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## Original Article

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# Echocardiography Changes in Hypertensive Disorder of Pregnancy

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### Abstract:

**Background:** Acute preeclampsia is associated with significantly higher prevalence of asymptomatic global left ventricular (LV) abnormal function and myocardial injury than uneventful pregnancy.

**Objective:** To evaluate the LV changes in pre-eclamptic women and to compare with normotensive women.

**Methods:** This study was conducted in the Department of Obstetrics and Gynecology, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. Two hundred women were in each group: 200 patients with preeclampsia as cases and 200 normotensive patients as controls.

**Results:** The mean LV end-systolic volume (LV ESV) in pre-eclamptic women was  $33.45 \pm 2.8$ , LV end-diastolic volume (LV EDV) was  $106 \pm 3.01$ , and LV systolic mass (LV Ms) was  $87.1 \pm 1.65$  when compared to normotensive women LV ESV  $27 \pm 0.74$ , ( $P < 0.0001$ ) LV EDV  $106.2 \pm 0.43$ , ( $P = 0.3528$ ), and LV Ms  $84 \pm 0.56$  ( $P < 0.0001$ ).

**Conclusion:** This study emphasizes the importance of identifying this subset of preeclamptic patients with echo changes who are at higher risk of developing cardiovascular complications later in life by undergoing echocardiography.

**Key Words:** Echocardiography, echocardiography, pregnancy

### Introduction:

Preeclampsia is an acute increase in blood pressure during pregnancy, which is short, lived. More than 50% of the women with elevated blood pressure during pregnancy return to normal by 6 weeks. Nearly everyone in four mothers with preeclampsia/eclampsia is at

Risk of persistent hypertension after the puerperium [1]

Acute preeclampsia is associated with significantly higher prevalence of asymptomatic global left ventricular (LV) abnormal function/geometry and myocardial injury than uneventful pregnancy. [2] Cross sectional studies of women with preeclampsia have revealed diverse hemodynamic findings such as elevated cardiac output (CO), high vascular resistance, and reduced CO and myocardial contractility. [3]

Impairment of LV diastolic function as well as systolic function appear very early in the course of heart disease [4] Detection of any abnormality in the LV diastolic function and its treatment at an asymptomatic phase can help in improving the prognosis. There are not many studies on myocardial function in preeclamptic women. Hence, this study was undertaken to evaluate the LV changes in preeclamptic women and to compare with normotensive women

### Material and Methods:

This study was conducted in the Department of Obstetrics and Gynecology, Chalmeda Anand Rao Institute of Medical Sciences, Telangana. A case-control type of study was done which included 200 women in each group 200 patients with preeclampsia as cases and 200 normotensive patients as controls. Preeclampsia is defined as new onset hypertension of 140/90 mmHg or more and 24 h proteinuria of 0.3 g or more, occurring after 20 weeks of gestation. [5, 6] Blood pressure was checked with a mercury sphygmomanometers using an appropriate size cuff with the woman lying in semi reclining or sitting position with arm at the level of the heart and phase V Korotkoff sound (sound disappearance) to measure diastolic blood pressure. Echocardiography was performed, and data regarding LV function were recorded with patients in left lateral position.

The criteria for exclusion were gestational age < 20 weeks of gestation, pre existing medical disorders such as hypertension, diabetes mellitus, heart disease, and renal disease, and connective tissue disorders. A  $P < 0.05$  was considered statistically significant.

**Results:**

**Table 1: Distribution of patients according to age, gestational age and BMI**

Parameter		Pre-eclampsia	Percent age	Normotensive	Percent age
Age (years)	< 20	20	10	16	8
	21-30	125	62.5	116	58
	31-40	55	27.5	68	34
Gestational age (weeks)	≤ 20	32	16	28	14
	21-30	102	51	100	50
	31-40	66	33	72	36
BMI	≤ 18.5	0	0	4	2
	18.5-24.9	60	30	168	84
	25-29.9	108	54	28	14
	≥ 30	32	16	0	0

A majority of the patients in both hypertensive and normotensive patients were in the age group 21–30 years. Body mass index was normal in 60 women (30%) of pre-eclamptic women and in 168 women (84%) of normotensives while 108 women (54%), 32 (16%) of pre-eclamptic women were overweight and obese, respectively, in comparison to the normotensives in which only 28 women (14%) were overweight and none were obese.

