

Incidence and Outcome of Left Ventricular Dysfunction in Asymptomatic Pregnant Women-An Institutional Study.

Pabba Kylasam¹, Pabba Anish², John Israel³

¹Associate Professor, Department of General Medicine, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India

²Junior Resident, Department of General Medicine, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India

³Professor & HOD, Department Of General Medicine, Prathima Institute Of Medical Sciences, Karimnagar, Telangana, India.

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ABSTRACT

Background: Or Left ventricular diastolic dysfunction, as occurs in patients with hypertension, diabetes mellitus, and/or aging, carries a substantial risk in pregnancy, may even lead to an uneventful pregnancy. Aim: To evaluate the incidence and outcome of left ventricular dysfunction in asymptomatic pregnant women and also to compare the changes in preeclamptic women and normotensive pregnant women. **Methods:** We carried a prospective study on left ventricular systolic and diastolic function by echocardiography in normal and preeclamptic pregnant women at Prathima Institute of Medical Sciences, Karimnagar, Telangana State, India. The study was carried out from January 2017 to December 2017. The study sample consisting of asymptomatic pregnant women divided into two groups. Group A- Normotensive pregnant women and Group B- Preeclamptic asymptomatic pregnant women. Various systolic and diastolic parameters were measured. **Results:** We found 3 % incidence of left ventricular dysfunction in asymptomatic pregnant women and also found significant differences in the mean end diastolic dimensions when compared to systolic dimension between two groups. **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. Effective management of patients who showed left ventricular dysfunction prevented pulmonary edema and cardiac failure.

Keywords: Diastolic dysfunction, Echocardiography, Preeclampsia, Systolic dysfunction.

INTRODUCTION

Preeclampsia complicates around 5% of pregnancies and hypertensive disorders of pregnancy are responsible for over 60,000 maternal deaths worldwide annually. It is characterized by hypertension and features of multiple organ disease. Diagnosis remains a challenge as clinical presentation is highly variable and even with severe disease a woman can be asymptomatic. Both maternal and neonatal morbidity and mortality are increased in pregnancies complicated by preeclampsia, and there is significant personal cost to families affected by the disease and economic implications for the health service.^[1,2]

Left ventricular (LV) diastolic dysfunction, as occurs in patients with hypertension, diabetes mellitus, and/or aging, carries a substantial risk of the subsequent development of heart failure and reduced survival, even when it is asymptomatic or “preclinical.” Diastolic dysfunction is defined as

functional abnormalities that exist during LV relaxation and filling.^[2]

It is well known that the maternal cardiovascular system undergoes significant changes throughout pregnancy, which impose considerable stress on the pregnant woman’s heart. Accurate assessment of cardiac function during pregnancy is therefore important. In the past, studies on the maternal cardiovascular system focused mainly on systolic function. However, myocardial relaxation is an energy-dependent process and diastolic dysfunction has been shown to precede impairment of systolic function in the evolution of most cardiac diseases.^[3,4]

Preeclampsia is an acute increase in blood pressure during the second half of pregnancy which is short-lived. More than 50% of the women with elevated blood pressure during pregnancy return to normal by 6-12 weeks postpartum. Echocardiography is cheap, non invasive modality, with no radiation risk to mother and fetus to evaluate pregnant women for left ventricular dysfunction.^[5,6]

We carried this study to evaluate the incidence and outcome of left ventricular dysfunction in asymptomatic pregnant women, both hypertensives and normotensives.

Name & Address of Corresponding Author

Dr. Pabba Anish
Junior resident
Department of general medicine
Prathima institute of medical sciences
Karimnagar, Telangana,
India.

MATERIALS AND METHODS

We carried a study on 100 patients who have been admitted in the antenatal ward at Prathima Institute of Medical Sciences, Karimnagar, Telangana State, India, over a period of one year from January 2017 to December 2017. We followed the methodology of Sengodan SS et al (2017) in our sample. Blood pressure was recorded for all the patients. The study sample was equally divided in to two groups.

1. Group A (n=50) - Normotensive pregnant women and
2. Group B (n=50) - Preeclamptic pregnant women.

Inclusion Criteria

1. Patients age between 18 to 35 years
2. Patients of gestational age 28 to 36 weeks.

Exclusion criteria

1. Patients with pre existing hypertension
2. Patients with known cardiorespiratory disease, renal disease, connective tissue disorders
3. Patients with anaemia
4. Patients with gestational diabetes mellitus
5. Twin pregnancy
6. Alcohol and Tobacco usage.

