

## Prospective Observational Evaluation of Pregnancy Induced Hypertension (PIH) and Intrauterine Growth Restriction (IUGR) in Primigravida using Doppler

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### Abstract

**Aim:** The aim of the present study was to assess the role of doppler study in evaluation of pregnancy induced hypertension (PIH) and intrauterine growth restriction (IUGR) in primigravida.

**Methods:** This Prospective observational study was carried out in the Department of Obstetrics and Gynaecology at Patna Medical College and Hospital Patna, Bihar, India from January 2017 to December 2017. In our study a total of 100 Primigravida patients between 18 to 35 years of age, attending antenatal outpatient department, were screened at 18 to 22 weeks of gestation with USG along with Doppler study.

**Results:** All the patients' age ranged from 19 years to 35 years. 15% were in the age group of  $\leq 20$  years, Majority of the patients (49%) were in the age group of 21-25 years, 29% were in the age group between 26-30 years, least number of patients (7%) were seen in the age group of 31-35 years. The mean maternal age was 23.57 years. The study group included patients whose gestational age ranged from 18-22 weeks of gestation. Mean gestational age at the time of 1st scan was 22.18 weeks. The study group included patients whose gestational age ranged from 30-38 weeks of gestation. Mean gestational age at the time of 2nd scan was 32.48 weeks. 8 patients developed only PIH (3 PE + 5 GH); 9 patients had only IUGR and 7 patients were complicated by both PIH and IUGR.

**Conclusion:** Elevated uterine artery PI and presence of diastolic notch appears to be more significantly superior to other parameters in prediction of Preeclampsia. Umbilical artery Doppler findings are better predictor of perinatal outcome than abnormal MCA in early weeks of gestation whereas MCA PI Doppler is more useful than Umbilical PI or uterine artery in predicting the adverse perinatal outcome in later weeks.

**Keywords:** Uterine Artery Doppler, Pregnancy induced hypertension, Intrauterine growth restriction, Maternal Outcome, Neonatal Outcome

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### Introduction

Hypertensive disorders affect approximately 5-10% of all pregnancies worldwide. [1] It is the most typical medical condition in pregnancy. As a significant risk factor of maternal and perinatal mortality and morbidity globally, it accounts for almost 10-20% of pregnancy-related mortality in low and middle-income countries. [2] Hypertension during pregnancy results in uteroplacental insufficiency. It is considered a major contributing factor in adverse post-delivery outcomes such as newborn intensive care unit (NICU) admission, low birth weight, birth asphyxia, preterm birth, perinatal death, intrauterine growth restriction and stillbirth. [3]

As per the classification recommended by the National High Blood Pressure Education Program

Working Group on High Blood Pressure in Pregnancy, hypertensive disorders in pregnancy are classified as chronic hypertension, preeclampsia-eclampsia, pre-eclampsia superimposed on chronic hypertension, and gestational hypertension. [4] Doppler ultrasound, based on the physical principle first described by CA Doppler in 1842, states the change in frequency of a sound wave when a moving object reflects it provides a safe, non-invasive, and rapid method to assess uteroplacental and fetal circulation, which helps in examining the relationship of impaired blood flow to adverse perinatal outcome. [5,6]

The incidence of preeclampsia is 8%-10% in pregnant women, according to the National Health Portal of India. In India, the research found that the

frequency of hypertensive disorders during pregnancy was 7.8%, with preeclampsia (PE) occurring in 5.4% of the population. [7] Fetal growth restriction (FGR) and fetal distress that results due to fetal hypoxemia or asphyxia can be investigated using Doppler velocimetry of uteroplacental and fetoplacental circulations. [8] The placenta through implantation and development modifies the uterine circulation from one of low flow and high resistance to one of high flow and low resistance. The primary defect that predisposes pregnancy to uteroplacental complication appear to be partial/complete failure of trophoblastic invasion. [9] It is therefore desirable to know the accurate changes in uteroplacental and fetal circulation to predict perinatal outcome and help in appropriate intervention. It is here that role of Color Doppler comes. Doppler ultrasound examination is a non-invasive method, which gives useful information about impaired blood flow to the fetus at risk among high risk patients several studies suggested a significant decrease in neonatal morbidity & mortality when doppler evaluation was a part of fetal surveillance. [10] The rates of preterm birth, growth retarded foetuses and perinatal death, are significantly increased in pregnancies complicated by severe preeclampsia. [11,12]

The aim of the present study was to assess the role of doppler study in evaluation of pregnancy induced hypertension (PIH) and intrauterine growth restriction (IUGR) in primigravida.

