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Research Article

Echocardiogram in Hypertensive Disorder and its Outcome

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Received: April 19, 2022; **Published:** May 26, 2022

Abstract

Background: In Hypertensive disorders in pregnancy there is increased vascular resistance which leads to hypoperfusion. 1 in 4 women with Pre-eclampsia is at risk of developing chronic hypertension in future. Usually these patients are associated with asymptomatic LV dysfunction. Routine ECHO in asymptomatic patient will help to identify the risk factors and early intervention will improve prognosis.

Objectives: To evaluate the LV dysfunction by ECHO in hypertensive pregnant women.

Methods: This is prospective study of 300 cases of hypertensive disorders of pregnancy conducted at the Department of OBG, ESIC MC PGIMSR Bengaluru from January 2021 to June 2021. Echocardiographic parameters were compared amongst cases of hypertension and their impact on feto-maternal outcome was studied.

Results: In this study conducted amongst 300 hypertensive pregnant women with different forms of hypertensive disorders, 56 (18.6%) had chronic hypertension, 104 (34.6%) had gestational hypertension, whereas 128 (42.6%) had pre-eclampsia. Abnormal echocardiographic findings was found in 104 (34.6%) cases. Amongst them 13% had Grade I diastolic dysfunction while 5% had Grade II diastolic dysfunction, 14% women had Concentric left ventricular hypertrophy. Diastolic dysfunction was more common in Preeclamptic women. 9.3% women had LV ejection fraction less than 60%. 55% of the babies weighed < 2.5 kg, 25% of the babies required NICU admission.

Conclusion: Understanding the structure and function of the heart in hypertensive women is important in terms of timely diagnosis, better management and good prognosis. Echocardiography is a valuable safe, non invasive tool to stratify risk and can guide management.

Keywords: *Echocardiography; Diastolic Dysfunction; Ejection Fraction; Hypertension*

Introduction

Pregnancy is associated with hemodynamic and hormonal changes that can affect the heart. From the first trimester, there is an increase in cardiac output that places a volume load on the heart. Hormonal changes include increased circulating estrogen and relaxin, which may directly or indirectly affect the heart. During pregnancy, the heart undergoes remodeling with increases in chamber dimensions, left ventricular (LV) wall thickness, and mass that is consistent with a process of eccentric hypertrophy [6].

Hypertension is the most common medical disorder encountered during pregnancy, complicates 5 - 10% of all pregnancies worldwide, contributes greatly to the maternal and perinatal morbidity and mortality [8]. Preeclampsia syndrome affects approximately 4 - 5% of all pregnancies Preeclampsia is associated with significant Cardiovascular morbidity during pregnancy and later in life [1]. Left Ventricular dysfunction, both systolic and diastolic is known to occur in hypertensive disorder. Diastolic dysfunction usually precedes the compromise of systolic function in hypertension and can lead to heart failure or pulmonary oedema.

Structurally, the expanding plasma volume seen during normal pregnancy is reflected by enlarging cardiac end-systolic and end diastolic dimensions. However, septal thickness or ejection fraction does not change. This is because the dimensional changes are accompanied by substantive ventricular remodeling, which is characterized by left-ventricular mass expansion of 30 to 35 percent near term.

Since the appearance of these changes occur prior to the clinical modifications, the main reason of this research is to detect these changes beforehand and to approach for a therapeutic management.

Echocardiography (ECHO) - is a safe, powerful, non-invasive and painless technique [8]. Improved understanding of the myocardial mechanics associated with preeclampsia would be clinically useful as a guide to choosing the most effective and physiologically appropriate therapeutic option.

Aims and objectives

1. To assess maternal cardiovascular function using echocardiography in women with hypertensive disorder of pregnancy.
2. To know the maternal and perinatal outcome.

Methodology

- It is an observational study conducted in Department of Obstetrics and Gynaecology at ESIC-MC- PGIMSR, Rajajinagar, Bengaluru from January 2021 to June 2021. All pregnant women fullfilling the inclusion criteria and admitted in our ANC ward during the study period are included in the study.

Inclusion criteria

1. Pregnant women of age 20-35 yrs
2. Singleton pregnancy
3. With hypertensive disorder of pregnancy.

Exclusion criteria

1. Multiple gestation
2. Severe anemia
3. Preexisting Heart disease
4. Other associated medical illness (Thyroid disorder, epilepsy).

