UTERINE ARTERY DIASTOLIC NOTCH AS A PREDICTOR OF PREGNANCY INDUCED HYPERTENSION

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ABSTRACT

Objective: *To study the role of uterine artery notch on color Doppler ultrasound in prediction of PIH.*

Methods: *This observational prospective longitudinal study was conducted in Department of Obstetrics and Gynaecology Mahatma Gandhi Medical College and Hospital, Jaipur. Study sample comprised of 100 antenatal patients with 20-28 weeks of gestation attending OPD of Department of Obstetrics and Gynaecology Mahatma Gandhi Medical College and Hospital, Jaipur from august 2013-14 and studied for the presence of Doppler changes during antenatal period.*

Results: *The primary outcome was that uterine diastolic notch shows sensitivity 60%, specificity 100%, PPV 100 % and NPV 85.37% in predicting PIH.*

Conclusion: *After analysing all the results, it has been concluded that uterine artery Doppler notching is good predictor for PIH.*

Keywords: *Uterine artery notching, Color doppler, Pregnancy induced hypertension*

INTRODUCTION

Pregnancy induced hypertension (PIH) is the most common complication of pregnancy and it affects up to 10% of pregnancies (1). It is one of the leading causes of maternal morbidity and mortality with an estimated 50,000-60,000 preeclampsia related deaths worldwide (2). Also it is the leading cause in 23% of all viable low birth weight babies (3).

So prevention of PIH could have salutary effects on pregnancy outcome both for mother and neonate. Although physicians have recognized preeclampsia, relatively, little is known about its pathogenesis and prevention. PIH is more common at either end of reproductive age, influenced by parity, race, and socioeconomic status, previous history of PIH and family history. It is 5 times more common in twin pregnancies especially dizygotic twins. Incidence of PIH is 12% in both diabetics and in gestational diabetics.(4) It is associated with metabolic syndrome(5).

Pregnancy induced hypertension (PIH) remains a great challenge to obstetricians. Impaired uteroplacental blood flow in PIH may result in intrauterine growth restriction (IUGR), placental abruption and intrauterine fetal death (IUFD) (1, 2 and 3).

Pre-eclampsia is characterized by an imbalance between prostacycline and thromboxane production (6), as well as failure of the second wave trophoblastic invasion of the endometrio- myometrial vasculature. The result is abnormal uteroplacental blood flow, and this has lead to the idea of using Doppler assessment of uterine artery to detect fetal defects much before any other ante partum test.

Doppler ultrasound evaluation of uterine artery impedance in the second trimester has been used as an early screening test for preeclampsia (7). Uterine artery Doppler wave form is unique and characterized by high diastolic flow velocities. Increased resistance to flow and development of a diastolic notch have been associated with PIH (8).

AIMS AND METHODS

The purpose of the present study is to study the predictive value of uterine artery diastolic notch on color Doppler ultrasonography at 20–28 weeks gestation for prediction of PIH.

100 antenatal women, randomly selected who were willing to participate in study ,without any high risk such as family history of PIH, previous history of PIH, eclampsia, APH (Antepartum Haemorrhage; including abruption), gestational diabetes, chronic hypertension, Rh incompatibility, polyhydramnios, oligohydramnios, anhydramnios, twin pregnancy, chronic nephritis, severe anemia, elderly primigravidas, grand multipara and previous bad obstetric history were included.

Detailed general physical examination of the women along with routine hematological investigations, blood sugar levels, ABO Rh grouping, renal function tests, hepatic function tests, fundus oculi examination, urine examination for albumin was done.

Detailed antenatal examination was done on all women. They were then subjected to Doppler ultrasound at 20–28 weeks to evaluate the presence or absence of notch in the uterine artery.

Data was simultaneously entered into proforma and was updated during review at 3

months. It was entered into Microsoft excel (MS Office XP) and master chart prepared. The data were analyzed using SPSS software version 18.0.

Continuous data (such as age, lab values) were expressed as mean, standard deviation and range. Chi-Square test was applied as appropriate for comparison of nominal data.

OBSERVATIONS

The observations were recorded considering—age, gravidity, mode of delivery, gestational age relationship with PIH. 30 out of 100 women included in study developed PIH (Table 1).

Table 1: Distribution of patients according to age, gestational age and blood pressure

S. No.	Descriptive and biophysical parameters	PIH (n=30)	Normal patients (n=70)	p value
1.	Maternal Age (in completed years)	25.57±3.64	24.99±3.47	0.451
2.	Gestational Age (Weeks)	24.80±2.107	25.27±2.021	0.294
3.	Systolic BP (First Visit)	113.33±8.44	112.57±6.95	0.639
4.	Diastolic BP (First Visit)	73.33±6.61	72.57±5.30	0.543
5.	Systolic BP (at 30-38 week)	156.00±14.76	110.86±5.03	0.000
6.	Diastolic BP (at 30-38 Weeks)	102.33±11.94	76.14±6.21	0.000

The difference in mean Systolic BP of women with PIH at 30 to 38 weeks was statistically significant ($p < 0.01$). Both the groups were statistically indifferent for distribution of maternal age ($p=0.451$) and gestational age ($p=0.294$) (Table 1).

