

Research Article

Uterine Artery Doppler as Predictive Measure for Fetal Growth Restriction in Chronic Hypertensive Patients

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Abstract

Background: Fetal growth restriction (FGR) is when the fetal weight is less than tenth centile for the given gestational age. Chronic hypertension is one of the risk factors of FGR. Growth restricted fetuses are at risk of intrauterine death and many comorbidities later in life. Detection of those fetuses at risk of developing FGR can help in timely intervention and better outcome.

Objective: To evaluate uterine artery Doppler for prediction of FGR in patients with chronic hypertension.

Methods: One hundred and sixty four women having chronic hypertension at 24 weeks of gestation were included in the study. Women with multiple pregnancy and comorbidities other than hypertension were excluded. Doppler USG of uterine arteries was done at 24 weeks of gestation by radiologist and absence or presence of diastolic uterine artery notch was observed. Patients were divided into 2 groups A and B depending upon the presence or absence of notch respectively. These women were followed till they delivered and by taking birth weight as an outcome measure, frequency of fetal growth restriction (FGR) was found in both groups by the researchers themselves.

Results: The mean age of women in group A was 26.76 ± 3.89 and in group B was 26.21 ± 3.57 years. Major portion of women was multipara 58% (96 women). Forty (24.39%) patients developed fetal growth restriction while 124 patients (75.61%) fetuses were of normal weight. Among the patients who had growth retarded foetuses 35.37% patients were in group A and 13.41% were in group B with p-value of 0.001.

Conclusion: Uterine artery doppler diastolic notch at 24 weeks of gestation has significant association with development of FGR in patients with chronic hypertension.

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Introduction

Among systemic diseases encountered in pregnancy, chronic hypertension is found to be one of the prevailing medical disorders.¹ Pregnancies with chronic

hypertension are at risk of various detrimental consequences like fetal growth restriction, pre-eclampsia, preterm delivery, operative delivery and fetomaternal mortality. During pregnancy chronic hypertension is referred to raised blood pressure established before conception or identified before 20 weeks of pregnancy. Approximately 20 to 30 percent of world's population is affected by chronic hypertension and one to five percent of pregnancies are afflicted with chronic hypertension.² A person is said to be hypertensive if systolic



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and/or diastolic blood pressure remains persistently higher than >140 mmHg and >90 mmHg.³

Chronic hypertension leads to reduced flow of blood through placental circulation, reason being the poor remodelling of uterine vasculature in 2nd half of pregnancy which results in growth retardation of the fetus.⁴ Growth restriction puts the fetus at increased risk of morbidity and mortality and delay in neurodevelopmental growth.

In first world countries 2% to 10 % of newborns are growth retarded with a prevalence of 10% in all pregnant population.⁵ However its more common i.e. 30% prevalent in those pregnancies with co-morbidities like chronic hypertension and 3-5% in those without any co-morbidity. Fetal growth retardation can lead to increased fetal morbidity and mortality which make earlier recognition important so that actions can be taken before the fetus is compromised.⁶

Doppler ultrasound has played an important role in this regard as its non-invasive and is not associated with any risks to the fetus.⁷ Basis of doppler ultrasound are the dynamics of circulation of blood which include its velocity, direction of flow, resistance by the vascular wall.⁸ Flow of blood in placental circulation can be accessed through it and any changes in flow can detect the fetuses who are at risk of compromise. In a healthy pregnancy, starting from 8 weeks of gestation the resistance starts decreasing in the uterine artery flow velocity waveform (FVW) on Doppler ultrasound. If the resistance is higher in uterine artery FVW, it is depicted by reduced diastolic flow velocity and a diastolic notch can be depicted.⁹ Notch on uterine artery doppler ultrasound is a normal finding during early pregnancy. In a normal pregnancy i.e. with normal fetoplacental circulation, this notch disappears by 24 weeks and high resistant fetoplacental circulation transforms into a low resistant circulation favouring increased blood flow to fetus. Uterine artery notch persistence has a sensitivity of 84% and 66% and a specificity of 71.4% and 64% and positive predictive value of 20% and 35 % in relation to occurrence of intrauterine growth restriction.^{10,11} By continued surveillance and timely intervention risks can be minimised by recognising fetal growth restriction beforehand.

