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ROLE OF UTERINE ARTERY DOPPLER SCREENING IN PREDICTING HYPERTENSIVE DISORDERS OF PREGNANCY

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ABSTRACT **Introduction-** Hypertensive disorders of pregnancy are one of the most prevalent obstetrics complications with unknown etiology. Inspite of all the medical advancement, hypertensive disorders of pregnancy remains one of the most common causes of maternal and perinatal morbidity and mortality. So, there is a felt need for identifying a non-invasive highly sensitive and specific method for early diagnosis and treatment of hypertensive disorders of pregnancy.Uterine artery Doppler is a non invasive method used to assess earlier changes in uteroplacental circulation.It is reliable, safe,easily reproducible tool and also can be performed along with nuchal transulency scan. **Material and methods-** After following strict inclusion and exclusion criteria 250 patients were recruited in the study and were subjected to transabdominal ultrasound after taking proper history and blood pressure recorded at each antenatal visit. Mean of uterine artery PI taken In 1st and 2nd trimester amd patients were followed till term to note the development of HDP and neonatal outcome. **Results-** The sensitivity, specificity, PPV , NPV of 1st trimester uterine artery Doppler was 6%, 97%, 33.3%, 80.5%:while that of 2nd trimester was 32%, 90%, 44.4%, 84.1% **Conclusion-** Hence,the specificity is very high, hence, it is concluded that women with normal Doppler are unlikely to develop hypertensive disorders of pregnancy.

INTRODUCTION

HDP are one of the most prevalent obstetrics complications with unknown etiology affecting 5-10% of all pregnancies and counts as a member of the lethal triad, with bleeding and infections being the leading causes of maternal morbidity and mortality.1 In India, the incidence of HDP is 5.38%, with preeclampsia and eclampsia accounting for 44% and 40% of complications, respectively. The incidence of preterm birth due to pre-eclampsia is approximately 15%, with a greater impact on the fetus.

Trophoblastic invasion of the placenta or "Placental remodeling" occurs in two stages: first stage between 8-12 weeks of gestation & second stage by 16-18 weeks.2 The method of choice to indirectly monitor the status of spiral artery bed is by uterine artery waveform3

In the non-pregnant state, uterine artery Doppler(Ut.A.Doppler) shows low peak flow velocity and early diastolic notch. At 18 to 20 weeks, there is high flow with no diastolic notch. Impaired Ut.A.flow is considered when there are high resistance uteroplacental waveforms which is associated with higher rate of pregnancy complication with 70% chance of developing protienuric hypertension and 30% chance of a coexisting small for gestational age fetus .

Although several studies have used uterine artery Doppler as a screening tool for preeclampsia and fetal growth restriction(FGR) in unselected population, a debate continues as to its value. Varying sensitivities are obtained depending on the type of Doppler used, the sampling site, the definition of abnormal uterine artery resistance, gestational age of assessment and different end points4.This study intends to evaluate the usefulness of first and midtrimester Ut.A.Doppler study in low risk women to predict HDP.

MATERIALS AND METHODS

This was a prospective observational study including 280 pregnant women with gestational age 11 to 13weeks +6 days attending antenatal clinic at AIMSR, Bathinda (tertiary health care centre).Following the strict inclusion and exclusion criteria and after written informed consent, a thorough history and physical examination was done for all the patients.Along with the demographic and vital statistics, recording of blood pressure was done in sitting position after 10 minutes of rest. The reading was repeated after 4 hours, if above 140/90 mmHg .

Ultrasound scan using GE VOLUSON E8 machine was done at 11 to 13weeks+ 6 days and 18 to 22 weeks till pulsed wave Doppler was obtained for 3 consecutive waveforms on both sides. The Mean PI was calculated as peak systolic flow minus end diastolic flow divide1d by mean flow.

All patients were followed till delivery to note the fetomaternal outcome. The findings, thus, obtained were noted down on excel sheet and statistical tests applied.

RESULTS

250 antenatal women were followed till delivery to assess the role of raised Ut. A. PI in HDP (30 patients were lost to followup). Out of these 250 women, 50 developed pre eclampsia with mean age being 23.86 +/-4.89 years. Among these, 53.2% were primigravida and 46.8% were multigravida indicating nulliparity may be associated with HDP. It was also seen that 55.6% patients belonged to upper lower socioeconomic status indicating towards a probable association of a higher income group with HDP.

