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Original Research Article

The prediction of pregnancy induced hypertension from umbilical and uterine Doppler flow study

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ABSTRACT

Background: Hypertensive disorder along with hemorrhage and infection contribute greatly to maternal mortality and morbidity. Pregnancy induced hypertension remains among the most significant and intriguing unsolved problems in obstetrics.
Methods: In this prospective analytical study investigations and color doppler findings 0f umbilical artery PI, RI and end diastolic flow in same, uterine PI, RI and persistent diastolic notch in uterine artery recorded. Total 100 Cases of PIH between 20-36 weeks of gestation in 2 years with B.P ≥ 140/90 mm hg and protienuria ≥ 1+ were observed.
Results: In this study, out of 100 cases, there were 58 cases of mild PIH (58%) and 42 cases of severe PIH (42%). Umbilical artery PI was elevated in 43(43.0%) patients and was normal in 57(57.0%) patients. Umbilical artery RI was more than and equal to 0.7 in 77 patients (77%) and was below of 0.7 in 23 (23%) pa-tients.9(9.0%) fetuses showed absence and 14 (14.0%) fetus had reversal and 46 (46.0%) had reduced end diastolic umbilical artery flow with total 69 out of 100 fetuses having abnormal waveforms.65 (65%) mothers had an elevated uterine artery PI and 35(35%) patients had normal uterine artery PI. in observation 69 (69%) patients were having RI more than 0.6, while 31 (31%) were having less than 0.6 out of 100 patients. In this study, 65 (65.0%) women were having persistent diastolic notch.
Conclusions: This study was to evaluate arterial flow velocities as a predictor of impending pregnancy induced hypertension with raised RI and PI along with umbilical ab-sent or reverse end diastolic flow velocities and elevated RI and PI in the presence of a diastolic notch are considered as abnormal uterine doppler findings doppler finding with unfavorable outcome.

Keywords: Pregnancy induced hypertension, Pulsatility index (PI), Resistive index (RI)

INTRODUCTION

Hippocrates in Greece have mentioned about severe PIH disorder 2200 B.C. Atharva Veda in India, Wang dui Me in china have also mentioned about PIH. In the, Williams obstetric 1999 the term pregnancy induced hypertension (PIH) was used.[1] Hypertensive disorders of pregnancy ranked 75th in terms of DALYs and were responsible for 6% of the burden of all maternal conditions. It was estimated that deaths due to hypertensive disorders of pregnancy represented 13% of all maternal deaths. Hypertensive disorder along with hemorrhage and infection contribute greatly to maternal mortality and morbidity. How pregnancy initiate or aggravate hypertension remain unsolved despite decades of intensive research. still hyper-tension remains among the most significant and intriguing unsolved problems in obstetrics.

Until now, most information on feto-placental and fetal blood flow was obtained from animal studies or by invasive technique. During normal pregnancy,

physiological modifications of the uteroplacental bed (uncoiling and trophoblastic invasion of the spiral arteries) take place as a result of which, there is low resistance in the uterine arteries. Until the end of pregnancy, a tenfold higher circulating output towards feto-placental unit is achieved. A failure of trophoblastic invasion results in the so called muscular spiral arteries. This causes a decrease in the uteroplacental capacitance and consequent increase in the uterine artery resistance. This causes fall in diastolic flow. Latest advances in Doppler sonography technology have led to the applications for non-invasive assessment of maternal and fetal hemodynamic. The analysis of flow velocity waveforms is a far simpler technique which has improved by development of real time spectral analysis. The characteristic spectral wave form from the normal uteroplacental system is unidirectional, of low pulsatility So a presence of decreased diastolic flow, persistent diastolic notch in second trimester and raised flow indices are considered abnormal and suggestive of poor trophoblastic invasion.[2] Accumulated data reveal that there is a strong association between abnormal Doppler finding and high-risk pregnancies like Pregnancy Induced Hypertension.

