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Sonographic Association of Uterine Artery Pulsatility Index with Hypertension During Third Trimester of Pregnancy

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Abstract
Background: Hypertension (HTN) in pregnancy is the second most basic reason for maternal death and cause obstetric complications in 5-10% of all pregnancies. HTN directly affects the blood flow of uterine artery. Doppler screening test is a valuable method to do safe and non-invasive detection and has high reliability in the detection of uterine artery blood flow characteristics. **Objective:** The purpose of the present study is to find association between predictive value of uterine artery pulsatility index in normal and hypertensive pregnancy during third trimester. **Methods:** A descriptive cross-sectional study was conducted with the sample size of 138 patients by selecting the convenient sampling from Ghurki Trust Teaching Hospital, Lahore. The pulsatility index of uterine artery of all the women with normal singleton pregnancy and hypertensive during third trimester of pregnancy were obtained using Doppler ultrasound. Data was analyzed with the help of Anova .The results were derived by mean, frequency and standard deviation . **Results:** The significance between groups was 0.002. The mean values of right and left uterine artery pulsatility index of 36 hypertensive patients were 1.40 and 1.41 and standard deviation 0.4 and 0.5 respectively whereas the mean values of right and left uterine artery pulsatility index of 102 normal patients were 0.739 and 0.77 and standard deviation 0.23 and 0.5 respectively
Conclusion: Our study concluded that there was an association between uterine atery pulsatility index and hypertension during pregnancy. The uterine artery pulsatiltiy index has increased with hypertension in third trimester of pregnancy.
Keywords: Hypertension, Pulsatility Index, Doppler Ultrasound
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Introduction

Hypertension (HTN) in pregnancy is the second most basic reason for maternal death and cause obstetric complications in 5-10% of all pregnancies [1,2]. In HTN, the trophoblast invasion is abnormal, the placental perfusion is incomplete and utero-placental circulation remains in the state of high resistance [3]. In pregnancies, complicated by pre-eclampsia or intrauterine growth retardation (IUGR), the placental bed spiral arteries shows an incomplete physiological transformation [4]. HTN in early pregnancy can easily be detected by Doppler ultrasound of uterine artery (UtA) [5]. The black women, women who are obese and diabetic have high rates of HTN [1].

Doppler screening test is a valuable method to do safe and non-invasive detection of utero-placental circulation by comparing the systolic and diastolic waveforms [3]. Doppler screening not only gives information about the direction of blood flow but it also helps to measure the diameter of the vessels and the volume of the blood flow in the vessels [6] . The velocity of blood flow in the uterine artery is measured by using Doppler ultrasound and expressed as pulsatility index (PI). In normal pregnancies, uterine artery PI decreases with advancing gestation [7]. The placenta plays a necessary role in supporting the endocrine, nutriotionary and oxygenation needs of the growing fetus. Throughout gestation, the maternal uterine artery bear intensive transforming, hypertrophy and hyperplasia of vascular smooth muscle and diminished blood vessel resistance to match fetal demand for oxygen and nutrients [8]. The trophoblast invasion is thought to occur in two stages during the first and second trimesters. The first stage takes place between 8 and 10 weeks of gestation and begins with endovascular plugging of the spiral arteries by trophoblast cells. This is followed by trophoblast invasion and destruction of the musculoelastic media of the intradecidual segments of the spiral arteries. The second stage occurs between 14 and 16 weeks, and involves trophoblast invasion of the spiral artery segments in the inner third of the myometrium [9-11]. The changes in the blood flow velocity of uterine artery and hazardous pregnancy consequences are directly proportional to each other [9]. Uterine artery PI is increased before the onset of clinical signs of the illness. Doppler screening remarkably decreases the ratio of prenatal death and unnecessary medical interventions in high-risk pregnancies [12-13].

HTN directly affects the blood flow of uterine artery. Which ultimately result in placental insufficiency, IUGR and sometimes catastrophic pervaginal bleeding. Doppler ultrasound has high reliability in the detection of uterine artery blood flow characteristics. If the Doppler evaluation of uterine artery is incorporated in the routine obstetrical examination especially in high risk (HTN) then we will be able to detect these conditions earlier. The

early diagnosis and timely management can reduce unwanted outcomes to a great extent.

The aim of our study is to compare uterine artery PI in normal pregnancies and the pregnancies associated with maternal HTN in third trimester of pregnancy.

Methods

In this descriptive cross sectional study, 138 singleton pregnant women with or without hypertension in third trimester were included. All the patients had been collected from Ghurki Trust Teaching Hospital, Lahore. After informed consent data were collected by using Doppler ultrasound. Pulsatility index of right uterine artery and left uterine were obtained .Exclusion criteria consisted of pregnant women with auto-immune disease, multiple gestations, history of recurrent miscarriages and fetal structural or genetic anomalies.

Results

According to the table, the mean values of right and left uterine artery pulsatility index of 36 hypertensive patients were 1.40 and 1.41 and standard deviation 0.4 and 0.5 respectively whereas the mean values of right and left uterine artery pulsatility index of 102 normal patients were 0.739 and 0.77 and standard deviation 0.23 and 0.5 respectively. From this data, we concluded that PI was significantly more abnormally high in hypertensive pregnancies as compared to normotensive pregnancies (Table 1).

TABLE 1: No of normal and hypertensive patients, mean and standard deviation of pulsatility index of right and left uterine artery

Normal /hypertensive	No of patients	Mean Right uterine artery PI	Mean Left uterine artery PI	Std.deviation Right uterine artery PI	Std.deviation Left uterine artery PI
Normal	102	0.739	0.77	0.23	0.21
Hypertensive	36	1.40	1.41	0.4	0.5
Total sample	138				

Study data was analyzed using anova.

