EVALUATION OF LEFT VENTRICULAR SYSTOLIC PARAMETERS IN PRE-ECLAMPTIC WOMEN

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Abstract

Objective: to study systolic parameters with echocardiography in pre-eclampsia. Pre-eclampsia is a multisystem disorder of unknown etiology. The underlying pathophysiological mechanism is to be impaired trophoblastic invasion of spiral arteries with placental hypoperfusion and hypoxia.

Methods: This was a hospital based prospective case control study carried out in Department of Obstetrics & Gynaecology in SMS Medical College, Jaipur during the period of June 2018 to Aug 2019. 60 women enrolled in the study after applying inclusion and exclusion criteria. All women underwent 2D-echocardiography. Cardiac systolic parameters were recorded and compared.

Results: 2D-echocardiography revealed impairment in form of mean LVESV in pre-eclamptic women was 35.73 ± 0.70 mL, mean stroke volume was 63.50 ± 13.26 mL when compared to normotensive women LVESV 33.40 ± 0.63 mL ($p = 0.04$) and stroke volume was 53.96 ± 9.46 mL ($p = 0.02$).

Conclusion: To identifying pre-eclamptic patients who are at higher risk of developing cardiovascular complication later in life by non-invasive 2D-echocardiography.

Keywords: Echocardiography, Systolic parameters, Stroke volume, Left ventricular end systolic

Introduction

Cardiovascular disease is the main cause of death worldwide, representing 30% of all deaths. Coronary heart disease and stroke account for the 3/4th of deaths and affect people in their mid-adult life. The remaining 1/4th of deaths can be attributed to other causes, such as rheumatic heart disease, peripheral arterial disease, pulmonary embolism and congenital heart disease.¹ Behavioral risk factors, such as tobacco use, unhealthy diet and obesity, physical inactivity, high blood pressure, diabetes and raised lipids accounts for 80% of coronary disease and stroke are generally modifiable.^{1,2} Determinants of CVD such as globalization, population ageing, poverty, stress and genetics require implementation of social, economic and cultural measures.¹

The American Heart Association expanded its focus on female-specific clinical recommendations. It emphasized that pregnancy represents a unique opportunity to identify women's lifelong cardiovascular risk.³ The panel elucidated that pregnancy complications such as gestational hypertension, preeclampsia (PE) and fetal growth restriction (FGR) are associated with maternal CVD morbidity and mortality later in life.⁴⁻⁹

Women with preeclampsia have diverse haemodynamic findings such as increased cardiac output, high vascular resistance and decreased myocardial contractility. This leads to significantly higher risk of subsequent heart failure, ischaemic and hypertensive heart diseases, and related mortality compared with uneventful pregnancy in later life.^{10,11}

METHODS

This study was conducted in Department of Obstetrics & Gynaecology in SMS Medical College, Jaipur. Total 60 women were recruited in this study, 30 pre-eclamptics and 30 controls. Inclusion and exclusion criteria were applied. Echocardiography was performed and left ventricular systolic parameters were recorded in left lateral position.

Inclusion criteria included: pregnant women after 20 wks of gestation period with normotensive and pre-eclamptic. Pre-eclampsia was defined with blood pressure measurements on at least two occasions at 4 hrs interval blood pressure $\geq 140/90$ mm of Hg and proteinuria >3 g/L. Exclusion criteria were pre-existing co-morbid conditions like hypertension, diabetes mellitus, heart disease, connective tissue disorders, severe anaemia and multiple pregnancies.

RESULTS

Table 1: Distribution of Subjects According to Age Group

Age Group (in yrs)	Cases		Controls	
	No.	%	No.	%
<20	3	10.00	3	10.00
20 - 25	9	30.00	17	56.67
26 - 30	12	40.00	8	26.67
31 - 35	6	20.00	2	6.66
Total	30	100.00	30	100.00

The table shows the age distribution of the study population. Maximum i.e. 12 (40.00%) of patients in study group were in 26-30 yrs of age group followed by 9 (30.00%) patients who were in age group 20-25 yrs.

In control group, 17 (56.67%) patients were in 20-25 yrs age group followed by 8 (26.67%) patients in 26-30 yrs of age group.

Table 2: Distribution of Subjects According to Gravidity

Gravidity	Cases		Controls	
	No.	%	No.	%
G ₁	17	56.67	15	50.00
G ₂	7	23.23	9	30.00
≥G ₃	6	20.00	6	20.00
Total	30	100.00	30	100.00

p-value = 0.912

The table shows the distribution of patients according to gravidity. In study group, 17 (56.67%) patients were primigravida, 7 (23.23%) patients were second gravidas and rest 6 (20.00%) were multigravida.

In control group, 15 (50.00%) patients were primigravidas, 9 (30.00%) patients were second gravidas and rest 6 (20.00%) were multigravidas.

There were more primigravidas in pre-eclampsia group compared to the control group.

Table 3: Distribution of Subjects According to BMI

BMI (in kg/m ²)	Cases		Controls	
	No.	%	No.	%
≤25	19	63.33	27	90.00
>25	11	36.67	3	10.00
Total	30	100.00	30	100.00

p-value = 0.03

The table shows the distribution of patients according to BMI. In study group, 11 (36.67%) of the patients had BMI >25 kg/m² and 19 (63.33%) patients had BMI ≤25 kg/m².

