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Research Article,

'Role of Uterine Artery Doppler to Predict Pregnancy Induced Hypertension and Intrauterine Growth Restriction'

Pallavi Gurav[1], Mangala Rajput[2*]

[1]Assistant professor - Department of OBGY, MGM Medical College, Aurangabad (M.S) -India
[2]Professor and Head, Department of OBGY, Wanless Hospital and Miraj Medical Center, Miraj, (Maharashtra) –India
Email Address - drpallavigurav@gmail.com

Abstract:

Introduction: Early screening for preeclampsia and IUGR using Doppler ultrasound may allow vigilant antenatal surveillance, early diagnosis, proper treatment and appropriate timing of fetal delivery in order to avoid serious sequelae. The present study was to evaluate predictive value, sensitivity and specificity of uterine artery Doppler at18-20 weeks of gestation with regards to development of preeclampsia using pulsatility index as parameter.

Methods: A total of 100 females between 18-20 wks of gestation were included in the present Prospective observational study was carried out in Obstetrics and Gynecology department at tertiary care hospital during June 2010 to June 2012.

Results: In the low risk group, early diastolic notch was present in 5(10%) females, out of these 3(60%) developed PIH and 4(80%) developed IUGR. Pulsatility index was abnormal in 8(16%) women. Out of these 5(62.5%) developed PIH and 3(37.5%) developed IUGR. In the high risk group, early diastolic notch was present in 8(16%) females, out of these 7(87.5%) developed PIH and 6(75%) developed IUGR. Pulsatility index was abnormal in 9(18%) women, where 6(66.6%) developed PIH and 8(88.88%) developed IUGR.

Conclusion: Abnormal uterine artery Doppler at 24 weeks of gestation was a statistically significant predictor of PIH in both low risk and high risk group.

Keywords: Doppler, Pre-eclampsia, Pulsatility index, IUGR

Introduction:

Optimizing health care to prevent and treat women with hypertensive disorders is a necessary step towards achieving the Millennium Development Goals. The incidence of pregnancy induced hypertension (PIH) in India is upto 12% and the prevalence of IUGR in India is around 23%.[1] Preeclampsia and Intrauterine growth restriction are major causes of maternal or perinatal morbidity and mortality during later half of pregnancy.[2] Preeclampsia is characterized by an imbalance between prostacycline and thromboxane production[3], as well as failure of the second wave of trophoblastic invasion of the endometrio-myometrial vasculature. Abnormal placentation occurs long before the clinical appearance of PIH and IUGR. This has generated a great interest in the possibility of using uterine artery Doppler as a screening test, particularly for preeclampsia, foetal growth restriction and abnormal pregnancy outcome.[4] Early screening for preeclampsia and IUGR may allow vigilant antenatal surveillance, early diagnosis, proper treatment and appropriate timing of fetal delivery in order to avoid serious sequelae. It enables us to identify women with high risk for developing obstetric complications, such as PIH and/or IUGR secondary to utero-placental dysfunction, who require more intensive surveillance during pregnancy. Doppler ultrasound has emerged as one of the most important objective and noninvasive methods to assess pregnancies at risk for PIH, IUGR, and other adverse perinatal

outcomes. Normal uterine artery Doppler is reassuring for fetal well being. In high risk pregnancies an abnormal uterine artery Doppler is an indication for closer follow up and frequent fetal surveillance.[5]

The purpose of this study was to evaluate predictive value, sensitivity and specificity of uterine artery Doppler at18-20 weeks of gestation with regards to development of preeclampsia using pulsatility index as parameter and its role as a routine screening test with regards to development of preeclampsia in high risk and low risk group.

Methods:

The present Prospective observational study was carried out in Obstetrics and Gynecology department at tertiary care hospital during June 2010 to June 2012, a total of 100 females between 18-20 wks of gestation attending antenatal clinic were included in the study.

Inclusion Criteria: In low risk group all normotensive patients without any risk factor were included. For High Risk group, Primigravida with familial risk of preeclampsia (mother or sister), Age < 20 or >35 yrs., Obesity (BMI>25), h/o renal disease, Severe migraine, Diabetes mellitus included. Multigravida with History of preeclampsia in previous pregnancy, intrauterine growth restriction, Placental abruption, IUD or still birth in previous pregnancy was included.

Exclusion criteria: Patients with chronic hypertension and congenital anomaly in fetus were excluded. Uterine artery Doppler study was done between 18-20wks of gestation. Pulsatility index was calculated. Pulsatility index > 1.56 was considered as abnormal result.Follow up was done in ANC clinic. They were called every month till 28 weeks of gestation, then every 15 days till 36 weeks and every week thereafter till delivery. The abnormal pregnancy outcomes considered are development of preeclampsia.

Statistical Analysis: The data was entered in predesigned and pretested questionnaire. For statistical analysis, Chi-square test was applied to check the association of doppler abnormality and development of preeclampsia. P value < 0.05 was considered statistically significant. The validity of the test of the predictor tested using the parameters like sensitivity, specificity, positive and negative predictable value

Results:

Table 1: risk group wise distribution of patients:

Risk group	No. of patients
Low Risk	50(50%)
High Risk	50(50%)

Table 1 show that Low risk group consisted of 50 women without any risk factor. High risk group comprised of 50 women with one or more risk factors

Table 2: Risk factor wise distribution of high risk group:

Risk factor	No. of patients
Previous history of HDP	24 (48%)
Previous history of IUGR	13 (26%)
H/O stillbirth in previous pregnancy	4 (08%)
Age>35	1 (02%)
Obesity	1 (02%)
Diabetes mellitus	1 (02%)
H/O preterm delivery	6 (12%)
Total	50 (100%)

Table 2 shows that out of 50 women in the high risk group, majority of 24 (48%) women had history of PIH in previous pregnancy, 13(26%) women had Previous history of IUGR followed by 6 (12%) women had H/O preterm delivery.