The cut off value for Ut.A.PI was taken as 95th centile i.e. 2.38 for 1st trimester and 1.47 for 2nd trimester as per ROC curve obtained for the study population. The mean Ut.A.PI for the

study was calculated as 1.27 +/-0.61 (p value <0.05). It was observed that 6% patients with HDP had mean Ut.A.PI above cut off in 1st trimester. [X2 =1.037,p value=0.3] However, 32% patients had mean Ut.A.PI above the cut off in 2nd trimester which was statistically significant. [X2=15.70,p value <0.001] as shown in table 1.

The sensitivity and specificity of Ut.A.Doppler to predict HDP in 1st trimester was calculated as 6% and 97% respectively while that for 2nd trimester was 32% and 90% respectively shown in table 2.

Table 1: Association Of Hdp And Cut Off Value Of Mean Ut.α.pi In 1st And 2nd Trimester

		HDP						Chi-Square	P-value
		Yes		No		Total			
MeanU t.A PI (1st Trimest er)	>=2.38	3	6.0%	6	3.0%	9	3.6%	1.037	0.308
	<2.38	47	94.0%	194	97.0%	241	96.4%		
	Total	50	100.0%	200	100.0%	250	100.0%		
MeanU t.A PI (2nd Trimest er)	>=1.47	16	32.0%	20	10.0%	36	14.4%	15.706	.0001
	<1.47	34	68.0%	180	90.0%	214	85.6%		
	Total	50	100.0%	200	100.0%	250	100.0%		

Table 2 Distribution of data showing role of Ut.A.Doppler in predicting HDP in first trimester and second trimester

Variables	S nsitivity	Sp cificity	PPV	NPV
Ut.A.PI 1ST	6%	97%	33.3%	80.5%
Ut.A.PI 2ND	32%	90%	44.4%	84.1%

Feto-maternal outcomes were also observed in patients with mean Ut.A.PI values above cut off and who developed HDP.It was observed that 50% patients with HDP delivered babies at term, while only 2% were early preterm (28-32 weeks). 19 out of 50 patients (38%) had preterm vaginal delivery.

The mean birth weight calculated in the study came out to be 2.69 +/- 0.52kg. It was observed that 50% babies born to mothers with HDP had normal birth weight while 38% babies were low birth weight. Also, 16 babies (32%) born to mothers with HDP had FGR with 56% requiring NICU admission with average NICU stay of 8 days.(Table 3)

Table 3 : Association Between Fgr And Hdp

		HDP						Chi-Square	P-value
		Yes		No		Total			
FGR	Yes	16	32.0%	8	4.0%	24	9.6%	36.136	.0001**
	No	34	68.0%	192	96.0%	226	90.4%		
	Total	50	100.0%	200	100.0%	250	100.0%		

DISCUSSION

Pre-eclampsia is the most common pregnancy complication associated with serious maternal-fetal morbidity and mortality. At present, the only effective treatment is delivery of the placenta. It has been proposed that Ut.A.Doppler wave forms can identify women with obstetric complications related to abnormal placentation, as Doppler ultrasonography is a useful method to assess the velocity of uterine artery blood flow.

In our study, there were 50 (20%) patients who developed HDP. Results were similar to studies by Yousuf et al5(25.37%) but less than that of Verma et al6 (30.67%).It was also observed that, 29(11.6%) patients had delivery before 37 weeks(preterm delivery), where 24(9.6%) pregnant women delivered FGR babies. In the study by Bhattacharya et al7, incidence of FGR

was 36.54%. This was slightly lower than various other studies, which showed a higher incidence of FGR associated with abnormal Doppler values.This low frequency in our study may be probably due to selection of low risk cases .In various other studies the incidence of preeclampsia was ranging from 8.18% to39.2%.

In our study, majority (62.4%) of the patients were between the ages of 21 to 30 years, with mean age 23.85 +/- 4.39years. These results were comparable to study by C K H Yu et al8 where mean age was 23+/- 3.65years and by Shinde T et al9, where mean age was 26.65+/-4.06years.

HDP is twice as common in primigravida as compared to women for whom it is their second or more pregnancy. In our study, 133(53.2%) patients were primigravida, thus indicating that gravidity can be a predisposing factor for the disease. Results were similar to study by Scandiuzzi RM et al10 where 48.7% were primigravidas.