### Materials and Methods

This Prospective observational study was carried out in the Department of Obstetrics and Gynaecology at Patna Medical College and Hospital Patna, Bihar ,

India from January 2017 to December 2017 In our study a total of 100 Primigravida patients between 18 to 35 years of age, attending antenatal outpatient department, were screened at 18 to 22 weeks of gestation with USG along with Doppler study. Follow up Doppler studies were done after 30 weeks of gestation in the third trimester as per indicated to determine a favorable or worsening trend in Doppler indices. All the eligible candidates were included in the study depending on the following inclusion and exclusion criteria:

**Inclusion Criteria:** All Primigravida coming to our OPD. All Primigravida with singleton pregnancy.

**Exclusion Criteria:** Multiple gestations. Patients with history of medical disorders such as diabetes, hypertension, renal disease and cardiac disease. Unregistered Primigravida term gestation. All subjects with preterm labour and PROM. Congenital anomalies of uterus and fetus. Pregnant women of age less than 18 years and more than 35 years, or unknown last menstrual period. Intrauterine death at the time of first Doppler examination. Trophoblastic disease.

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using Statistical package for social sciences (SPSS) version 20 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) Windows software program. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were also calculated for all Doppler measurements.

### Results

**Table 1: Age distribution**

Age in years	N	%
≤20	15	15
21-25	49	49
26-30	29	29
31-35	7	7

All the patients' age ranged from 19 years to 35 years. 15% were in the age group of ≤20 years, Majority of the patients (49%) were in the age group of 21-25 years, 29% were in the age group between 26-30 years, least number of patients (7%) were seen in the age group of 31-35 years. The mean maternal age was 23.57 years.

**Table 2: Distribution of patients according to gestational age at 1st scan (18-22 weeks) and at 2nd scan (After 30 weeks)**

Gestational age at 1 <sup>st</sup> scan (weeks of gestation)	No. of Patients	Percentage (%)
18	22	22
19	14	14
20	23	23
21	17	17
22	24	24
Total	100	100
Mean	22.18	-
Std. Deviation	1.448	-
Gestational age at 2 <sup>nd</sup> scan (weeks of gestation)		

30	11	11
31	10	10
32	15	15
33	14	14
34	13	13
35	11	11
36	20	20
37	3	3
38	3	3
Total	100	100
Mean	32.48	-
Std. Deviation	2.220	-

The study group included patients whose gestational age ranged from 18-22 weeks of gestation. Mean gestational age at the time of 1st scan was 22.18 weeks. The study group included patients whose gestational age ranged from 30-38 weeks of gestation. Mean gestational age at the time of 2st scan was 32.48 weeks.

**Table 3: Distribution of cases of pre-eclampsia (pe), gestational hypertension (gh) and intrauterine growth restriction (iugr) in study population**

Outcome	No. of Patients	Percentage (%)	Total
(GH + IUGR)	8	8	-
PIH (PE + GH)	8	8	
IUGR	9	9	25
(PIH + IUGR)	7	7	
Normal Subjects	75	75	75
<b>Total</b>	-	-	<b>100</b>

8 patients developed only PIH (3 PE + 5 GH); 9 patients had only IUGR and 7 patients were complicated by both PIH and IUGR.

**Table 4: Adverse pregnancy outcome in study population**

OUTCOME	Number of patients					
	PIH (PE + GH)	IUGR	PIH + IUGR	Normal subjects	Total	
Gestational Age at delivery	<37 weeks	1	7	7	5	20
	37- 42weeks	7	1	0	72	80
	>42weeks	0	0	0	0	0
Birth Weight	<10th centile	0	8	7	0	15
	>10th centile	8	0	0	77	85
Stay in NICU	YES	1	9	7	4	23
	NO	7	0	0	72	77
APGAR at 1 minute	≤7	1	9	7	5	22
	>7	7	0	0	71	78
APGAR at 5 minute	≤7	1	9	7	3	20
	>7	7	0	0	73	80

Mean gestational age at time of delivery - 37.68 weeks. Preterm delivery – 20%. Term delivery – 80%. Minimum Birth weight - 1.42 kilograms. Maximum Birth weight -3.26 kilograms. Mean Birth weight at time of delivery - 2.7028 kilograms. Stay in NICU – 23%. Minimum stay in NICU – 3 days. Maximum stay in NICU – 14 days.

