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Maternal Left Ventricular Systolic Parameter in Pre-Eclampsia in Term Pregnancy

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Abstract

Objective: To study and compare the echocardiographic systolic pararmeters in pre-eclampsia and normotensive pregnant women.

Methods: This was a hospital based comparative analytical cross sectional study carried out over 2 years period from May 2019 in the Department of Obstetrics and Gynecology, SMS Medical College and attached hospitals, Jaipur. The study included two groups consisting of 45 women in each group match with age and gestational age. Inclusion and exclusion criteria were applied. All women underwent echocardiography and systolic parameters were recorded and studied.

Results: The mean LVESV in study group was 34.26 ± 7.29 ml whereas in the control group mean LVESV was 30.31 ± 6.23. The difference was statistically significant. Mean LVEDV in study group was 80.32 ± 14.23 ml v/s 71.20 ± 5.62 ml in control group and the difference was statistically significant. Mean stroke volume was higher in study group as compared to the control group (55.87 ± 10.73 ml v/s 45.44 ± 12.93ml) and difference was statistically significant. Mean cardiac output was higher in the cases as compared to the controls (5.54 ± 0.51 **L/min** v/s 5.28 ± 0.42 **L/min**) and the difference was statistically significant. Mean TVR in study group was found to be higher as compared to control group (1356.88 ± 112.42 **dyne/sec/cm-5** v/s 1252.00 ± 86.49 **dyne/sec/cm-5)** and difference was statistically significant.

Conclusion: Pre-eclampsia is associated with significantly higher prevalence of global left ventricular systolic dysfunction and myocardial injury. Thus early detection of these parameters help in identifying high risk women developing cardiovascular morbidity in later life.

Keywords: Echocardiography, Systolic parameters, Pre-eclampsia, Normotensive

Introduction

Pre-eclampsia is a pregnancy specific syndrome, which affects 3% to 5% of all pregnancies.[1]According to American College of Obstetrician and Gynecologist it is defined as hypertension greater than 140/90 mmHg 4 hours apart associated with proteinuria greater than 0.3 gm/dl in a 24 hours urine collection or greater than 1 g/dl or ≥+1 on urine dipstick examination.

It is a complex multisystem condition. It is now well established that pre-eclampsia is an independent risk factor for subsequent cardiovascular disease.[2,3] One of the principal manifestation of this progress is the change in geometry and function of left ventricle. Women with pre-eclampsia have diverse hemodynamic findings such as increase cardiac output, high vascular resistance, and decreased myocardial contracility.[4] This leads to significantly higher risk for further hypertension, ischemic heart disease, stroke and premature cardiovascular death in women.

Trans-thoracic echocardiography is a non invasive device and is validated in pregnancy, however it is currently rarely used. Blood pressure monitoring alone is insufficient to identify the risk of cardiovascular complications. Thus maternal echocardiography if introduced in routine management protocol could help in identifying women who are at high risk to develop complications.

Methods

This was a hospital based comparative analytical cross sectional study carried out over 2 years period from May 2019 in the Department of Obstetrics and Gynecology, SMS Medical College and attached hospitals, Jaipur.

The study included two groups consisting of 45 women in each group match with age and gestational age.

Group-A : 45 women with singleton pregnancy with gestational period of ≥34 weeks with preeclampsia.

Group-B : 45 normotensive women with singleton pregnancy with gestational period of ≥34 weeks.

Women with singleton pregnancy, ≥34 weeks gestation normotensive pregnant, ≥34 weeks gestation with preeclampsia and women willing to participate were included in the study.

Subjects with any renal disease, chronic hypertension, cardiovascular disease, Congenital cardiac disorder of pregnant and obesity were excluded from the study. After applying inclusion and exclusion criteria informed written consent were taken and women willing to participate in this study were recruited from routine antenatal clinic. Approval from Institutional Research, Review Board and Ethical Committee was taken. Echocardiography was done in left lateral position and left ventricular systolic parameters were recorded.

