

Increased resistance to the uterine artery blood flow in second trimester and pregnancy outcome

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ABSTRACT

Objective: The aim of study was to observe the resistance of uterine artery blood flow in second trimester and its relation to pregnancy outcome. **Methodology:** This randomized observational study was carried out in 196 women attending the antenatal clinic between 20-24 weeks of gestation. Uterine artery colour doppler was done trans-abdominally and were followed up till delivery. **Results:** Out of 196 cases, 25 (12.75%) showed unilateral notch whereas 7 (3.57%) showed bilateral notch on uterine artery doppler. The 7 cases with bilateral notch subsequently developed complications of which 6 cases developed preeclampsia with intrauterine growth restriction (IUGR) and one case had preeclampsia. Out of 25 cases with unilateral diastolic notch, 7 developed preeclampsia with IUGR, 3 developed preeclampsia alone, 3 women delivered IUGR babies, 2 developed gestational hypertension and remaining 10 cases had no complications. The predictive value of diagnostic notch in relation to sensitivity for preeclampsia and IUGR were 54.84% and 61.54% respectively. **Conclusion:** Persistence of uterine artery diastolic notch can be a good predictor of future foetal growth restriction and preeclampsia.

Keywords: Diastolic notch, Preeclampsia, Growth restriction.

The use of sonography has changed the practice of obstetrics as it allows to evaluate the anatomical structure of the foetus. Further, the addition of doppler ultrasonography enables the obstetricians to study maternal and foetal vessels which play an important role in modern antenatal care as obstetricians can assess the foetal well being and predict adverse pregnancy outcome. The American College of Obstetrics and Gynecology (ACOG) advocates for the use of doppler as an adjunct to standard antenatal testing [1]. The blood vessels targeted most often for

doppler evaluation in pregnancy are the uterine arteries in the mother and umbilical and middle cerebral artery in the foetus. Nowadays, Doppler ultrasound velocimetry of uteroplacental umbilical and fetal vessels has become established method of antenatal monitoring, allowing the noninvasive assessment of fetal circulation [2]. Uterine artery doppler screening is commonly performed around 20 weeks, however, it can be performed in the first trimester also. The waveforms can be analysed by calculating indices (pulsatility index, resistance index), or by presence or absence of

Received: 10th January 2016; **Accepted:** 28th February 2016.

Dutta BK, Gupta S. Increased resistance to the uterine artery blood flow in second trimester and pregnancy outcome. The New Indian Journal of OBGYN. 2016; 3(1): 42-46. doi:10.21276/obgyn.2016.3.1.8

diastolic notch.

In normal pregnancies, during the development of placenta, trophoblastic cells invade the intradecidual portion of spiral arterioles early in pregnancy, destroying first the endothelium and then the muscular and elastic tissue and replacing it with fibrinoid material. The process is completed by the end of first trimester. The second wave of invasion occurs between 14-16 weeks of pregnancy when the same process is extended to involve the intra-myometrial part of spiral arteries. This finally converts to a muscular arterial system into a low resistance uteroplacental unit capable to immense dilatation to accommodate the increased blood flow to the uterus and placenta. These physiological changes are reflected in the uterine artery doppler waveforms in pregnancy which is characterised by high end diastolic blood flow, increasing as the pregnancy advances. So, uterine artery doppler investigation serves as a screening tool for impaired placentation and its complications such as pre-eclampsia, foetal growth restriction, and placental abruption and may aid in stratifying antenatal care. It is good screening test as it is accessible, available, inexpensive, reproducible and is relatively easy to perform with training and experience. The study was carried out to evaluate uterine artery blood flow in second trimester onwards and its value in pregnancy outcome.