Method of data collection

Study will be conducted in department of OBG ESIC MC PGIMSR, Bengaluru, jointly with help from Cardiologist for 2D ECHO assessment of study groups. Women who fulfill the inclusion criteria have been enrolled for the study. Informed and written consent will be obtained. Two-dimensional Echocardiography will be performed by the cardiologist in ESIC MC PGIMSR, Bengaluru at 32 to 34 weeks and patients are followed up till delivery and Maternal and perinatal outcomes are studied.

Procedure of study

After taking informed consent, the pregnant women with preeclampsia routine ECHO is done at 32 to 34 weeks and are followed up till delivery. Details and relevant data were recorded through a structured proforma. Gestational age was determined by last menstrual period, clinical examination and obstetric ultrasound.

In all patients clinical examination was performed and relevant laboratory investigations were done.

Investigations included

2D Echocardiography

ECG.

Routine investigations – Blood Grouping And Rh Typin, Complete Hemogram, serology, Urine routine and microscopy with urine albumin, Renal function tests Liver function test, Thyroid profile, fasting and 2hr post prandial sugar, 24 hr Urine protein.

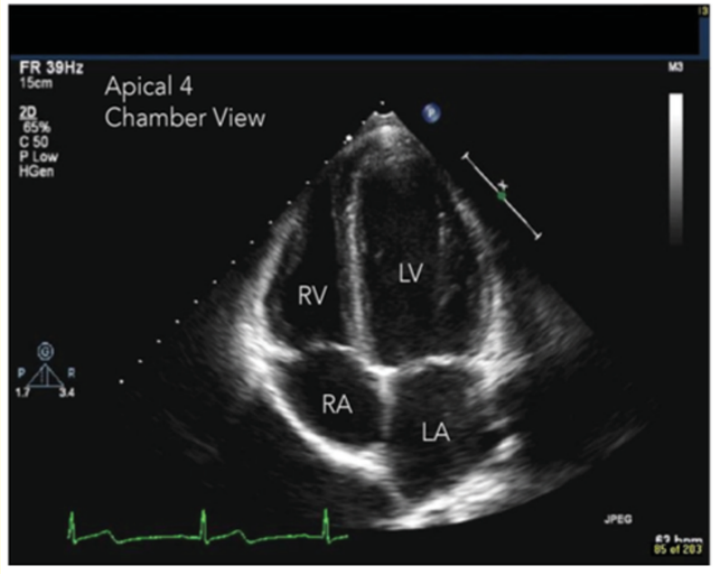

Figure 1: *Apical four chambered view of adult heart.*

2D ECHO parameters studied are

Left ventricle internal diameter – end diastole and end systole (LVIDd, LVIDs)

Left atrial mas

IVSD

E/A ratio across mitral valve

Left ventricular ejection fraction (LVEF).

Based on the above parameters, structural and functional (both systolic and diastolic) cardiac abnormalities identified in the study groups.

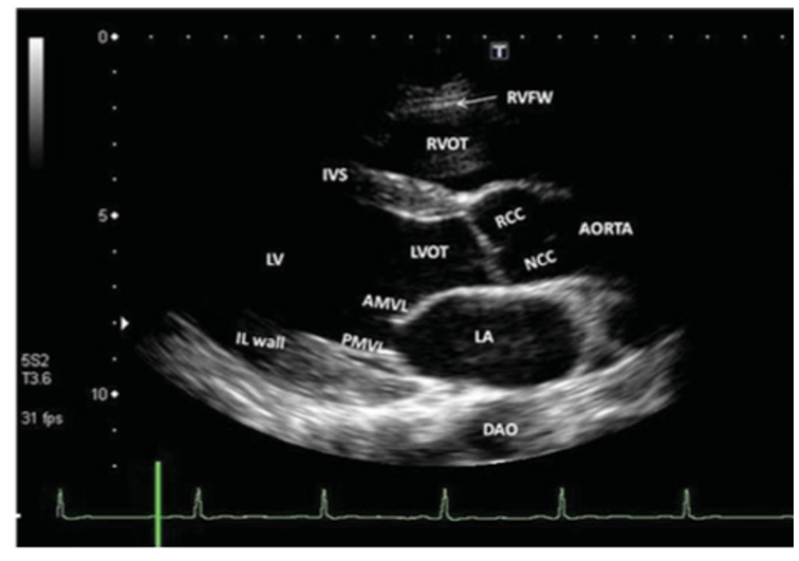

Figure 2: *Left parasternal window long axis view.*

Statistical analysis

Descriptive data are shown as means and standard deviations. ANOVA for repeated measures was used to compare data between sequential studies in the normotensive pregnant group. Independent *t*-tests for continuous data and Chi square-tests for categorical data were used for comparisons between normotensive pregnant, control, and preeclamptic groups (SPSS 8.0; Chicago, IL). A two-tailed *P* value of < 0.05 is described as significant.

