mmHg diastolic) at greater than or equal to 20 weeks' gestation. Patients without proteinuria who show symptoms of renal, hepatic, or hematological dysfunction are now included in the updated criteria from the International Society for the Study of Hypertension and the American College of Obstetricians and Gynecologists. [1]

Physiological remodelling of the walls of the spiral arteries is thought to be avoided by a confluence of risk exposure, polymorphic genes, and other factors including vasoactive and vascular remodelling proteins, thrombophilia, hypo fibrinolysis, oxidative stress, lipid metabolism, endothelial injury, and immunogenic factors[2]

These hemodynamic changes, present before the onset of PE symptoms, can be detected by Doppler testing. Ultrasound's ability to quantitatively and qualitatively evaluate vascular flows has been found to be reliable and reproducible as part of a multimodal ensemble of screening indicators, recognizing 75 % of cases of preterm.[3]

Impaired trophoblast invasion causing persistent early diastolic notch , anomalies in blood flow velocity , presence of High pulsatility index (PI) , Resistance Index (RI) [4]

Production of progesterone, implantation, uterine development, and immune cell activity are all regulated by Human Chorionic Gonadotropin (HCG), a pregnancy-specific hormone generated by trophoblast cells (Cole LA, 2010). HCG regulates placental development, angiogenesis and vasculogenesis in addition to vascular endothelial growth factors (VEGFs). Clinical manifestation of PE has been linked to HCG levels, both high and low, according to several research[5].

This study set out to determine how well Uterine Artery Doppler and maternal Serum Beta Human Chorionic Gonadotropin (b-HCG) could predict the onset of PE in the first trimester

Methodology:

This prospective observational research was done in the department of obstetrics and gynaecology at Maharajah's Institute Of Medical Sciences during the period from May 2023 to October 2023 including 100 pregnant women.

Inclusion criteria: 100 pregnant women who fulfilled the following criteria were age group (18 -34) years, Gestational age from 11 to 13 weeks, Prim gravida, and single or multiple living gestation.

Exclusion Criteria:

Pregnant women greater than 13 weeks of gestation, Uncertain gestational age, pelvic pathology as uterine fibroid and intrauterine fetal death, fetal anomalies.

Ultrasounds scan to assess the gestational age and to detect any abnormality, Uterine artery doppler at 11-13 weeks and serum bHCG level at 11-13 weeks. These cases were followed up in 2nd trimester with urinary proteins with Dipstick test

Satistical analysis of the data: IBM's statistical program, SPSS 20.0, was analyze the data. Quantitative and percentage descriptions were employed for qualitative information. The minimum and maximum values ,as well as the mean, standard deviation, median and interquartile range (IQR), were used to characterize the quantitative data. The acquired findings were deemed significant at the 5 % level

RESULTS:

The ages of the women in this research are from 18 to 34 years ,as shown in the Table 1 . The average BMIwas30(kg/m2), with a lower limit of 25 (kg/m2)

Table 1 Age and body mass index descriptive study (n= 100)

	Min to max	Mean ±SD	IQR
Age	18.0-34.0	26.83±3.22	26.0(25.0-29.0)
BMI	25.0-30.0	27.30±1.53	27.0(26.0-28.0)

They had a mean age of 26.83 and a mean body mass index of 27.3

Table 2 protein in urine mg /day during 1st and 2nd trimester

Dip stick test	1st trimester	2nd trimester	p value
Nil	100	65	0.564
1+	0	13	0.230
2+	0	21	<0.001
3+	0	1	0.5

As regard urine protein ,all cases were normal in the first trimester but second trimester 20% of cases had plus 2 proteins in urine and 12 % had plus 1 protein in urine. Urinary protein levels varied significantly among the first and second

trimesters

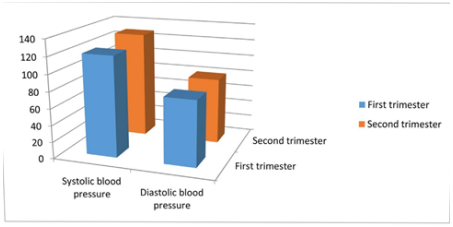

Fig. 1. Comparison between first trimester and second trimester according to blood pressure.

Table 3 Descriptive analysis of the studied cases regarding doppler USG and b-hcg

Doppler USG	Min-max	Mean ±SD	Inter quartile range
Ut art PI	1.50-2.60	1.83±0.33	1.70(1.60-1.90)
Ut art RI	0.71- 0.89	0.78±0.05	0.79 (0.73-0.79)
B hCG	4567-76899	60743.6 ±130107	61438(56732-67892)

This table shows doppler US findings: mean uterine doppler PI, RI was 1.83, 0.78, respectively. Mean b-hCG level was 60743.6

Table 4 : relation between cases who developed preeclampsia with the number of fetus (n =100)

	Preeclampsia not developed	PE developed	Chi square	Fisher exact test
No. Of fetus				
Single	73(96%)	24(95.8%)	0.002	1.000
Twins	3 (3.9%)	1(4.2%)		

There was insignificant relation between the number of fetus and cases who developed PE

