

Frequency of Persistent Pre-diastolic Notch on Uterine Artery Doppler in Diagnosed Cases of Pre-Eclampsia

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Abstract

Objective: To determine the frequency of persistent pre-diastolic notch on uterine artery Doppler in diagnosed cases of pre-eclampsia.

Method: Descriptive Cross Sectional study, carried out in the Radiology Department Lahore General Hospital, Lahore. Study duration was 6 months, 01-01-2022 to 30-06-2022 A total of 160 cases that fulfilled inclusion/exclusion criteria were enrolled Doppler ultrasound was performed. Patients who had still prediastolic notch at 24 weeks, then persistent prediastolic notch was labeled. All the information was recorded on a predesigned proforma. Data was entered and analyzed by using SPSS version 20.

Results: The mean age of patients was 30.07±6.94years. The mean gestational age was 29.61±3.87weeks. There were 37 (23.1%) females with parity 0, 50 (31.3%) had parity 1, 30 (18.8%) had parity 2, 23 (14.4%) had parity 3 and 20 (12.5%) had parity 4. The mean BMI was 26.65±4.58kg/m². There were 57 (35.6%) females who had persistent pre-diastolic notch on uterine artery Doppler ultrasound while 103 (64.4%) did not show persistent pre-diastolic notch.

Conclusion: Incidence of persistent pre-diastolic notch is high in pregnant females diagnosed with preeclampsia.

Keywords: Persistent pre-diastolic notch, uterine artery Doppler, preeclampsia

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Introduction

Hypertensive disorders account for the three common causes of perinatal as well as maternal mortality and morbidity in both under-developed and developed countries.¹ Pre-eclampsia (PE) which is defined as a combination of maternal hypertension and proteinuria at 20 weeks of gestation, complicates about 3–8% pregnancies in the western world.^{1,2} Majority of these complications include 13-26% of small-for-gestational age newborns and 16-21% of preterm births leading to perinatal deaths and long-term morbidity in neonates.³

Depending on ethnic group, the incidence of PE in healthy nulliparous women ranges from 3% to 7% and in multiparas from 1% to 3% globally.⁴ In Pakistan this incidence is 1.2%. According to an estimate of World Health Organization (WHO) 12% or maternal mortality is attributed to PE in Asia.⁵

In an uneventful pregnancy the resistance of the uterine artery (UA) flow reduces reciprocally with progressing gestational age.⁶ If a low resistance-circulation is not achieved, risk of adverse pregnancy outcome increases, one of them being PE, which is a multi-system disorder.^{7,8} Utero-placental perfusion can be determined by performing Doppler studies of bilateral uterine arteries and studying their waveform and flow velocities.⁹

Pre diastolic notch appears in the first trimester of pregnancy and represent normal high resistance flow in placental vessel during early pregnancy; it usually disappears after 22 weeks of pregnancy. The presence of

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this notch late in pregnancy indicates increased uterine vascular resistance and hence, impaired uterine circulation. This indicated that the pregnancy is complicated by maternal PE.¹⁰ Previous studies have demonstrated an improvement in the screening of adverse pregnancy outcomes utilizing UA Doppler alone in the first and second trimester of pregnancy with different sensitivity and specificity.¹¹

The presence of notch in bilateral uterine arteries in second trimester has sensitivity and specificity of 36.1 and 97% respectively, while these measures were 57.5 and 98.2% in third trimester for the prediction of PE.¹⁰⁻¹²

The rationale of this study was to find out the frequency of persistent pre-diastolic notch in the uterine arteries utilizing Doppler study and pulse waveforms in diagnosed cases of PE in our population, as these tools are readily available in virtually all the obstetric set ups locally. Unfortunately the timely utilization of these tools for early detection of PE and consequent clinical intervention to reduce its complications remains low in our region.

Material and Methods

This was a descriptive cross sectional observational study and it was conducted in Radiology Out Patient Department (OPD) of Lahore General Hospital from 1st January till 30th June, 2022, after letter of approval from the ethical board. The sample size was $n=160$ calculated by the formula $n=z^2pq/d^2$ where $z=1.96$, $p=88.2\%$ and $d=5$. Patients referred from Obstetrics OPD of the same hospital, fulfilling the inclusion criteria; parity <5 , gestational age of 20 weeks (assessed on ultrasound), clinically diagnosed to have pre-eclampsia (BP $\geq 140/90$ mmHg at least on two determinations 1-7 days apart and $\geq 2+$ protein on at least one dipstick measurement in urinalysis) with presence of pre-diastolic notch on uterine artery Doppler done at 20 weeks of gestational age (assessed on ultrasound) were enrolled in our study after getting written informed consent. The patients were also booked for a follow up Doppler ultrasound on 24th week of gestation in the same visit.