The objective of current study was to evaluate uterine

artery Doppler for prediction of FGR in patients with chronic hypertension. The rationale of conducting this study was to specifically find those patients with chronic hypertension who are at risk of having growth restricted fetuses. These patients are then offered increased surveillance and timely intervention so that perinatal and neonatal morbidity and mortality are reduced. Those patients with disappearance of notch at 24 weeks require less surveillance as compared to those with persistent notch and this ultimately decreases the workload and is cost effective.

Methods

This prospective observational study was conducted at Department of Obstetrics & Gynecology, Shahida Islam Medical and Dental College (SIMDC), Lodhran from 23rd July 2022 to 22nd January 2023 after taking approval from ethical committee of the hospital (ERC letter no SIMC/H.R./6900/22) and consent from patients. Sampling technique was non probability purposive sampling. All 16-38 years old pregnant females with chronic hypertension, singleton pregnancy, up to para 4 were included in the study. Those patients who were anaemic (Hb $<$ 8.5 g/dL), having fetal structural malformation on ultrasound, chronic infection and systemic diseases other than chronic hypertension were excluded from the study.

Chronic hypertension was defined as, systolic B.P of more than or equal to 140 mmHg and/ or diastolic B.P of more than or equal to 90 mmHg before pregnancy. FGR was defined as, estimated fetal weight less than 10th centile for a given gestational age.

Patients fulfilling the inclusion criteria were booked for 24 weeks doppler scan for persistence or disappearance of uterine artery notch. Those with persistence of notch at 24 weeks were allocated in group A and equal number of patients with disappearance of notch and were allocated in group B.

The calculated sample size was 164 and divided in two equal groups, with 5% level of significance, 95% power of study using the formula. The eligible patients underwent Doppler ultrasound of uterine artery and were divided into two groups depending upon the persistence (group A) or disappearance of diastolic notch (group B).

Data were analysed using SPSS version 14.0. Age in

both groups was presented as mean and standard deviation. Parity and fetal growth restriction in each group were presented as percentage and frequency. Comparison between the groups was analyzed by Chi square test. P value ≤ 0.05 was considered statistically significant.

Results

The age range of women was 16 to 38 years with mean age was 26.84 ± 3.77 years. The mean age of group A was 26.76 ± 3.89 and group B was 26.21 ± 3.57 years. Regarding parity, 58.54% (96) patients were multigravida while remaining were primigravida. Forty (24.39%) patients developed fetal growth restriction while 126 patients (75.61%) fetuses were of normal weight. Among the patients who had growth retarded fetuses 35.37% (29) patients were in group A and 13.41% (11) were in group B (p-value 0.001). These results are shown in (Table-1 and Table-2).

Table 1: Comparison of age and parity in both groups (n=164)

Variable	Group A		Group B		P value
	No.	%	No.	%	
Age (years)					
16-25	38	46.34	43	52.43	0.250
26-38	44	53.65	39	47.56	
Parity					
Para 1	33	40.24	35	42.68	0.320
Multipara	49	59.76	47	57.32	

Table 2: Comparison of fetal growth restriction between both groups (n=164)

IUGR	Group A		Group B		P value
	No.	%	No.	%	
Present	29	35.37	11	13.41	0.001
Absent	53	64.63	71	86.59	

Discussion

Accurate prediction of adverse fetomaternal outcomes in pregnant population is a vital segment of antenatal care. Doppler ultrasound of uterine arteries has gained popularity as a valuable measure to predict unfavourable outcomes in high-risk pregnancies like those affected by chronic hypertension. Our study also supplements uterine artery doppler studies by revealing a remarkable relation between the fetal growth restriction development in those with persistent diastolic notch.