Pathological studies have demonstrated that increased impedance in the umbilical arteries becomes evident only when at least 60% of the placental vascular bed is obliterated. Fitzgeraled, the first Doppler ultrasound report using continuous wave assessment of the uteroplacent circulation and the high resistance waveforms was obtained in preeclapsia and IUGR. Doppler study of the umbilical artery searching for decreasing diastolic flow and reduce flow with worsening pulsatility index of the middle cerebral artery are also part of fetal surveillance undertaken on IUGR is defined as reversed diastolic flow is an ominous finding and is seen with a higher mortality rate within the subsequent seven days of the in-utero life.[3]

Yoon BH, Lee CM, an abnormal umbilical artery waveform a strong and independent predictor of adverse perinatal outcome in patients IUGR and pre- eclapsia.[4] This study was to evaluate arterial flow velocities as a predictor of impending pregnancy induced hypertension with umbilical absent or reverse and diastolic flow velocities.

METHODS

Present study is carried out in the department of obstetrics and gynecology, C.U Shah medical college and Hospital , Surendranagar Gujarat. Patients with PIH are enrolled in the study during a period of one year from May 2011 to April 2013.

During the study period total 1424 patients were delivered among that 100 cases of PIH were enrolled and thoroughly studied for case study. Observa-tions and result of the study are as below. This is a prospective analytical study which was conducted during the period from May 2011 to April 2013.Total 100 Cases of PIH between 20-36 weeks of gestation will be studied over a period of 2 years having B.P ≥140/90mm Hg and protienuria ≥1+ in this prospective randomized clinical trial study investigations and color doppler scanner with TA and TV probe will be used for studying uterine and umbilical artery PI and RI.

Inclusion criteria

- All Pregnancy beyond 20 weeks of gestation having Systolic BP >140mm Hg , Diastolic BP >90mm Hg on two occasions four hours apart in previously normotensive woman with Proteinuria ≥1+ on urine dip stick test.

Exclusion criteria

- Molar pregnancies
- Renal disease
- Chronic Hypertension
- Hematological Diseases
- Other causes of seizures
- Heart Disease including IHD.

Prior to the commencement of the study ethical clearance was obtained from the Institutional Ethical Committee, C.U Shah Medical college, Surendranagar, Gujarat. All Pregnant women between 20-36 weeks of gestation attending antenatal clinic were screened for eligibility by detailed his-tory, antenatal examination and investigations by trained residents in Department of Obstetrics and Gynecology.

Women fulfilling selection criteria are explained about the purpose of the study and the need for randomization. A written informed consent was obtained from all participants before the enrollment than demographic data, obstetric history and current pregnancy details were obtained. The data was recorded on predesigned and pretested proforma.

RESULTS

Out of 1424 patients total 100 cases of pregnancy induced hypertension were observed and 42 of severe variety of PIH suggestive of 2.95% incidence of same and total incidence of PIH was 7.02% in present study (Table 1).

Table 1: Incidence of PIH in present study.

Total no. of patients delivered	Total no. of cases of PIH	Total no. of cases of severe PIH	Incidence of severe PIH (%)	Incidence of PIH (%)
1424	100	42	2.95	7.02

In this study, out of 100 cases, there were 58 cases of mild PIH (58%) and 42 cases of severe PIH (42%) (Figure 1).

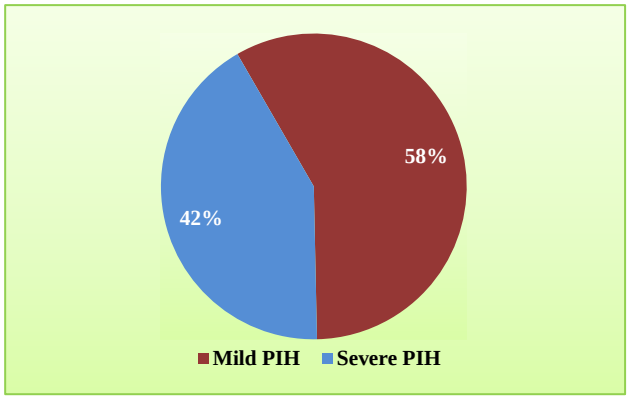

Figure 1: Percentage of mild and severe PIH in present study.

In this study umbilical artery PI was elevated in 43(43.0%) patients and was normal in 57(57.0%) patients (Table 2).

Table 2: Changes in umbilical artery pulsatility index (PI).

Umbilical artery PI	Number	Percentage
>1.5	43	43
< 1.5	57	57
Total	100	100

9 (9.0%) fetuses showed absence and 14(14.0%) fetus had reversal and 46 (46.0%) had reduced end diastolic umbilical artery flow with total 69 out of 100 fetuses having abnormal waveforms (Table 3).