The significance between groups was 0.002

TABLE 2: Normal / Hypertensive

During our study, hypertension in pregnancy was recorded in 36 (26.1 %) patients. The other 102 (73.9 %) patients remained normotensive (Table 2).

Normal/Hypertensive	Frequency	Percent
Hypertensive	36	26.1
Normal	102	73.9
Total	138	100.0

In our study , minimum age of women was 19 and maximum was 35, mean 26.65 and standard deviation 3.72 (Table 3).

TABLE 3

N	Minimum Age	Maximum Age	Mean	Std. Deviation
138	19.00	35.00	26.6594	3.72503

This table represented number of pregnant women in different gestational weeks of third trimester (Table 4).

TABLE 4: frequency of patients in relation to Gestational Age

Gestational age	Frequency	Percent
28	6	4.3
29	3	2.2
30	8	5.8
31	12	8.7
32	15	10.9
33	26	18.8
34	23	16.7
35	18	13.0
36	13	9.4
37	9	6.5
38	4	2.9
39	1	0.7
Total	138	100.0

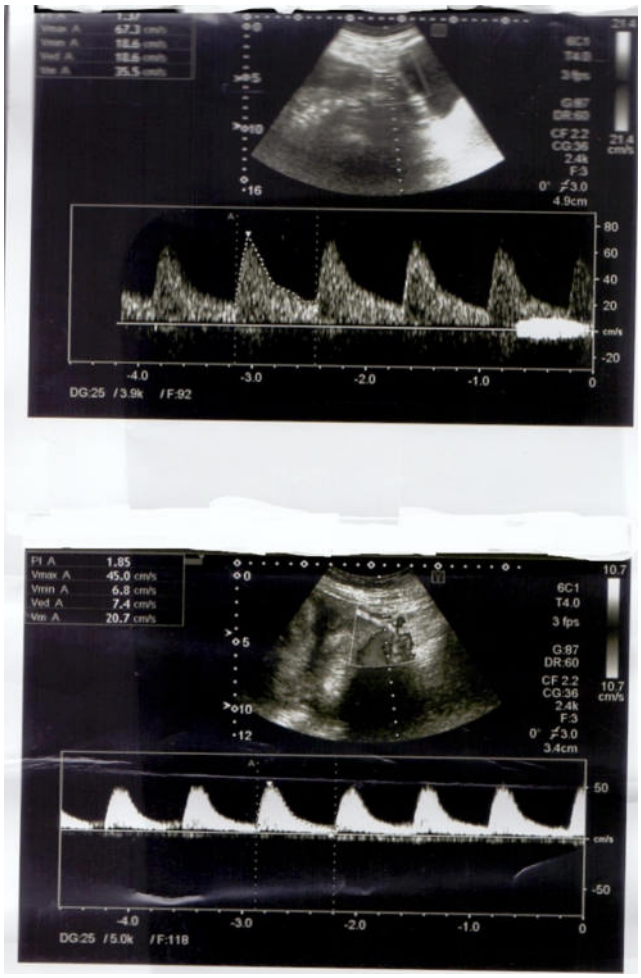

Figure (A) : This is the scan of a hypertensive patient, gestation age 36 weeks. The PI value of right and left uterine artery were 1.37 and 1.85 respectively

Discussion

The data was collected from 138 patients and investigation was carried out in Saira Miraj Hospital, Lahore. This study was aimed to find sonographic association between uterine artery pulsatility index with hypertension during

third trimester of pregnancy. When examined the patient by Doppler ultrasound, it was found that pulsatility index of uterine artery was abnormally high in hypertensive pregnant women. For comparison we also collected data from normal pregnant women in third trimester. A study was conducted by Ashraf Jamal to determine the role of uterine artery pulsatility index at second and third trimester in predicting unfavorable pregnancy outcomes .They concluded that in those patients whose uterine artery PI was increseaed , the risks of adverse pregnancy outcome like pre-eclampsia was also high [14].Another study was done by O. G´ OMEZ and fellows to create reference ranges for the uterine artery (UtA) mean pulsatility index (PI) at 11–41 weeks of pregnancy based upon gestational age. Their study results showed that there is a progressive decline in the mean uterine artery PI from 11-34 weeks and then remains stable until 41 weeks. . They concluded that these reference ranges for mean uterine artery PI may have clinical esteem in screening for placenta associated illnesses within the early stages of pregnancy, and in assessing patients with pregnancy-induced hypertension and/or small-for gestational age fetuses during the third trimester [6]. A cohort study was carried out in a teaching hospital in Recife, Brazil to assessed the uterine artery Doppler velocity in 154 women with severe preeclampsia as a predictor of adverse postpartum outcome in third trimester of pregnancy . In their research they concluded that high-resistance uterine artery Doppler in the third trimester of pregnancy is able to predict adverse postpartum outcome [15]. Seung Mi Lee *et al* precluded whether the uterine artery PI in hypertensive pregnancies is higher than that of typical pregnancies in the puerperium just as in the ante partum period. They made two groups. Group 1 has hypertensive pregnancies and group 2 has normal pregnancies during ante partum, prompt postpartum or late postpartum periods. They found that uterine artery PI was still higher in hypertensive pregnancies than normal pregnancies in puerperal periods [16].

Conclusion

Our study concluded that there was an association between uterine atery pulsatility index and hypertension during pregnancy. The uterine artery pulsatiltiy index has increased with hypertension in third trimester of pregnancy.

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