Table 5: PE risk in the first trimester as measured by Doppler USG of the uterine artery (n =100

	Preeclampsia not developed	Pre eclampsia developed	P value
Uterine artery PI			
Min-max	1.50-1.90	2.10-2.60	
Mean±SD	1.67±0.13	2.34±0.22	<0.001
Median	1.70	2.40	
Uterine artery RI			
Min-max	0.71-0.79	0.82-0.89	
Mean±SD	0.76±0.03	0.86±0.03	<0.001
Median	0.75	0.87	

PE is statistically associated with greater PI, RI in the uterine arteries during the first trimester, as seen in the table 5

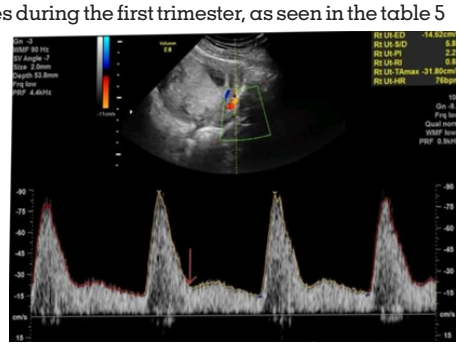

Fig 2 Transabdominal doppler of uterine arteryat the level of cervical internal Os

Table .6 Relation between cases who developed preeclampsia with b-HCG level in first trimester (n=100)

B HcG	PE+ve(24)	PE -ve (76)	Student t test	P value
Min -max	4567.0-45678.0	56732.0-76899.0		
Mean ±SD	42655.29±8211.14	66455.71±8061.41	12.433	<0.001
Median	43567.0	67890.0		

As regard b-hCG level there was a statistically significant relation among lower levels of b-hCG and development of PE

Table7. Validity(AUC, sensitivity, specificity) for dopplerultrasound and beta human chorionic gonadotropin levels for detection of preeclampsia.

	AUC	P value	95% CI	Cutoff	Sn	Sp	PPV	NPV
Ut art.PI	1.000	<0.001	1.0-1.0	>1.9	100.0	100.0	100.0	100.0
Ut art RI	1.000	<0.001	1.0-1.0	>0.79	100.0	100.0	100.0	100.0
B-hcg	1.000	<0.001	1.0-1.0	</=45678	100.0	100.0	100.0	100.0

AUC,Area Under Curve;CI,ConfidenceIntervals;NPV, Negative predictive value;PPV,Positive predictive predictive value Sn : sensitivity, Sp : specificity

Table 7 shows that: at a cut off greater than 1.9, Uterine artery PI had sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) were hundred %. At a cut off greater than 0.79, Uterine artery RI had sensitivity, specificity, PPV, NPV were 100%.at a cut off less than or equal to 45,678, b-hCG level had sensitivity, specificity, PPV, NPV were 100%

DISCUSSION

It is well recognized that PE is a syndrome characterized by chronic hypertension throughout pregnancy. As many as 3 % of first-time mothers and 1 to 3% of repeat mothers are affected. About 15 % of maternal deaths , and also resulting in maternal and infant mortality and morbidity.[6]

Doppler sonography is able to determine the capability and quality of blood flow, in the minor branches of uterine arteries, then to the uteroplacental circulation. As a pregnancy progresses, the uterine arteries become less restrictive, allowing more blood to flow through them. Inadequate trophoblastic invasion, on the other hand, causes the uterine arteries to have higher resistance to blood flow[7]

The current study showed that as regard urine protein, all cases was normal in first trimester but in second trimester 20 % of cases had plus 2 proteins in urine and 12 % had plus 1 protein in urine.In the study of **Kashinakunti** et al. 52 patients with PE took part in the research. Urinary protein levels ranged from 1643.3 ± 2079.5 mg/day on average[8]

In the study in our hands, as regard doppler USG findings, mean uterine doppler PI, RI was 1.83, 0.78, respectively. There was significant relation among higher uterine artery PI, RI and cases developed PE. Using ROC curve, at a cut off greater than 1.9, The sensitivity, specificity, PPVand NPV of the PI for the uterine artery were all perfect. Uterine artery RI had 100 % sensitivity, specificity, PPV, and NPV at a cut off of greater than 00.79.as similar results found in **Mittal et al** [9]

Our results showed that the mean b-hCG level was 60743.6. As regard b-hCG level there was significant relation between lower levels of b-hCG and development of PE. Using ROC curve, at a cut off less than or equal to 45,678, b-hCG level had sensitivity, specificity, PPV, NPV were 100 %.

Our findings were consistent with those of **Johnson** et al., who examined 62 pregnancies created with IVF/ET and assessed maternal serum HCG levels at 7e13 weeks of gestation. The eight women whoended upwith PE hadsignificantly lower levels of b-HCG.10

Our finding was supported by the research of **Abdel Moety** et al., who showed that serum b-hCG was significantly lower in

individuals who had PE matched to those who did not.11

CONCLUSION

Preeclampsia was linked to low levels of b-hCG in the first trimester and elevated PI and RI in the maternal uterine artery.

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