Echocardiograph findings

A cardiologist examined all the patients using echo machine with 2.5 mHz transducer at the Department of Cardiology, Prathima Institute of Medical Sciences, Karimnagar. Echocardiography of left ventricle was obtained under standard conditions during quiet expiration with patients in the left lateral recumbent positions after the patients remained undisturbed in this position for 15 minutes. Measurements

M-mode, 2D and Doppler echocardiographic evaluation were performed in all patients in the standard left parasternal axis view with continuous ECG gating according to the ASE guidelines. Initial 2 D studies were done to evaluate cardiac structure and visual assessment of left ventricle contractile function. M-mode studies were performed at the level of aorta, left atrium and left ventricle. Doppler flow was recorded across the mitral valve to obtain left ventricle diastolic filling pattern.

Systolic parameters studied were:

Left Ventricle end systolic volume (LVESV), Stroke volume (SV), Cardiac output (CO), Ejection Fraction (EF), Aortic root diameter (ARD), Left ventricular outflow tract (LVOT) and left ventricular mass (LVM).

$EF = \frac{EDV - ESV}{EDV} \times 100$ (Normal: 50 to 75%)

Diastolic parameters studied were:

E wave, A wave, E/A ratio, isovolumetric relaxation time (IVRT), E deceleration time (DtE), E wave velocity time integral (E VTI) and A wave velocity time integral (A VTI).

E/A ratio: early filling / filling due to atrial contraction (Normal 0.8 to 2)

Iso Volumetric Relaxation Time

Time interval between closure of aortic valve and opening of mitral valve. Normal values are 73 to 110 ms. More than 110 ms is considered as prolonged IVRT indicative of diastolic dysfunction.

Deceleration time (DT):

Time taken for left atrial and left ventricular pressures to equilibrate. Normal 160 to 230 ms. Prolonged in diastolic dysfunction.

RESULTS

We recorded the baseline features of study population. Age and BMI were similar in the two groups. Differences in Systolic BP, Diastolic BP and Mean Arterial Pressure (MAP) were statistically significant between the two groups. MAP in preeclamptic women was 90-120mm Hg, higher than that of normotensive women 70-85 mm Hg [Table 1].

Table 1: Baseline characteristics of two study groups.

Parameter	Normotensive (n=50)	Preeclamptic (n=50)
AGE (in years)	24-28	25-30
BMI (kg/m ²)	20-28	24-34
Systolic BP (mm Hg)	84-132	146-168
Diastolic BP (mm Hg)	64-76	88-104
MAP (mm Hg)	70-85	90-120

Table 2: Comparison of systolic parameters between two groups

Parameter	Normotensive (n=50)	Preeclamptic (n=50)
CO (ml/min)	52-55	64-72
LVESV (ml)	22-27	25-51
LVEDV (ml)	100-109	84-138
LVMS (gm)	58-104	82-98
LVMD (gm)	80-125	117-150

Table 3: Comparison of diastolic parameters between two study groups

Parameter	Normotensive (N=50)	Preeclamptic (N=50)
E wave (m/s)	0.526-0.804	0.846-1.108
A wave (m/s)	0.355-0.642	0.504-1.026
E/A ratio	1.09-1.47	1.002-1.864
DtE (ms)	112.8-129	131.8-226.2
IVRT (ms)	76.8-85.9	81-102.4
E VTI (ms)	10.51-13.52	9.25-17.98
A VTI (ms)	2.15-3.58	5.32-7.76

Systolic parameters were compared between two study groups [Table 2]. Cardiac output in the preeclamptic group was higher than the normotensive group, the difference being statistically significant. Left ventricular Diastolic mass was significantly higher in preeclamptic patients when compared to Left ventricular systolic mass. Left Ventricular Systolic Volume was significantly higher in preeclamptic when compared to Left Ventricular Diastolic Volume.

Systolic parameters were compared between two study groups [Table 3]. We found that E wave

velocity, A wave velocity, IVRT, E wave deceleration time and A VTI were higher in preeclamptic patients.