In the present study, 14 out of 50 patients who developed preeclampsia had abnormal Doppler waveforms which were evident from as early as the first trimester, whereas, 24 patients could be detected in 2nd trimester with these abnormal wave forms. The study therefore, demonstrated that an abnormal Ut.A.Doppler waveform could predict 28% of cases that developed Pe from as early as the 1st trimester, while 48% cases in 2nd trimester.

Mean Ut.A.PI in our study was 1.14+/- 0.46 and 0.89 +/- 0.56 in first and second trimester respectively. Comparing the mean values in our study to the mean values in the study done by Gomez and colleagues, a difference in the mean in the 1st trimester is noted while the 2nd trimester mean values were similar11. In both studies, it can be seen that the mean Pl values decreased as gestation increased as expected in a normal pregnancy. In our study, mean Ut.A.PI in patients with HDP was 1.27+/-0.61 but the 1st trimester Pl values in such patients was not a strong predictor of HDP. None of the values recorded were above the 95th centile when compared to the values by Gomez and co-workers. However, in clinical practice, a 1st trimester Pl value of >1.5 is deemed as elevated and warrants monitoring11.

In the 2nd trimester, most of HDP cases had a Pl value above the 50th centile signifying that Pl performed better as a predictor of HDP in the 2nd trimester. The study also assessed the association between mean Ut.A.PI and development of HDP, if any. The results were found to be statistically significant in 2nd trimester only(p value <0.01)..

In our study when the predictive value of PI in1st trimester was evaluated, the seensitivity and specificity were 6% and 97%(high) respectively in the 1st trimester which was similar to the studies by Scandiuzzi et al10 and Cnossens et al12.

In 2010, ArisAntsaklis, George Daskalakis13, concluded when the PI was in the upper quartile the risk of preeclampsia was increased by a factor of four and the risk of FGR was doubled when compared with women in which the PI was in the lower quartile. Similar results were found in our study.

2nd trimester: The sensitivity and specificity for the Ut.A.PI were 32% and 92.5 % using PI>1.5 as the criteria which was similar to the studies by Gomz et al11. They also found a significant change in the 95th percentile of mean Ut.A.PI with advancing gestation. There were 22 cases of preeclampsia, and using a cut-off of PI above the 95th percentile, the sensitivity for predicting preeclampsia was 24%, with a positive predictive value of 11%. The present study also has the positive and negative predictive value i.e. 44.1 % and 84.1% , which were similar to studies by Bhattacharya et al7

and Ratanasiri et al14

Pregnancy Outcomes

In the current study 50% of the population, who developed HDP, delivered at term and 38% of them delivered <2kg weight babies with mean of 10.77+/- 5.2 days stay in NICU. The mean birth weight in our study was 2.69 +/- 0.51 that is comparable to Scandiuzzi R M et al10 who concluded that 94.1% babies had more than 2.5 kg weight at birth.

Pilalis et al15, showed that the combination of maternal history with abnormal Ut. A.Doppler at 11 to 14 weeks achieves better results than either test alone in the prediction of preeclampsia. The same observation was also confirmed by our study and Plasencia et al16.

Preeclamsia And Fgr

Of all women who developed HDP, 32% of their babies had growth restriction while 26% had other complications like respiratory distress syndrome (Pvalue<0.05). However, in study done by C K H Yu et al8, 46.9% babies had growth restriction, which was much higher as compared to our study.

It has been proved beyond doubt in the present study that preeclampsia is significantly associated with FGR. This proves that both these entities, preeclampsia and FGR, stem from a common pathophysiology which has been known to be somehow related to early defective placentation.

CONCLUSION

A good obstetric care is now counted as the one where the aim is not to just treat but also to predict and prevent a poor outcome well in advance , thus shifting the spectrum of care from tertiary intervention to secondary and then to primary intervention. Hence, screening for HDP in low risk population is equally important but difficult in absence of a proper tool for the same .There is a need to construct a validated screening protocol for early and timely intervention in this regard.

The study concludes that, once the learning curve is overcome, Ut.A.Doppler being noninvasive, easily available tool can be included in the routine sonography to identify patients at risk of developing HDP with a higher specificity in second trimester.

Conflicts of Interest - None

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