In control group, 27 (90.00%) of the patients had BMI ≤25 kg/m², 3 (10.00%) of patients had BMI >25 kg/m².

The total no. of patients with BMI >25 kg/m² in study group were 11 (36.67%) as compared to only 3 (10.00%) in control group. The difference in BMI was statistically

significant in two groups there by indicating the importance of BMI in the incidence of pre-eclampsia.

Table 4: Distribution of Subjects According to Left Ventricular End Systolic Volume (LVESV)

LVESV (in ml)	Cases		Controls	
	No.	%	No.	%
20 - 25	5	16.67	0	0.00
25 - 30	7	23.33	12	40.00
30 - 35	4	13.33	6	20.00
35 - 40	8	26.67	10	33.33
>40	6	20.00	2	6.67
Total	30	100.00	30	100.00

p = 0.03

The table shows the distribution of patients according to left ventricular end systolic volume (LVESV). In study group, maximum i.e. 8 (26.67%) of patients had LVESV between 35-40 ml. 7 (23.33%) between 25-30 ml, 6 (20.00%) >40 ml, 5 (16.67%) between 20-25 ml and 4 (13.33%) had LVESV between 30-35 ml.

In control group, majority 12 (40.00%) of patients had LVESV between 25-30 ml, 10 (33.33%) of patients had LVESV between 35-40 ml, 6 (20.00%) between 30-35 ml and 2 (6.67%) patients had LVESV >40 ml.

In study group, 14 (46.67%) of patients had LVESV >35 ml whereas in the control group 18 (60.00%) patients has LVESV <35 ml indicating increased end systolic volume in pre-eclampsia.

Table 5: Distribution of Subjects According to Stroke Volume

Stroke Volume (in ml)	Cases		Controls	
	No.	%	No.	%
<40	5	16.67	11	36.67
40 - 50	8	26.67	13	43.33
51 - 60	7	23.33	4	13.33
61 - 70	7	23.33	2	6.67
>70	3	10.00	0	0.00
Total	30	100.00	30	100.00

p = 0.115

The above table shows the distribution of patients according to stroke volume. 24 (80.00%) patients in control group had SV <50 ml as compared to 13 (43.33%) patients in study group. 17 (56.68%) patients had SV >50 ml in study group and 3 (10.00%) patients in study group had SV >70 ml whereas none in the control group had SV >70 ml.

Discussion

Cardiovascular or hemodynamic state is a complex interplay of left and right ventricular systolic and diastolic function and integration with the vascular system. There is limited knowledge with respect to parameters of cardiac function in pregnancy and even less in the presence of pregnancy complication such as preeclampsia. In the latter

condition, there is currently no consensus on the systolic and diastolic parameter of cardiac function and the literature is conflicting regarding whether there is increased, decreased or any change in cardiac output.

Stroke volume (SV), the volume of blood ejected from the left ventricle during systole, is an index of left ventricle pumping function. It is obtained by calculating the end diastolic volume and end systolic volume using M- mode or 2D echocardiography and the difference between these volumes is SV. Stroke volume is higher in preeclampsia due to greater pumping action of the heart.

Results were comparable to study done by Memari B et al (2018)¹² who studied the 21 pre-eclamptic and 21 normotensive women and noted a difference in mean age between two groups. The mean age in study group was 32.86 ± 4.95 yrs v/s 30.00 ± 5.92 yrs in control group.

Akhter T et al (2013)¹³ studied 55 pre-eclampsia and 64 normotensive patients. Incidence of pre-eclampsia was found to be higher in nulliparous. In pre-eclampsia group, 71% was nulliparous and 50.00% in control group.

Melchiorre K et al (2011)¹⁴ evaluated cardiac function and remodelling in pre-eclampsia. 40 pre-eclamptics and 40 normotensives were included in this study. 68% of the patients in pre-eclampsia group were nulliparas compared to the 64% of the patients in the control group.

Memari B et al (2018)¹² studied the association of pre-eclampsia with carotid IMT. They observed a higher mean BMI in pre-eclampsia group. Mean BMI in pre-eclampsia group was 32.30 ± 3.75 kg/m² as compared to the 30.65 ± 3.40 kg/m² in control group.

In a study done by Dhanorkar SV et al (2018)¹⁵ to assess the cardio-vascular haemodynamic in pre-eclampsia, 35 patients with pre-eclampsia and 35 patients with normal pregnancy were enrolled. All the patients underwent 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.

Dhanorkar SV et al (2018)¹⁵ did a study of echocardiographic evaluation of cardiovascular hemodynamic in pre-eclampsia, they found stroke volume to be higher in pre-eclampsia group as compared to the control (72.45 ± 9.21 ml v/s 69.51 ± 5.12 ml).

Conclusion

Women with pre-eclampsia have significant systolic dysfunction when compared to normotensive pregnant

women. Early detection of these changes by echocardiographically could help to identify pre-eclamptic women who are at higher risk of developing cardiovascular morbidity in later life.

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