Methodology

This prospective observational study was carried out in the department of Obstetrics and Gynaecology in the medical college hospital over a period of one year from 1st June 2013 to 31st May 2014. The study was approved by the Institutional Ethics Committee. Uterine artery colour doppler was performed in randomly selected women attending the antenatal clinic between 20-24 weeks of gestation. Pregnancies with foetal anomalies, multiple gestations, diabetes mellitus, chronic hypertension, women withdrawal and unavailability to follow up were excluded from the study. Data were collected on a structured proforma. Uterine artery colour doppler was done trans-

abdominally with Mindray ultrasound machine (Model UMT – 150 with equations and normograms of Hadlock using a 3.5 MHz transducer).

At the time of doppler examination, position of mother was semi-recumbent with a slight lateral tilt to minimize the risk of developing supine hypotension syndrome due to caval compression. The uterine artery was visualised by placing the transducer on the left and right lower quadrant of abdominal wall, identifying the external iliac artery as the uterine artery is seen crossing it. Flow velocity waveforms were obtained. The presence or absence of diastolic notch was recorded. Bilateral uterine arteries were studied in each patient. A total of 220 booked cases were studied. Of which, 24 women were excluded from the analysis because of inability of follow up and details of clinical outcome were not available. Clinical data of 196 cases were collected from patients that were followed up till delivery. The end points to define an abnormal outcome of pregnancy were development of pre-eclampsia, intrauterine growth restriction (IUGR) baby or both. Every woman was advised to report immediately to the hospital if abnormal symptoms, such as headache, blurring of vision, epigastric pain, decrease urinary output and generalised oedema develop and was treated accordingly.

The data were analysed and sensitivity, specificity, positive predictive value, negative predictive value of the diastolic notch of the uterine artery in the prediction of pre-eclampsia and the intrauterine growth restriction were calculated. P – value and likelihood ratio were also calculated.

Results

Majority of the cases (90) taken were between 20 - <25 years of age; whereas 12.24% cases were above 30 years of age (24). Most of the cases (163) belonged to lower socio-economic class (83.16%) and 62.75% of cases (123) came from rural areas. Out of 196 cases, bilateral diastolic notch were found in 7 cases, unilateral notch was found in 25 cases and diastolic notch was absent in 164 cases (table 1). All the 7 cases with bilateral notch subsequently developed

Table 1: Uterine artery doppler study and pregnancy outcome (N=196)

Diastolic Notch	Normal outcome	Pre-eclampsia alone	IUGR alone	Pre-eclampsia with IUGR	Gestational hypertension	Total
Bilateral notch present	0	1	0	6	0	7
Unilateral notch present	10	3	3	7	2	25
Absent notch	124	10	6	4	20	164

complications of which 6 cases developed preeclampsia with IUGR and one case had preeclampsia. Out of 25 cases with unilateral diastolic notch, 7 developed preeclampsia with IUGR, 3 developed preeclampsia alone, 3 women delivered IUGR babies, 2 developed gestational hypertension and remaining 10 cases had no complications. In 164 absent notch cases, no complications was found in most cases (124) however 20 cases manifested as gestational hypertension, 10 cases developed preeclampsia and 6 women delivered IUGR babies. Table 2 shows the

for preeclampsia and IUGR were low which were 54.84% and 61.54% respectively.

Discussion

Hypertensive disorders are one of the commonest medical disorder during pregnancy, ranking second only to anaemia complicating around 5-10% of all pregnancies and account for approximately a quarter of all antenatal admissions [3]. There are many ways to predict hypertensive disorders in pregnancy by detailed history taking, proper examination, several biochemical and biophysical tests. But, most of the screening tests

Table 2: Analysis of outcome of bilateral and unilateral diastolic notch

Categories		Pre-eclampsia with IUGR		Pre-eclampsia alone		IUGR alone	
		Present	Absent	Present	Absent	Present	Absent
Diastolic notch bilateral	Present	6	1	7	0	6	1
	Absent	4	160	14	150	10	154
	P value	<0.0001		<0.0001		<0.0001	
	Relative risk	35.143		11.714		14.057	
Diastolic notch unilateral	Present	7	18	10	15	10	15
	Absent	4	160	14	150	10	154
	P value	<0.0001		<0.0002		<0.0001	
	Relative risk	11.480		14.686		6.560	
Present with Unilateral + Bilateral diastolic notch	Sensitivity	76.47%		54.84%		61.54%	
	Specificity	89.39%		90.91%		90.59%	
	PPV	40.63%		53.13%		50%	
	NPV	97.56%		91.46%		93.90%	