Left ventricular dysfunction was found in 3% of asymptomatic pregnant women on echocardiography done in third trimester with EF of < 45%.

DISCUSSION

Asymptomatic women with dilated cardiomyopathy and only mild left ventricular systolic dysfunction, generally do well during pregnancy. Women with symptoms prior to pregnancy or moderate or severe left ventricular systolic function are at higher risk for complications during pregnancy.^[7, 8]

Studies have shown considerable maternal and fetal morbidity and mortality due to preeclampsia. This was supposed to be due to angiogenic imbalance with high circulating levels of antiangiogenic proteins like tyrosinekinase -1 (sFlt-1) and soluble endoglin seen in women with preeclampsia. Hence sFlt-1 is considered as a sensitive marker for diastolic dysfunction and it is a proven pathognomonic marker for peripartum cardiomyopathy.^[7-10]

Patients with preeclampsia show left ventricular hypertrophy and regional longitudinal systolic dysfunction due to subendocardial ischemia and/or fibrosis in the longitudinal myocardial fibers.^[11]

However angiogenic imbalance is supposed to get resolved after pregnancy but the cardiac changes persist for a year or so. Due to preeclampsia there will be an increase in peripheral vascular resistance leading to a significant drop in cardiac output.^[8-10]

In our study, we used echocardiography and found reduced cardiac diastolic function when compared to systolic function. In normal pregnancy, an increased preload and a decreased after load favour an improved emptying of the left ventricle during systole and reduction of End Systolic Pressure. In preeclamptic women, the elevated after load is linked with a reduced emptying of the left ventricle and elevated End Systolic Pressure.^[5,11]

In our study, we found the mean LVESV was 25-51 ml in preeclamptic women when compared to 22-27 ml in normotensives. The mean LVEDV was 84-138 ml in preeclamptic when compared to 100-109 ml in normotensives. The LVMD was 117-150 gm in preeclamptic when compared to 80-125 gm in normotensives. The mean IVRT was 81-102.4 ms in preeclamptic when compared to 76.8-85.9 ms in normotensives. The mean E wave velocity was 0.846-1.108 m/s in preeclamptic when compared to 0.526-0.804 m/s in normotensives. The mean A wave velocity was 0.504-1.026 m/s in preeclamptic when compared to 0.355-0.642 m/s in normotensives. All the above values imply the implication of diastolic dysfunction. This difference between the values among both the groups is supposed to be due to the fact that in preeclamptic patients there will be an increased total peripheral

resistance, hence an increase in afterload resulting in the left ventricle becoming stiff. This might be the probable mechanism by which diastolic dysfunction develops independent of left ventricular hypertrophy.^[5,10]

On a whole we found left ventricular dysfunction in 3% of asymptomatic pregnant women on echocardiography done in third trimester with EF of < 45%. One patient had severe LV dysfunction and bronchospasm component (EF=30%). Initiation of treatment was done with beta blockers, mild dose of diuretics and digoxin and the outcome was good in all the patients.

The data on changes in left ventricular diastolic dysfunction is scarce. Hence this exploratory study assessed the various hemodynamic alterations in preeclampsia during second half of pregnancy, on echocardiography very clearly and found it to be a useful technique. Doppler imaging studies of myocardial function in women, following a preeclamptic pregnancy, is of value to define the long term clinical relevance of the disease process. BP monitoring alone is insufficient to identify effectively, the risk of complications. Maternal Echo can be introduced into routine investigation protocol, which could help to identify women who are at high risk of developing cardiovascular complications. Patients can even be followed during the postpartum period to examine whether the altered hemodynamic state reverts to normal after pregnancy.^[5,10,11]

Our 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. Effective management of patients who showed left ventricular dysfunction prevented pulmonary edema and cardiac failure.

CONCLUSION

Our study showed that there are significant cardiovascular dynamic changes in asymptomatic subjects with preeclampsia which can be studied with Echo and they are at higher risk of developing cardiovascular complications later in life. Women with preeclampsia have significant systolic and diastolic dysfunction when compared to normotensive pregnant women. Echocardiography is cheap, non invasive modality, with no radiation risk to mother and fetus to evaluate pregnant women for left ventricular dysfunction. Hence echocardiography evaluation is important to diagnose and assess left ventricular function in pregnant women.

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