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Research Article

DOPPLER SCAN ROLE IN PREDICTING PREGNANCY INDUCED HYPERTENSION

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Abstract:

Background: The purpose of the study is to analyze the pregnancy induced hypertension identified by Doppler ultrasound during second trimester of pregnancy. PIH (pregnancy induced hypertension) can cause maternal and fetal health issues.

Methodology: Total of 54 pregnant women were selected who were in their second trimester and were referred for trans abdominal ultrasound in the Department of Radiology in Lahore General Hospital. Pregnant women were scanned to identify absence or presence of Uterine artery Diastolic notch at 12th to 24th weeks of pregnancy. Follow ups of scans were maintained till 28th weeks of pregnancy. The diastolic notch early presence is a positive indicator for the development of preeclampsia.

Results: The patient's age group was from 18 years to 40 years and the mean age was 26 ±6 years and the gestational age mean was 17 ±2 weeks. The sensitivity of the Doppler ultrasonography was 94% and the specificity was 89%. The diagnosis accuracy of the Doppler ultrasound is 91%

Conclusion: From the study results it can be concluded that Doppler ultrasound results in second trimester helps in forecasting the PIH by development of Diastolic notch. Doppler ultrasound is a reliable predictor of PIH in women and helps to avoid the complications associated with PIH by treatment plans.

Keywords: Uterine artery, Diastolic notch, Pregnancy induced hypertension, Second trimester

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INTRODUCTION:

Pregnancy is a complex phenomenon where series of development and changes involved in the vascular anatomy. When the ovum is fertilized and implanted it bring changes in the arterial system and also helps in utero placental circulation. These changes results in the invasion of deciduas by trophoblast. The uterine vascularization and morphologic changes can be visualized with the help of pulse and color Doppler. Doppler USG helps in the identification of uterine artery and their spiral artery branches. The uterine placental circulations enhance the blood flow and as the gestational age increases the resistance decreases in blood flow. With the help of electromagnetic techniques, the blood flow to the uterine arteries can be measured. Hypertensions is the main disorder of pregnancy which became cause of complications to mother and fetal. In Pakistani population the hypertension is common and it occurs to every 37th women out of 100. PIH is also one of the major cause of mother mortality and morbidity, and also cause of IUGR, and delivery of babies with low birth weight. It can affect babies life and health. Prevention of PIH can bring positive impact on the mother and child health. The ratio of PIH in primi gravid is high as compared to the multi para. Preeclampsia and eclampsia are considered the major causes of maternal death. There are many factors which influence the PIH in women like primiparity, obesity, diabetes, family history of high blood pressure, multipara, age above 30 and hypertension. Placenta trophoblastic invasion and implantation helps in the oxygen and nutrients transport to the fetus. Spiral arteries elastic and smooth muscle loss can result in low resistance in circulation of uteroplacental. Preeclampsia development is because of poor trophoblastic invasion to the spiral arteries of mother. Trophoblastic invasion was identified from the Doppler ultrasound studies which resist the flow in the uterine artery from 6 to 24 weeks and then it remains constant. Doppler wave form helps in the evaluation of uterine artery. Locating the uterine artery color flow mapping is used. The early diastolic notch and high resistance flow are because of endovascular infiltration of trophoblast into the myometrium of placenta. Therefore the pulsatility index is high in 11 to 13 weeks of pregnancy. Pulsed wave Doppler is used to measure the pulsatility index. The study will help to assess the color Doppler ultrasonography diagnostic accuracy for identifying the PIH in pregnant female population

during second trimester of pregnancy. Color Doppler ultrasonography is reliable, easily available and cost effective non- invasive technique and helps in identifying the PIH for women better health and life. The screening helps to avoid the complications develops by PIH.

METHODOLOGY:

The cross-sectional study was conducted in Lahore General Hospital Radiology Department and the women who were willing to participate in study were included. Total sample size was 54 pregnant women from 11 to 28 week of pregnancy. Their age group was from 18 years up to 40 years of age. Demographic characteristics like age, income group, area, parity, gestational age and health status were noted. Trans abdominal scan were performed for identifying the uterine artery by Doppler ultrasound for evaluating the eclampsia, preeclampsia and hypertension development. General physical examination and hematological investigation for routine checkups were performed in addition with transabdominal ultrasound. To analyze the hypertension disorder in pregnancy the parameters were increased resistance, early diastolic notch and pulsatility index. Fetal with abnormalities were excluded from the study. Color Doppler ultrasound of 3.5 MHZ was used to identify the uterine artery at the gestational age of 11 to 20 weeks in first round of the study. The patients with diastolic notch were considered positive and without Diastolic notch were considered negative. Follow ups of women were recorded till 28th week of pregnancy in OPD. The blood pressure was monitored and if it increased from 140/90mmHg then the women were considered positive for developing PIH. The data was collected and analyzed in SPSS a statistical software version 20. The specificity, sensitivity, diagnostic accuracy, NPV (negative predictive value), PPV (positive predictive value), mean age and mean gestational age were calculated.

RESULTS AND DISCUSSIONS:

Total 54 women were selected for study and the mean age of the participants were 26 ±6 years and the gestational age mean was 17 ±3 weeks.

From table 1 it is clear that about 15(27.7%) women were primiparous. The women who have parity 1 were 25(46.2%) of the total sample. Women with parity 2 were 12(22.2%) and the women with parity 3 hold 3(5%) of the total sample.