Table 3: Development of hypertension with respect to abnormal PI in low risk group:

Pulsatility index (PI)	No. of patients		
	Hypertension (%)	No Hypertension (%)	P Value
Abnormal(8)	4 (50.0%)	4 (50.0%)	0.000
Normal(42)	1 (2.38%)	41(97.61%)	
Total	05 (10%)	45(90%)	

In the low risk group, out of 8 who had abnormal PI, 5(62.5%) developed HTN and out of 42 with normal PI, 4(9.52%) developed HTN. Development of hypertension during pregnancy is significantly more in presence of abnormal pulsatility index in uterine artery doppler in low risk patients.(P<0.05)

Table 4: Development of hypertension with respect to abnormal PI in high risk group:

Pulsatility index (PI)	No. of patients		
	Hypertension (%)	No Hypertension (%)	P Value
Abnormal(9)	6 (66.66%)	3(33.34%)	0.000
Normal(41)	2 (4.87%)	39(95.13%)	
Total	08 (10%)	42(90%)	50(100%)

In the high risk group, out of 9 women who had abnormal PI, 6 (66.66%) developed hypertension and out of 41 with normal PI, 2(4.87%) developed hypertension.Development of hypertension during pregnancy is significantly more in presence of abnormal pulsatility index in uterine artery doppler in high risk patients.(P<0.05)

Table 5: Predictive value of Doppler for pre-eclampsia in risk groups:

Risk groups	Sensitivity	Specificity	PPV	NPV
Low Risk	50	97.61	80	91.11
High risk	66.66	95.12	75	92.85

In both the risk groups predictive value of uterine artery Doppler with pulsatility index as parameter for development of preeclampsia is comparable.

PPV- Positive predictive value, NPV- Negative predictive value

Discussion:

The present prospective observational study was conducted in a set up of tertiary care center included first group comprised of primigravida or multigravida without any risk factor for PIH or IUGR. This was labeled as 'low risk group'. The second group comprised of females of any parity with one or more risk factors for Preeclampsia. In a study by P**. Zimmermann ET al**[6] concluded that pathological Doppler velocimetry of uterine artery was a more powerful predictor of preeclampsia in the high riskgroup than in the low risk population.

The period of gestation at which Doppler was done was between 18-20 weeks of gestation in present study. This gestational age was chosen because at this gestational age maximum females undergo routine ultrasound study to rule out congenital anomalies and because impaired trophoblastic invasion at 16-18 weeks of gestation might diagnose those pregnancies destined to become complicated by PIH, IUGR or both. Harrigton et al (1996)[7] and Antsaklis et al (2000)[8] have reported that screening by uterine artery Doppler is best performed at 24 weeks of gestation with improved sensitivity and specificity.

Predictivity of pulsatility index in low risk group for PIH: In the present study development of hypertension during pregnancy was significantly more in the presence of abnormal pulsatility index in uterine artery Doppler in the low risk patients **(P = 0.002).** Pulsatility index had good predictive values which were comparable to studies by Albaiges et al (2000)[4], Papagerhiou (2001)[9], Llurba et al (2009)[10], Cnossen JS et al (2008).[11]

Predictivity of pulsatility index in high risk group for PIH: In present study Abnormal Pulsatility index of uterine artery in high risk women was significant predictor of PIH **(P = 0.000).** In high risk group, pulsatility index had high specificity and NPV with fair sensitivity and PPV to use it as routine screening test in prediction of PIH**.**

Predictivity of pulsatility index in low risk group for IUGR: Development of IUGR was not statistically dependent on abnormal pulsatility index **(P=0.068).** Pulsatility index in the low risk group had good specificity and NPV also correlatingwith other studies mentioned above like Albaiges et al (2000)[4], Cnossen JS et al (2008)[11], Llurba et al (2009).[10] But it had low sensitivity and PPV as with Albaiges et al (2000)[4] which makes it controversial to use test for routine screening in the low risk group.

Predictivity of pulsatility index in high risk group for IUGR: In the high risk group, abnormal pulsatility index was significant predictor of IUGR **(P=0.000).** It had very high specificity and NPV along with good sensitivity and PPV to recommend it as routine screening test in high risk group. Pulsatility index was more accurate than rest parameters as it both systolic and diastolic flow are considered. It denotes progressive decrease in diastolic flow so can be used for follow up in case of IUGR. If diastolic flow becomes absent or reversed S/D ratio and resistance index cannot be measured, only pulsatility index remain predictive.

Perinatal outcome: In present study out of 25 NICU admissions, 10(40%) had abnormal Doppler and 2(8%) had normal Doppler in the low risk group, while 6(24%) had abnormal Doppler and 7 (28%) had normal Doppler in the high risk group. NICU admissions were not significantly more in Doppler abnormal group compared to Doppler normal group. (P>0.05) In the low risk group there was one stillbirth with normal uterine artery in that patient. In the high risk group there were 2 still births with one women having normal doppler and 1 having abnormal doppler. These results were comparable with Tamera Stampatija et al review (2010).[12]

Conclusions:

The incidence of PIH in low risk group was 10% and 16% in the high risk group.Abnormal uterine artery Doppler with pulsatility index as parameter at 20-24 weeks of gestation was a statistically significant predictor of preeclampsia in both low risk and high risk group. Uterine artery Doppler screening at 20-24 weeks of gestation can be done along with routine ultrasound and is a safe, noninvasive, and cost-effective method to predict pregnancy induced hypertension in both the low risk as well as the high risk groups, although this needs further studies in larger population.

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