Females who were known cases of chronic hypertension (BP $\geq 140/90$ mmHg) before conception, gestational or chronic diabetes (BSR >186 mg/dl), females with twin pregnancy (on ultrasound), females suffering from anemia (Hb <10 g/dl) or renal impairment (creatinine

>1.2 mg/dl) and liver diseases (ALT >40 IU, AST >40 IU) were excluded from the study. Demographic details (name, age, parity, Body Mass Index, gestational age at presentation) were recorded. Then UA Doppler ultrasound was performed using GE Logic S8 ultrasound machine having a 2.3–4 MHz trans-abdominal transducer. All scans were done by at least three qualified radiologists having at least 4 years of experience in ultrasound and Doppler. The right and left uterine arteries were identified in patients at 20 weeks of gestation using grey scale and colour Doppler in an oblique plane of the pelvis with the patient lying in supine position. The Doppler signals were sampled at the level where the uterine arteries cross over the external iliac arteries. At least three consecutive waveforms were obtained to identify the pre-diastolic notch in uterine artery evident as a trough-like notch in between the systolic and diastolic phases. The patients who had the notch in bilateral uterine arteries were assessed again at 24th week of gestation using the same technique and parameters. Redemonstration of the pre-diastolic notch in bilateral uterine arteries at 24 weeks of gestation was labeled as persistent pre-diastolic notch. All this information was recorded on a predesigned preforma.

Data was entered and analyzed by using SPSS version 20. Quantitative data including maternal age, gestational age, height, weight and BMI was presented by mean and standard deviation (SD). Qualitative data like parity and persistent pre-diastolic notch was presented as frequency and percentages. After this chi-square test was applied to check the significance of the results with p -value ≤ 0.05 .

Results

During the study 160 patients with singleton pregnancy and clinical diagnosis of PE underwent ultrasound at 20 weeks and again at 24 weeks of gestation.

The mean age of patients was 30.07 ± 6.94 years and the mean gestational age was 29.61 ± 3.87 weeks. There were 37 (23.1%) females with parity 0, 50 (31.3%) had parity 1, 30 (18.8%) had parity 2, 23 (14.4%) had parity 3 and 20 (12.5%) had parity 4. The mean BMI was 26.65 ± 4.58 kg/m².

There were 57 (35.6%) females who had persistent pre-diastolic notch on UA Doppler ultrasound while 103 (64.4%) did not show persistent pre-diastolic notch. Figure 1, 2

Data was stratified for age of patients. In patients aged

18-30years, persistent pre-diastolic notch was present in 45 (54.2%) patients. In patients aged 31-42years, persistent pre-diastolic notch was present in 12 (15.6%) patients. The difference was in significant range ($p < 0.05$). Table 1

Data was stratified for gestational age of patients. In patients presented at gestational aged 24-30weeks, persistent pre-diastolic notch was present in 30 (31.9%) patients. In patients presented at gestational aged 24-30 weeks, persistent pre-diastolic notch was present in 27 (40.9%) patients. The difference was insignificant ($p > 0.05$). Table 2

Data was stratified for parity of patients. In nulliparous patients, persistent pre-diastolic notch was present in 23(62.2%) patients. In primiparous patients, persistent pre-diastolic notch was present in 20 (40.0%) patients. In multiparous patients, persistent pre-diastolic notch was present in 14 (19.2%) patients. The difference was significant ($p < 0.05$).

Data was stratified for BMI of patients. In normal weight patients, persistent pre-diastolic notch was present in 20(29.9%) patients. In overweight patients, persistent pre-diastolic notch was present in 21(42.9%) patients. In obese patients, persistent pre-diastolic notch was present in 16 (36.4%) patients. The difference was significant ($p < 0.05$).