Table 1

Age	Participants	Percentage
Less than 25 years(Primi para)	15	27.7%
Less than 30 years(Parity 1)	25	46.2%
Less than 35 years(Parity 2)	12	22.2%
Less than 40 years(Parity 3)	3	5%

When these women were analyzed for PIH by using spectral Doppler Ultrasound the results are shown below in table 2. It is clear from the table that total 27 women developed PIH and remaining 27 women were PIH negative.

Table 2

Doppler Scan Results	PIH positive	PIH negative	Total
Positive	11	1	12
Negative	16	26	42
Total	27	27	54

Other indicators which can influence blood pressure were recorded like socioeconomic factors, age, gravity, weight and family history. It was observed from the data that hypertension was developed usually among women who were less than 30 years of age, were primipara and were from low socio-economic status. Their weight was also above 60 kg. The women who have developed uterine artery were PIH positive and the women who have not developed uterine artery were PIH negative. 26 women have not developed PIH in their whole pregnancy. From table 3 ultrasonography results are obvious. Sensitivity of the results in predicting PIH was 94% and the specificity was 89%. Diagnostic accuracy of the results was 91%. NPV and PPV was 86% and 94% respectively.

Table 3

Doppler US results	Value
Sensitivity	94%
Specificity	89%
Diagnostic Accuracy	91%
NPV	86%
PPV	94%

From table 4 it is obvious that mean gestational age of the fetus was 26.41 ± 2.5 weeks and the mean systolic blood pressure was 150.17 ± 8.8 mmHg and mean diastolic blood pressure was 96.21 ± 4.6 mmHg

Table 4

Gestational age	26.41 ± 2.5
SBP	150.17 ± 8.8
DBP	96.21 ± 4.6

The trophoblast cells of placenta enter the myometrium and reach at all spiral arteries of mother. Vascular flow helps to transfer oxygen and nutrients to fetus, results in minimum resistance and enhanced flow. The Doppler ultrasound results help to visualize the uterine artery and the resistance in flow during diastolic flow. The hemodynamic changes of maternal placenta can be visualized at 20th week of gestational age. At 25th week the spiral arteries and elastic lamina can be observed when the trophoblast cells penetrate the spiral artery by one third of myometrium. At this stage the dilation is maximum and resistance to flow is minimum in the vessels.

Table 5

Age	Sensitivity	Specificity	NPV	PPV	Diagnostic accuracy
Less than 25	98	90	99	92	95
Less than 30	83	84	88	76	83
Less than 35	80	74	82	70	80
Less than 40	91	92	90	98	94
Primipara	99	91	98	88	95
Parity 1	92	83	90	86	89
Parity 2	90	91	90	89	90
Parity 3	100	88	99	81	92

The above table 5 shows the distribution of results regarding specificity, sensitivity, PPV, NPV and diagnostic accuracy of the results according to the age of the pregnant women. The women who were less than 25 years of age their sensitivity was 98%, specificity was 90%, NPV was 99%, PPV was 92% and the diagnostic accuracy was 95%. Women with age less than 30 years have the results as sensitivity 83%, specificity 84%, NPV 88%, PPV 76% and diagnostic accuracy was 83%. Women with age less than 35 years USG results were 80% sensitivity,

specificity was 74%,NPV 82%,PPV 70% and the diagnostic accuracy was 80%.The women with age group less than and up to 40 years USG results were sensitivity 91 %, specificity 92 %,NPV 90% ,PPV 98% and diagnostic accuracy was 94%.The distribution of data was also done according to the parity of the women .The women with primipara have the sensitivity 99%, specificity 91 %, NPV 98 %,PPV 88% and diagnostic accuracy of Spectral Doppler US was 95%.The women with parity 1 sensitivity was 92 %, specificity 91%,NPV 90,PPV 86% and diagnostic accuracy of Doppler US was 89%.Women with parity 2 have sensitivity 90%, specificity 91%,NPV 90%,PPV 89 % and diagnostic accuracy 90%.Women with parity 3 have sensitivity 100%,specificity 88 %,NPV 99% ,PPV 81% and diagnostic accuracy was 92 %.

Uterine artery Doppler results helps to identify the complications associated with abnormal development. The Doppler USG helps to screen the high-risk women in order to avoid the mortality and morbidity.

The research conducted by the medical researcher have evaluated that the resistance index and pulsatility index helps to identify the artery diastolic notch. Uteroplacental vascular resistance increases by the development of early diastolic notch. Campbell et al were the first researcher who identified the pregnancy complication due to hypertension. PIH and proteinuria is correlated.

Table 6

Academic Studies	Sensitivity	Specificity	Negative predictive value	Positive predictive value
May Backos et al	38	85	90	27
Bower et al	78	96	99.5	28
Zimmer men et al	22	90	70	80
Sharma et al	15.63	98	83	71.28
Pai	45.45	92	38	93.87

The above table 6 indicate the studies conducted by other researchers and their results for analysis purpose .The study conducted by May Backos et al have concluded that the Doppler US results specificity 85%, sensitivity 38%, negative predictive value 90 % and positive predictive value as 27%.The study conducted by Bower et al have evaluated sensitivity 78%, specificity 96%, negative predictive value 99.5% and positive predictive value as 28%.

CONCLUSION:

The study has helped to conclude that the Spectral Doppler USG was a reliable tool to identify the PIH in pregnant women at early stage (second trimester) and can help in the prevention of PIH at later stage by good treatment plan. The study was time bound and need large sample size for larger time and proper follow ups for the authenticity of the results. The uterine artery Doppler scans are cost effective and cause no harm to pregnancy and can be considered accurate diagnostic option for PIH.

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