### Discussion

Hypertensive disorder of pregnancy is one of the most common complication that effects human pregnancy. It is one of the leading cause of maternal & fetal mortality & morbidity. [13] It comprises 7-

10% of all pregnancies. Pregnancy Induced Hypertension includes Gestational hypertension, Pre-eclampsia and Eclampsia. PIH has many complications. The most common complication of PIH is Intra uterine growth retardation (IUGR). perinatal deaths - including intrauterine and early neonatal deaths, hypoxic ischemic encephalopathy intraventricular hemorrhage, periventricular leukomalacia, pulmonary hemorrhage and necrotizing enterocolitis. Minor outcomes included caesarean delivery for fetal distress, APGAR score below 7 at 5 minutes, admission to neonatal intensive care unit. Others are placental infarcts,

abruption. The main goals of prenatal testing are to identify fetuses at increased risk for perinatal morbidity & mortality. Early detection of disease would lead to an improved outcome, through increased surveillance and use of prophylactic therapies such as low dose aspirin. [14,15]

All the patients' age ranged from 19 years to 35 years. 15% were in the age group of  $\leq 20$  years, Majority of the patients (49%) were in the age group of 21-25 years, 29% were in the age group between 26-30 years, least number of patients (7%) were seen in the age group of 31-35 years. The mean maternal age was 23.57 years. The study group included patients whose gestational age ranged from 18-22 weeks of gestation. Mean gestational age at the time of 1st scan was 22.18 weeks. The study group included patients whose gestational age ranged from 30-38 weeks of gestation. Mean gestational age at the time of 2nd scan was 32.48 weeks. In Pregnancy induced hypertension there is inadequate invasion of spiral arteries leading to increased resistances in spiral arteries. This leads to increased impedance of blood flow in uterine arteries Fleischer A, Schulman H, Farmakides G et al 1986. [16] The findings in our study are consistent with above. In our study of uterine artery Doppler velocimetry among 41 case group, 15 (36.53%) subjects had normal flow pattern in uterine artery and 26 (63.46%) had abnormal flow pattern with raised indices and diastolic notches. Out of 26 cases of PIH showing raised Doppler indices and diastolic notch, 14 cases showed bilateral abnormality (B), either raised indices, diastolic notch or both leading to (34.1%) cases of total. Our findings were consistent with Mohd Khalid et al (2011) [17] to determine the role of Color Doppler Sonography in evaluation of fetal outcome in 58 antenatal females (22 normotensive, 36 hypertensive) in their third trimester of pregnancy. Arteries evaluated included – bilateral uterine arteries, umbilical artery, fetal middle cerebral and fetal aorta. In this study, 34(94.44%) out of 36 hypertensive patients showed abnormal uterine artery flow. U/L Uterine artery involved in 12 cases (33.3%). B/L uterine artery was involved in 22 (61.11%) cases. Axt-Flidner Ret al (2004) [18] in a Prospective study to assess the role of uterine artery color Doppler waveform analysis in the prediction of adverse pregnancy outcome such as preeclampsia, intrauterine growth retardation, placental abruption or a combination of outcome parameters in risk pregnancies (n=52). According Jackson MR et al [19], patients with uterine artery notches and high resistance flow had significantly higher rates of fetal growth retardation and caesarean delivery because of fetal distress and had significantly bad pregnancy outcome.

8 patients developed only PIH (3 PE + 5 GH); 9 patients had only IUGR and 7 patients were complicated by both PIH and IUGR. Mean

gestational age at time of delivery - 37.68 weeks. Preterm delivery – 20%. Term delivery – 80%. Minimum Birth weight - 1.42 kilograms. Maximum Birth weight -3.26 kilograms. Mean Birth weight at time of delivery - 2.7028 kilograms. Stay in NICU – 23%. Minimum stay in NICU – 3 days. Maximum stay in NICU – 14 days. The umbilical artery represents the fetoplacental system which primarily reflects placental resistance and is the primary vessel for monitoring high-risk pregnancies. Various studies reported abnormal umbilical artery PI and S/D ratio as factors influencing adverse pregnancy outcomes like intrauterine growth restriction (IUGR), neonatal death and low Apgar score. [20,21] Park et al. also suggested the consequence of notch depth in the presence of diastolic notch to predict poor perinatal outcomes. [22] Also, it is observed that adverse outcomes were substantially higher amongst cases with abnormal fetal MCA measurements and abnormal CPR (p-value <0.05). Similar findings were observed in other studies. [23,24]

According to Ochi, et al [25] increased PI and the presence of diastolic notch in the uterine artery flow velocity, indicate increased uterine arterial resistance and impaired uterine circulation. The findings in the present study suggest that the increased Doppler indices in uterine artery with associated diastolic notch and persistence of diastolic notch after 30 weeks of gestation constitute an ominous sign and indicate the requirement for timely and intense fetal surveillance and intervention. The present study concludes that elevated uterine artery PI and presence of diastolic notch at early weeks of gestation appears to be a better predictor and more significant than uterine artery S/D in assessment of intrauterine fetal growth and in predicting perinatal outcome.

### Conclusion

Elevated uterine artery PI and presence of diastolic notch appears to be more significantly superior to other parameters in prediction of Preeclampsia. Umbilical artery Doppler findings are better predictor of perinatal outcome than abnormal MCA in early weeks of gestation whereas MCA PI Doppler is more useful than Umbilical PI or uterine artery in predicting the adverse perinatal outcome in later weeks.

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