analysis of the diagnostic performance of the diastolic

women susceptible for development of IUGR and

notch of the uterine artery in relation to the development of preeclampsia with IUGR, preeclampsia and IUGR alone. The predictive value of diagnostic notch in relation to sensitivity

are not reliable, valid and cost-effective. However, uterine artery doppler velocimetry serves as a good screening test. Similarly, foetal growth restriction is a condition where the foetus fails to achieve its genetic growth potential and is at risk of increase perinatal morbidity and mortality. These cases have an increased risk of stillbirth, preterm labour, neonatal morbidity and mortality due to birth asphyxia, meconium aspiration, neonatal sepsis, hypoglycaemia and hypothermia [4-6]. Thus by identifying the group of

instituting appropriate management, perinatal morbidity and mortality can be reduced and passively long term health problems in the individual avoided.

The incidences of unilateral or bilateral diastolic notch were found to be different in various studies. Ratanasiri et al in 2004 in Thailand observed that the incidence of unilateral notch was 12.6% and bilateral was 0.79% [7]. Park et al in 2005 in Korea found the incidence of unilateral notch was 17.98% and bilateral notch was 6.33% [8]. In another study Agrawal et al in 2006 in India, found the incidence of unilateral and bilateral notch was 22.64% and 32.07% respectively [9]. In present study, out of 196 cases, 25 (12.75%) showed unilateral notch whereas 7 patients showed bilateral notch (3.57%) on uterine artery doppler. Thus the incidence of unilateral and bilateral notch in the study was found similar to the study done by Ratanasiri et al as both the studies were done on low risk unselected women.

Agrawal et al found that the incidence of preeclampsia and IUGR is 16.98% and 13.20% respectively in case of persistent bilateral uterine artery notch and 1.8% and 5.66% respectively in case of unilateral persistent diastolic notch [9]. In present study, the incidence of preeclampsia and IUGR is 3.57% and 3.06% respectively in case of bilateral notch and 5.10% and 5.10% respectively in unilateral notch. Perhaps, the difference in the above data is because the study which was conducted by Agrawal et al in India in 2006 had a small sample size (53 women) and all are high risk pregnancies. But, present study included 196 randomly selected women and so the incidence of preeclampsia and IUGR is low comparative to the study done by Agrawal et al. Though the incidence of bilateral diastolic notch was low i.e. seven cases but six of them developed preeclampsia and IUGR. However, the incidence of unilateral diastolic notch was comparative higher i.e 25 numbers of cases but out of them 10 developed preeclampsia and IUGR. Thus, persistence of uterine artery notch, specially bilateral one, can be a good predictor of future growth retardation and hypertension in pregnancy.

The prediction of preeclampsia in the presence of diastolic notch in various studies like Ratanasiri et al, Park et al, Axt-Flidner et al [10] showed the sensitivity ranging from 63% to 94.4% and specificity ranging from 76% to 92%, a low positive predictive value (PPV) and a very high negative predictive value (NPV). In present study the sensitivity, specificity, PPV and NPV were 54.84%, 90.91%, 53.13% and 91.46% respectively which were comparable. In prediction of IUGR in the presence of diastolic notch, most of the studies such as Harrington et al [11], Axt-Flidner et al, Park et al showed the sensitivity ranging from 36% to 71%, specificity 77% to 86%, PPV 14% to 31% and NPV 92% to 97% respectively which were comparable to present study.

Conclusion

Persistence of uterine artery notch, specially bilateral one, can be a good predictor of preeclampsia of mother and growth retardation of foetus. It can be evaluated along with a routine scan in all women if possible. But in high risk women it should be specifically evaluated so that necessary timely intervention can be done.

Conflict of interest: None. **Disclaimer:** Nil.

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