Table 3: Umbilical artery end diastolic flow pattern.

End diastolic flow pattern	Number	Percentage
Normal	31	31
Absent	09	09
Reversed	14	14
Reduced	46	46
Total	100	100

In my study umbilical artery RI was more than and equal to 0.7 in 77 patients (77%) and was below of 0.7 in 23 (23%) patients (Table 4).

Table 4: Changes in umbilical artery resistance index (RI).

Umbilical Artery RI	Number	Percentage
>0.7	77	77
<0.7	23	23
Total	100	100

65(65%) mothers had an elevated uterine artery PI and 35 (35%) patients had normal uterine artery PI (Table 5).

Table 5: Changes in uterine artery PI.

Uterine artery PI	Number	Percentage
>1	65	65
<1	35	35
Total	100	100

Here in my observation 69 (69%) patients were having RI more than 0.6, while 31 (31%) were having less than 0.6 out of 100 patients (Table 6).

Table 6: Changes in uterine artery RI.

Uterine artery RI	Number	Percentage
>0.6	69	69
< 0.6	31	31
Total	100	100

In present study observation suggested that 65 (65.0%) women were having persistent diastolic notch in uterine artery doppler flow study out of 100 cases (Table 7).

Table 7: Persistent early diastolic notch in uterine artery.

Diastolic notch	Number	Percentage
Present	65	65
Absent	35	35
Total	100	100

DISCUSSION

In this study total 100 cases were observed and their umbilical and uterine Doppler findings and were recorded during May 2011 to April 2013.

As in table 1, present study stated that incidence of PIH was 7.02% which was comparable with that of Vidyadhar B Bangal et al was 8.96% while another study by Punam D Sachdeva et al stated that incidence was 14.7% and that of J Prakash et al was 5.38%.[5-7] Similarly study by Bhattacharya S.et al had report-ed the overall incidence of PIH to be 15.5% same as in textbook of Dr D C Dutta and Dr Williams Obstetrics 23rd edition showed incidence of PIH 5-15% and 5-10% respectively also in Krishna Menon MK stated incidence of PIH is reported to be 8-10% of pregnancies.[8,9] Same as present study shows that incidence of mild PIH were 58% and severe PIH were 42% that were comparable with study of Vidyadhar B. Bangal et al 539% of mild PIH and 42% incidence of severe PIH.

Umbilical artery doppler study

Umbilical artery PI was elevated in 43 (43.0%) patients and was normal in 57 (57.0%) patients while Absence

of end diastolic flow in umbilical artery was seen among 9 (9.0%) fetuses and 14 (14.0%) fetus had reversal and 46 had reduced end diastolic umbilical artery flow with total 69 out of fetuses having abnormal waveforms. Umbilical artery RI was more than 0.7 in 77 (77%) patients and was below of 0.7 in 23 (23%) patients.

In present study abnormal umbilical PI was 43% which was comparable to Uma Gupta et al 39 % and Lavnaya Rai et al 33.8% which suggests in patients with PIH group there are more chances of having abnormal umbilical artery Doppler.[10,11]

Table 8: Comparison of present study results with other study for changes in umbilical artery end diastolic flow.

Studies	Umbilical artery end diastolic flow			
	Absent	Reversal	Reduced	Normal
Present study	9%	14%	46 %	31%
Devendra et al[12]	5%	10%	33%	40%
Anshul et al[13]	6%	11%	29%	54%

Uterine artery doppler study

Present study it was observed that 65(65%) mothers had an elevated uterine artery PI and 35 (35%) patients had normal uterine artery PI same as 69 (69%) patients were having RI more than 0.6 while 31 (31%) patients were having less than 0.6 out of 100 patients. In this study, 65 (65.0%) women were having persistent diastolic notch while, 35 (35.0%) were having absence of notch in uterine artery. In present study abnormal PI of uterine artery was 65% which is comparable to Bhanap PL et al study 66 % but more than Lavnaya Rai et al study 38.90%. Here persistent diastolic notch in uterine artery was 65 % which is on lesser side than Dev Maulik et al study where it was 77 %.[14]

CONCLUSION

This study was to evaluate arterial flow velocities as a predictor of impending pregnancy induced hypertension with umbilical absent or reverse and diastolic flow velocities.