In our study, mean age of population was found to be $26.84 + 3.77$ years and there was no notable difference between both groups. Study done by Tundoer et al also demonstrated almost same mean age i.e. $28.5 + 6.25$ years with no significant difference in both the control group and that with hypertension.¹² These studies also show that hypertension is becoming more common in young age most likely to the lifestyle changes. Contrary to that Adefisan et al's study revealed average age to be 30 years which is slightly higher than our study.¹³ In another study, average age of females was 23 years which is lower than mean age in our study.¹⁴ Large number of women i.e. 58.54% in our study were multigravidas. This finding matched with other studies by Smith et al and Moazzani et al showing that mostly chronic hypertension is found in multigravidas.^{15,16} FGR was noted in 24.39% of the patients. A remarkable difference was observed between both groups. Among Patients in group A which had persistent diastolic notch, 35.37% developed fetal growth restriction as compared to patients in group B with disappearance of diastolic notch, 13.41% patients developed with the p value of 0.001. This significant difference highlights the importance predictive value of uterine artery doppler for development of fetal growth restriction.

The outcomes of our study are comparable with the results of different researchers who focused on doppler studies of uterine artery to predict unfavourable consequences in chronic hypertensive patients. Results of the study done by Kherad et al. (2020) revealed that diastolic notch persistence in uterine artery at twenty four weeks correlates significantly with fetal growth restriction developing later in pregnancy which supported our results.¹⁷ Another study done at Pakistan Institute of Medical Sciences showed that 35.7% of chronic hypertensive patients having persistent uterine artery notch developed FGR as compared to 26.7% chronic hypertensive patients with disappearance of notch.¹⁸ Novac et al showed that 39.28% of the fetuses who developed IUGR had abnormal uterine artery doppler.¹⁹ Our findings were further backed by a meta-analysis done by Frolova et al in 2018 confirming that abnormal indices on uterine artery doppler is a powerful determinant of fetoplacental insufficiency and later development of FGR.²⁰

On the other hand, some studies showed conflicting

evidence relating to predictive value of doppler studies of uterine artery in developing FGR in pregnancies affected by chronic hypertension. Studies carried out by Gonzalez et al and Martin et al revealed that although abnormal uterine artery doppler might be indicative of fetoplacental insufficiency, it is not always typically consistent with fetal growth restriction.^{21,22}

These inconsistencies in different studies might have originated due to variations in populations under study, differences in Doppler modalities and FGR definitions in various researches. In addition to that, fetal growth restriction is caused by multiple factors in addition to impaired placental perfusion such as maternal and environmental factors and genetic make-up. Moreover, regarding doppler studies there are certain debates related to the optimal timings, number of assessments and the steps taken to improve fetomaternal outcome.²³ Although our study emphasises the predictive role of Uterine artery doppler study for development of FGR in patients with chronic hypertension, further research is required to address these conflicting issues so that guidance to clinicians is refined and perinatal outcome can be improved.

There are certain restraints to our study. First of all, interpretation of doppler ultrasound is subjective although it was done by qualified radiologist. Secondly, few patients didn't come for follow up at exact 24 weeks and reported later which decreases the significance of uterine artery doppler ultrasound studies.

Conclusion

Uterine artery doppler diastolic notch at 24 weeks of gestation has significant association with development of FGR in patients with chronic hypertension. Therefore, recommendation drawn from our study is that patients with chronic hypertension in pregnancy should be offered a uterine artery doppler at 24 weeks to screen those at risk of developing growth restriction. Doppler ultrasound of uterine arteries may be included as a routine screening tool in the set ups having doppler facilities and those patients found at risk should be closely followed till delivery.

Ethical Approval: The Ethical Committee of Shahida Islam Medical College, Lodhran approved the study vide No. SIMC/H.R/6900/22.

Conflict of Interest: The authors declare no conflict of interest.

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Authors' Contribution:

SH: Conception & design, analysis & interpretation of data, drafting of article, critical revision for important intellectual content, final approval

AB: Conception & design, critical revision for important intellectual content, final approval

FU: Conception & design, drafting of article, final approval

WA: Analysis & interpretation of data, drafting of article,

JS: Critical revision for important intellectual content, final approval

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