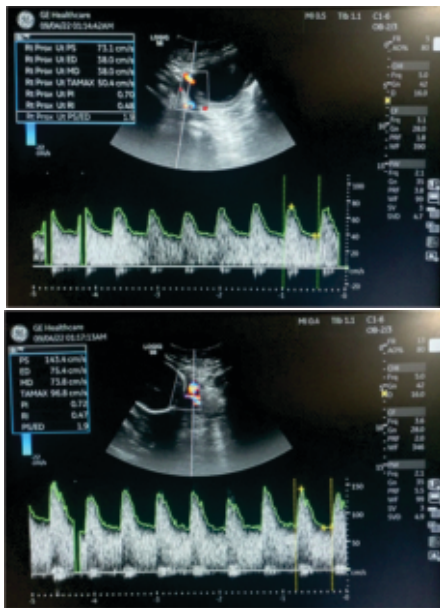


Figure 1 Right and Left uterine artery Doppler and pulse waveform of a diagnosed patient of preeclampsia at 25 weeks of gestation with absent pre-diastolic notch.

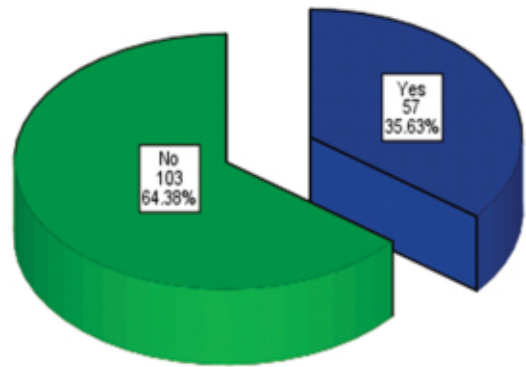


Figure 2 Distribution of persistent pre-diastolic notch

Discussion

In our study, there were 57 (35.6%) females who had persistent pre-diastolic notch on uterine artery Doppler ultrasound. One international study showed that the frequency of persistent pre-diastolic notch on uterine artery Doppler was 22.6% in females with preeclampsia.¹³ Another study showed that the frequency of persistent pre-diastolic notch on uterine artery Doppler was 36% in females with preeclampsia.¹⁴ This high frequency of abnormal UA Doppler studies was also reflected by another Pakistani study done by Tabassum S., et al however in their study obesity was reported in 18.8% of the patients while in our study it was 35.6%.¹⁵ The

Table 1: Comparison of persistent pre-diastolic notch in age strata

		Age (years)		Total
		18-30	31-42	
Persistent pre-diastolic notch	Yes	45 (54.2%)	12 (15.6%)	57 (35.6%)
	No	38 (45.8%)	65 (84.4%)	103 (64.4%)
Total		83 (100%)	77 (100%)	160 (100%)

Chi-Square Test = 25.994: p -value = 0.000 (Significant)

Table 2: Comparison of persistent pre-diastolic notch in gestational age strata

		Gestational Age (weeks)		Total
		24-30	31-36	
Persistent pre-diastolic notch	Yes	30 (31.9%)	27 (40.9%)	57 (35.6%)
	No	64 (68.1%)	39 (59.1%)	103 (64.4%)
Total		94 (100%)	66 (100%)	160 (100%)

Chi-Square Test = 1.368: p -value = 0.242 (Insignificant)

difference can be attributed to a increased incidence of obesity in general population in Punjab compared to Sindh, where their study was conducted.¹⁶

A recent local study done by Shahid N., et al, showed the mean maternal age to be 27.65 and mean gestational age of 23.88 which is in correspondence to our study.¹⁷

The presence of pre-diastolic notch in the second trimester has been linked to a high probability of developing pre-eclampsia.¹⁸ In a study conducted by El-Hamedi A., et al, the disease was predicted in almost 75% of the most severe cases who had developed pre-eclampsia before eighth month of gestation. This suggests that the clinical value of UA doppler is favorable in predicting severe forms of adverse outcomes in patients at a higher risk for pre-eclampsia.^{19,20}

Conclusion

Thus the incidence of persistent pre-diastolic notch in UA Doppler is high is diagnosed case of PE . We will recommend the gynecologists to utilize UA Doppler studies as a non-invasive, quick and affordable screening tool for early detection of PE so that timely clinical interventions can be made to prevent its grave complications.

Conflict of Interest

None

Funding Source

None

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Authors Contribution

RN: Conceptualization of Project

SS: Data Collection

AZS: Literature Search

SS: Statistical Analysis

AY: Drafting, Revision

AY: Writing of Manuscript