Failure of uncoiling and trophoblastic invasion of the spiral arteries leads to formation of muscular spiral arteries causes reduction in the uteroplacental capacitance and consequent increase in the uterine artery resistance. This causes fall in diastolic flow. important indices of flow velocity waveforms are PI, RI.

Pulsatility index

Pulsatility is the difference between the maximum systolic and the end diastolic components. P.I.= S-D / A. As the gestational age advances the end diastolic flow increases and the pulsatility de-creases.

Resistive index

Reported as similar index called the resistance index (RI). R.I.=S-D/S This also gives an angle independent measure of pulsatility in the vessel. Abnormal uterine artery Doppler in the second trimester of pregnancy is known to predict adverse outcomes related to pre-eclampsia, intrauterine growth restriction, placental abruption and intrauterine death. The most frequent descriptors of the uterine artery waveform are the measurement of impedance and velocity indices and the presence of uterine artery notches. Before 24 weeks' gestation early diastolic notching, due to the immature uteroplacental vascular system, is normally observed. Beyond this gestational age, persistent early diastolic notching is associated with preeclampsia. Elevated RI and PI the presence of a diastolic notch are considered as abnormal doppler finding.

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REFERENCES

1. Lindheimer MD, Taylor RN, Roberts JM, Cunningham FG, Chesley L. Introduction, history, controversies, and definitions. InChesley's Hypertensive Disorders in Pregnancy (Fourth Edition) 2015 (pp. 1-24).
2. Bhanap PL, Ingole P. Doppler Study of Uterine and Cubital Artery in Normal Pregnancy, Pre-eclampsia and Intrauterine growth restriction: evidence for systemic vessel involvement. Int J Recent Trends Sci Tech.2013;160(3):160-2.
3. Fitzgerald DE, Drumm JE. Non-invasive measurement of human fetal circulation using ultrasound: a new method. Br Med J. 1977;2(6100):1450-1.
4. Yoon H, Lee CM, Kim SW. An abnormal umbilical artery waveform: a strong and independent predictor of adverse perinatal outcome in patients with preeclampsia. Am J Obstet Gynecol. 1994;171(3):713-21.
5. Bangal VB, Giri PA, Mahajan AS. Maternal and foetal outcome in pregnancy induced hypertension: A study from rural tertiary care teaching hospital in India. Int J Biomed Res. 2011;2(12):595-9.
6. Sachdeva PD, Patel BG, Bhatt MV. A study of incidence and management of pregnancy induced hypertension in central Gujarat, India. Int J Univ Pharm Life Sci. 2011;1:61-70.
7. Prakash J, Pandey LK, Singh AK, Kar B. Hypertension in Pregnancy-Hospital Based Study. J Asso Phy India. 2006;54(R):273.
8. Bhattacharya S. Bhattacharya Sudhindra Mohan: Pregnancy induced hy-pertension and prior trophoblastic exposure. J Obstet Gynecol India. 2004;54(6):568-70.

9. Menon K, Palaniappan B. Hypertensive disorders of pregnancy. In: Mudaliar Menon ed. Clinical Obstetrics. 9th ed. Orient Longman: Madras; 1994;133:154.
10. Gupta U, Qureshi A, Samal S. Doppler velocimetry in normal and hypertensive pregnancy. Internet J Gynecol Obstet. 2008;11(2).
11. Rai L, Lekshmi S. Value of third trimester uterine artery doppler in high-risk pregnancies for prediction of adverse perinatal outcome. J South Asian Fed Obstet Gynecol. 2010;2(1):31-5.
12. Devendra A, Desai SK, Sheth PN, Prema K. Significance of umbilical artery velocimetry in perinatal outcome of growth restricted foetuses. J Obstet Gynecol India. 2005;55:138-43.
13. Anshul D, Neelu S, Suneeta G. Significance of umbilical artery Doppler velocimetry in the perinatal outcome of the growth restricted fetuses. J Obstet Gynecol India. 2010;60(1):38-43.
14. Maulik D. Doppler ultrasound in obstetrics and gynecology. Zalud I, editor. Berlin Heidelberg New York: Springer;2005: 362-74.

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