**Table 2: Systolic echo-cardiography**

Parameter	Pre-eclampsia	Normotensive	P value
	Mean±SD	Mean±SD	
IVRT	98±9.99	84.6±0.59	< 0.0001
Edec	162±18.99	128.2±5.1	< 0.0001
E	0.98±0.14	0.66±0.09	< 0.0001
A	0.70±0.12	0.56±0.03	< 0.0001
E/A	1.4±0.24	1.2±0.24	< 0.0001

Out of the 200 women with preeclampsia, the mean systolic pressure was 161.4±10.4 mmHg and mean diastolic blood pressure was 110.3±7.6 mmHg and among the 200 normotensive women the mean systolic pressure was 105±8.2 mmHg and mean diastolic blood pressure was 73.5±7.1 mmHg. CO in the pre-eclamptic group was

64.2±3.4 ml/min as compared to 56.99±0.78 ml/min in normotensive group

This observation was statistically significant at P < 0.0001. The mean LV end systolic volume (LV ESV) in pre-eclamptic women was 33.45±2.8, LV end-diastolic volume (LV EDV) was 106±3.01, and LV systolic mass (LV Ms) was 87.1±1.65 when compared to normotensive women LV ESV 27±0.74, (P < 0.0001) LVEDV 106.2±0.43, (P = 0.3528), and LV Ms 84±0.56 (P < 0.0001).

**Table 3: Diastolic echo-cardiography**

Parameter	Pre-eclampsia	Normotensive	P value
	Mean±SD	Mean±SD	
CO	64±3.4	56.99±0.78	< 0.0001
LV ESV	33.45±2.8	27±0.74	< 0.0001
LV EDV	106±3.01	106.2±0.43	< 0.0001
LV MS	87.1±1.65	87.1±1.65	< 0.0001
LV MD	125±6.5	109.2±4.98	< 0.0001

SD = Standard deviation, LV EDV = Left ventricular end diastolic volume, LV ESV = Left ventricular end systolic volume, LV MS = Left ventricular systolic mass, CO = Cardiac output, LV MD = Left ventricular diastolic mass

Table 3 shows comparison of diastolic parameters between normotensive and pre-eclamptic subjects. Mean isovolumetric relaxation time (IVRT) in pre-eclamptic women was 98±9.99, E wave deceleration time mean was 162±18.99, mean peak E wave velocity as 0.98±0.14, A wave 0.70±0.12, ratio of E/A 1.4±0.24 while that of normotensives IVRT 84.6±0.59, E wave deceleration time mean 128.2±5.1, mean peak E wave velocity as 0.66±0.09, A wave 0.56±0.03, ratio of E/A 1.20±0.24.

**Discussion:**

Preeclampsia is a disease unique to pregnancy that contributes substantially to maternal and fetal morbidity and mortality, and the condition has been thought to be one of hypo-perfusion in which increased vascular resistance characterizes the associated hypertension.<sup>[7]</sup> Arterial hypertension produces evident structural changes in the left ventricle usually accompanied by functional alterations and in the great majority of cases, these alterations precede the appearance of clinical manifestations.<sup>[8]</sup>

In this study, we have evaluated the role of echocardiography in preeclampsia and found that there were marked LV changes in these patients. In normal pregnancy, an increased preload and a decreased after load favor an improved emptying of the left ventricle during systole and a reduction of the end systolic pressure.<sup>[9]</sup> In pre-eclamptic women, the elevated after load is linked with a reduced emptying of the left ventricle and elevated end-systolic pressure. In our study, we found that the mean LV ESV in normotensive women was 27 ± 0.74 while in preeclamptic women 33.45 ± 2.8 (P < 0.0001).

The prolonged IVRT in hypertensive patients in comparison to normotensives (98±9.99, 84.6±0.59) was significant (P < 0.0001) as LV pressure takes greater time to fall below the atrial pressure compared with normotensive patients as also shown in study by Valensiseet al. in which IVRT in

normotensives was  $71.1 \pm 5.0$  ms(at  $33 \pm 1$  weeks),  $P < 0.001$ .<sup>[10]</sup>

The mean E-wave deceleration time in preeclamptic subjects was  $162 \pm 18.99$  compared to  $128.2 \pm 5.1$  in normotensive women which indicates that passive filling of left ventricle is increased during early diastole. The mean E wave velocity in preeclamptic subjects was  $0.98 \pm 0.14$  compared to normotensive women in whom it was  $0.66 \pm 0.09$  ( $P < 0.0001$ ), which indicates that the pressure gradient across the mitral valve during early passive filling was higher.

This was comparable to the study by Solanki and Maitra in which the preeclamptic patients had E wave velocity was  $1.023 \pm 0.1926$  in comparison to the normotensives  $0.675 \pm 0.137$ .<sup>[3]</sup> The mean peak A wave velocity in preeclamptic patients was  $0.70 \pm 0.12$  in comparison to the normotensives ( $0.56 \pm 0.03$ ,  $P < 0.0001$ ) which reveals the significance of atrial systole.

### Conclusion:

Preeclampsia still contributes to a majority of maternal mortality and morbidity. This study shows that there are significant cardiovascular dynamics changes in subjects with preeclampsia which can be studied by echo. Hence, this study emphasizes the importance of identifying this subset of preeclamptic patients who are at higher risk of developing cardiovascular complications later in life by undergoing a timely echocardiography.

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