Results and Observations

A total of 300 women were included in the study.

Majority of the women (73.4%) were aged between 20 - 25 years,

Age group (years)	Frequency	Percentage
20-25	221	73.66
26-30	69	23
>30	10	3.3

Table 1: *Distribution of Age group among study subjects.*

In our study majority of subjects (66%) were primigravida.

Parity	Frequency	Percentage
Primi	198	66
Multi	102	34

Table 2: *Distribution of parity among study subjects.*

Gestational Age (weeks)	Frequency	Percentage
<32	40	13.33
32-36	64	21.33
>37	196	65.33

Table 3: *Distribution study subjects based on Gestational Age.*

In our study majority (65.3%) of subjects belonged to the gestational age > 37wks.

Entity	Frequency	Percentage
Gestational hypertension	104	34.66
Preeclampsia	128	42.66
Superiposed preeclampsia	12	4
Chronic hypertension	56	18.66
Eclampsia	0	0

Table 4: *Distribution study subjects based on severity of PIH.*

	Frequency	Percentage
LSCS	113	37.66
Normal	187	62.33

Table 5: *Distribution of Mode of Delivery among study subjects.*

Indication	Frequency	Percentage
Fetal distress	35	30.9
Failed induction	28	24.7
Malpresentation	20	17.7
Previous LSCS	15	13.6
Cephalopelvic Disproportion	10	8.85
Severe Preeclampsia with Poor Bishop's	3	2.65
Grade II diastolic dysfunction	2	1.76

Table 6: *Indication for Caesarean delivery.*

	Frequency	Percentage
Normal study	196	65.33
Abnormal	104	34.66

Table 7: *Comparison of 2D ECHO findings in study groups.*

	Frequency	Percentage
Normal study	196	65.33
Grade I Diastolic dysfunction	40	13.33
Grade II Diastolic dysfunction	15	5
Concentric left ventricular Hypertrophy	44	14.66
Peripartum cardiomyopathy	1	0.33
Other structural/ Functional abnormality	4	1.33

Table 8: *Distribution based on ECHO impression among study groups.*

	GHTN	Preeclampsia
Grade I Diastolic dysfunction	14	26
Grade II Diastolic dysfunction	4	11

Table 9: *Distribution of diastolic dysfunction.*

2D ECHO parameters	Mean ± SD	P value
LVIDd	4.38 ± 0.34	<0.0001
LVIDs	2.53 ± 0.30	0.1665
IVSD	0.89 ± 0.26	0.0154
LPWD	0.90 ± 0.28	0.004
LA	2.94 ± 0.18	0.0002
LVEF	59.85% ± 3.98%	1.4861
E/A ratio	0.96 ± 0.30	0.0418

Table 10: *Comparison of ECHO Parameters between study groups.*

In our study, the various systolic and diastolic ECHO parameters were studied among the study participants, of which, LVIDd, IVSD, LPWDs, LA dimension, E/A ratio and E/E' ratio shows statistically significant changes in preeclamptic women (Table 11 to 13).

LVEF	Frequency	Percentage
<40%	2	0.66
41-50%	8	2.66
51-60%	18	6
>60%	272	90.66

Table 11: *Distribution based on left ventricular ejection fraction (LVEF) among study subjects.*

Birth weight	Frequency	Percentage
<2.5kg	166	55.33
>2.5 kg	134	44.66

Table 12: *Birth weight among the babies of study subjects.*

NICU admission	Frequency	Percentage
Yes	74	24.66
No	226	75.33

Table 13: *NICU admission among the study subjects.*

Discussion

Echocardiography is a non invasive and safe technique. 2-D ECHO gives a snapshot in time of a cross-section of tissue, they can show 'real-time imaging' of the heart chambers, valves and blood vessels.