Table 2: Distribution of patients according to uterine artery notch in PIH and normal patients

UTERINE ARTERY NOTCH	Patients		Total
	PIH	Normal	
ABSENT	12	70	82
PRESENT	18	0	18
Total	**30**	**70**	**100**

The incidence of uterine artery notch in ultrasound Doppler was 60% in women who devloped PIH while it was not detected in any of the woman without PIH (Table 2).

In our present study, the sensitivity of uterine artery diastolic notch was found to be 60%, specificity 100%, PPV 100 % and NPV 85.37%.

Table 3: Distribution of patients according to Mode of Delivery

MODE OF DELIVERY		Patients	
		PIH	Normal
Vaginal	N	15	43
LSCS*	N	13	17
Instrumental(ventouse10,O.forceps 2)	N	2	10
Total	**N**	**30**	**70**

Chi- Square=4.02, p value: <0.01
LSCS=Lower Segment Caesarian Section
43.33% of the women were delivered by LSCS in PIH group in comparison to only 24.28% in the normal group (Table 3).

Table 4: Distribution of patients according to Maternal Complication

MATERNAL COMPLICATIONS	Patients	
	PIH	Normal
PPH*	10(33.3%)	3 (4.3%)
APH*	3(10%)	0 (0%)
deranged RFT*	2 (6.7%)	0 (0%)
HELLP syndrome*	2 (6.7%)	0 (0%)
No maternal complications	13(43.3%)	67 (95.7%)
Total	**30**	**70**

Chi- Square=50.42, write p <0.01
PPH= Postpartum haemorrhage, APH = Antepartum Haemorrhage,

RFT= Renal Function Test,
HELLP syndrome =Hemolysis, Elevated Liver enzymes, Low Platelet count

The women in PIH group developed more maternal complications like PPH (33.3% vs. 4.3%), APH (10% vs. 0%), deranged RFT (6.7% vs. 0%) than those in normal group. 95.7% of women in normal group developed none of the recorded maternal complications in comparison to 43.4% of those in the PIH group (Table 4).

DISCUSSION

In present study, the prevalence of PIH (Pregnancy Induced hypertension) was 30% whereas incidence of PIH as reported by various authors is 5–10% (12), 11% (13), 12–20% (14) and 3–14% (15).

Forty per cent of women with bilateral notches of uterine arteries and high pulsatility index have chances of developing preeclampsia, while in 45% there is chance of developing IUGR. (9-11), Color Doppler is an excellent tool for non-invasive hemodynamic monitoring of PIH patients. It helps to identify the foetus at risk and predict perinatal morbidity and mortality (9-13).

The characteristic shape of uterine waveform shows a steep systolic slope, an early diastolic notch and a small amount of diastolic flow. The waveform is essentially a high resistance form in the non-pregnant state. As the pregnancy progresses, there is gradual removal of the notch and an increase in the diastolic flow, as seen by the fall in resistance index (RI) (4). By using the persistence of the notch of the uterine arteries as the definition of abnormality, it was found that it persists in the majority of the women diagnosed with PIH.

In PIH group 13 (43.33%) out of 30 deliveries were LSCS while 17 (24.28%) out of 70 deliveries in normal group were LSCS. More deliveries are by LSCS in PIH group.

In the present study, Uterine artery notch in ultrasound Doppler was present in 18(60%) of the patients with PIH. The sensitivity of uterine artery diastolic notch was found to be 60%, specificity 100%, PPV 100 % and NPV 85.37%.

Similarly in a study by Sharma S et.al (16), the sensitivity of uterine artery diastolic notch was found to be 15.63%, specificity 98.53%, PPV 83.33% and NPV 71.28%.

The disparity in PPV and NPV of our study and in various studies done previously is probably because of variation in the study population.

CONCLUSION

The incidence of PIH in the study is 30%. This is higher than in other centres because ours is a tertiary care hospital receiving referral cases from the peripheral hospitals and centres.We conclude that Doppler ultrasound evaluation reflects fetal and maternal hemodynamic adequately and the results of our study support the use of Doppler uterine artery notch analysis as an important fetal well-being investigation which has an immense prognostic value. Estimation of notch early second trimester may bring about early recognition of patients at risk of preeclampsia before the clinical symptoms and complications of preeclampsia appear for a better fetomaternal outcome. Thus in collaboration with obstetrician, neonatologist, the timing and mode of delivery can be decided well within time to improve the perinatal outcome.

The derived statistical data including the sensitivity and P values correlate with previous studies thus testifying hypothesis to be positive. The findings indicate that the availability of Doppler studies leads to better obstetrical decision making.

Uterine artery diastolic notching shows a high specificity for predicting PIH.

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