Table 1: Distribution of subjects according to mean Left Ventricular End Systolic Volume (LVESV)

Group	Cases	Controls	P-value
Mean LVESV (in ml)	34.26 ± 7.29	30.31 ± 6.23	0.001

Table 2 : Distribution of Subjects According to Mean Left Ventricular End Diastolic Volume (LVEDV)

Group	Cases	Controls	P-value
Mean LVEDV (in ml)	80.32 ± 14.23	71.20 ± 5.62	<0.01

Table 3 : Distribution of Subjects According to Mean Stroke Volume

Group	Cases	Controls	P-value
Mean Stroke Volume (in ml)	55.87 ± 10.73	45.44 ± 12.93	<0.01

Table 4: Distribution of Subjects According to Mean Cardiac Output (CO)

Group	Cases	Controls	p-value
Mean Cardiac Output (in L/min)	5.54 ± 0.51	5.28 ± 0.42	0.02

Table 5: Distribution of Subjects According to Mean Total Vascular Resistance(TVR)

Group	Cases	Controls	P-value
Mean TVR (in dyne/sec/cm^{-5})	1356.88 ± 112.42	1252.00 ± 86.49	<0.01

Results

A total of 45 women with pre-eclampsia and 45 normotensive pregnant women were recruited during the study period. Conventional echocardiography was done and systolic parameters were acquired. Compared with the healthy term normotensive pregnant women, echocardiography in the pre eclampsia showed a significant increase in the mean LVESV (34.26 ± 7.29 ml v/s 30.31 ± 6.23 ml), the mean LVEDV (80.32±14.23 ml v/s 71.20 ± 5.62 ml) and the mean stroke volume (55.87 ± 10.73 ml v/s 45.44 ± 12.93 ml). During normal pregnancy there are physiological changes in ventricular structure and function and these changes are exaggerated in pre-eclampsia.

Mean cardiac output was higher in the cases as compared to the controls and the difference was statistically significant.

Mean TVR in study group was also found to be higher as compared to control group and difference was statistically significant.

Discussion

In the women with pre-eclampsia, left ventricular systolic function was impaired on echocardiography.

Pan G et al (2019)[5] studied the cardiac dysfunction in women with severe pre-eclampsia by tissue doppler & speckle tracing echocardiography, the mean LVESV was found to be higher in pre-eclampsia group as compared to the normotensive control group (42.5 ± 13.2 ml v/s 41.8 ± 12.7 ml).

Similar study done by Dhanorkar SV[6] et al (2018)22. They did a study to assess the cardio-vascular haemo-dynamic in pre-eclampsia, 35 women with pre-eclampsia and 35 normotensive women were enrolled for echocardiographic evaluation. Mean LVESV in pre-eclampsia group was 32.02 ± 11.23 ml and in control group it was 28.21 ± 1.7 ml. The LVEDV in pre-eclampsia

group was higher than in control (110.12 ± 19.21 ml v/s 105.32 ± 3.32 ml). Our results were similar to Tangeda P et al (2015)[7]. They studied 15 normotensive pregnant women and 15 pre-eclamptic women. All underwent echocardiographic evaluation. Mean stroke volume was found to be higher in pre-eclampsia group as compared to the control group (73.03 ±19.6 ml v/s 60.49 ± 14.7 ml) , higher cardiac output in pre-eclampsia than control group (6642 ± 1508 ml/min v/s 5175 ± 1279 ml/min) and mean TVR in pre-eclamptic group was was 1286 ± 106.2 dyne/sec/cm-5 as compared to the 1236.5 ± 68.18 dyne/sec/cm-5 in control group.

Our results were similar to Buddeberg BS et al (2018)[8] who studied the cardiac maladaptation in term pregnancies with pre-eclampsia. 30 pre-eclampsia and 40 healthy term pregnancy were enrolled for doppler echocardiography. Cardiac output was found to be higher in pre-eclampsia group as compared to the controls and also found that mean TVR to be higher in pre-eclamptic group than normotensive pregnant women.

Our results were also similar to the study done by Shivananjiah C et al (2016)[9].They studied the echo changes in hypertensive disorders of pregnancy and found higher cardiac output in pre-eclamptic group as compared to normotensive group (64.2 ± 3.4 ml/min v/s 56.99 ± 0.78 ml/min).

Conclusion

Women with pre-eclampsia have significant high cardiac output, high systemic vascular resistance and functional changes in cardiovascular dynamics. Early detection of these changes by echocardiography could help to identify pre-eclamptic women who are at higher risk of developing cardiovascular complications in later life.

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