Hypertensive disorders in pregnancy are associated with high maternal mortality and morbidity In our study, majority of the pregnant women belonged to the age group of 20 - 25 years (73.4%). The mean age in our study group is 23.54 ± 2.82 years. In the study by Nuzhat Zaman., *et al* [7], the mean age is 27.4 ± 3.8, and the mean age in Preeclamptic group is 30.5 ± 5.7yrs in the study by Melchiorre., *et al* [1], In our study majority of subjects were primigravida 66%, Similarly in a study done by Melchiorre., *et al* [1] and Shahul., *et al* [4], 61.4% and 81.81% of the women were primigravida respectively. This is substantiated as - Young and nulliparous women are particularly vulnerable to developing preeclampsia, as they are exposed to chorionic villi for the first time.

In our study, majority of subjects belonged to the gestational age 37 wks in 65.3%. Comparable to the study done by Simmons., *et al* [6] and Melchiorre., *et al* [1], the mean gestational age is 37 ± 4 and 35.6 ± 3.8 respectively.

In our study, 128/300 (42.66%) had preeclampsia, 104/300 (34.66%) had gestational hypertension, 56 (18.66%) had chronic hypertension and 12 (4%) had superimposed preeclmpasia. Similarly in a study done by Parikh PM., *et al* [8-15], 75 (50%) had gestational hypertension, 63 (42%) had pre-eclampsia and 12 (8%) had chronic hypertension.

Mode of delivery

In our study, Vaginal delivery rate is higher in our study 62.33%mainly because of good cervical Bishop's score while 37.6% women underwent Caesarean section especially for emergency obstetric indications. The most common indication for LSCS is Fetal distress in 31% of cases, while only 2 case had to be done fore severe preeclampsia with Grade II diastolic dysfunction with hemodynamic instability. In contrast, the study by Sajid Shahul., *et al* [4], in preeclamptic group 18.2% delivered vaginally and 81.8% underwent caesarean section.

ECHO abnormalities

In our study, increased incidence of variations in structural and functional parameters of 2D Echocardiography noted among pre-eclamptic women of about 34.66%. Comparable to our study, a study by Tanuja Muthyala., *et al* [2], 20.8% preeclamptic cases showed variation in ECHO parameters In the study by Solanki., *et al* [5], Left ventricular diastolic mass, ARD, TVR, E wave velocity, peak A wave velocity, IVRT, E wave deceleration time and A VTI were higher in preeclampsia group.

The study by Simmons [6] concluded that LV hypertrophy in normotensive and preeclamptic pregnancy matches changes in cardiac work, but LV contractility is preserved. In preeclamptic women, the peak mitral E wave velocity was greater than in normotensive women during the third trimester, which suggests higher atrial pressures in these women.

Valensise H [3] in their study inferred that Increased incidence of diastolic dysfunction in early onset PE in comparison with late onset PE in which diastolic function is conserved.

Early PE group showed features of concentric remodelling of left ventricle whereas Late PE group showed features of concentric hypertrophy of left ventricle.

Ejection fractio

In our study, about 90% to the study participants had normal ejection fraction of > 60%, while 6% women had Ejection fraction 51 - 60%, 2 women had EF < 40%.

In the study by Sajid Shahul., *et al* [4]**,** the median ejection fraction of Preeclamptic patients was 67.5 (64.2 - 70.0).

Diastolic dysfunction

In our study**,** in patients with Gestational hypertension, 18 (32.7%) patients had diastolic dysfunction, of which majority 14 (35%) patients had grade I and only 4 (26.7%) had grade II diastolic dysfunction. In preeclampsia group, 37 (67.3%) patients had diastolic dysfunction, of which 26 (65%) patients had grade I and 11 (73.3%) had grade II diastolic dysfunction. Pre eclampsia is usually asssociated with dysregulation of Renin Angiotensin Aldosterone system which leads to thickening of left ventricular wall. Remodelling and hypertrophy of left ventricular wall is the most common feature.

Tanuja Muthyala., *et al* [2]**,** study showed, in severe preeclampsia group, 23 (38.9%) patients had diastolic dysfunction, of which 8 patients had grade I and 15 had grade II diastolic dysfunction.

Birth weight- in our study about 55.3% women delivered low birth weight babies (< 2.5 kg) In the study by Solanki., *et al* [5], women with preeclampsia delivered smaller babies (2410 ± 426.16 g)

Conclusion

ECHO is an important non invasive technique to know the cardiac structure and function. Pre eclampsia is associated with LV dysfunction. Routine ECHO in hypertensive pregnant women helps in early diagnosis and intervention to prevent mortality and morbidity.

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Volume 11 Issue 6 June 2022