Evaluation of Echocardiographic Diastolic Parameters in Pre-Eclamptic

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Abstract

Objective: To study cardiac diastolic parameters by using echocardiography in Pre- Eclamptic and normotensive pregnant women.

Methods: This was Hospital Based Comparative observational study carried out in Department of Obstetrics & Gynaecology SMS Medical College, Jaipur during the period of June 2018 to August 2019. Two-dimensional Echocardiography was performed in 30 Pre- Eclamptic and 30 Normotensive pregnant women. Cardiac Diastolic parameters were studied and compared.

Results: Echocardiography revealed left side diastolic impairment in form of Mean E (early ventricular filling) in Pre-eclamptic was 1.12 ± 0.45 v/s 0.80 ± 0.39 m/sec in control group and the difference was statistically significant. Mean A (Late ventricular filling) was higher in Pre-eclamptic compare to control group (1.13 ± 1.22 v/s 0.97 ± 1.48 in m/sec). Mean IVRT in Pre-eclamptic group was 77.90 ± 13.84 v/s 75 ± 15.52 milli/sec slightly higher as compare to control. Mean E/A wave was higher in Pre-eclamptic (1.27 ± 0.20 v/s 1.13 ± 1.22 in m/sec).

Conclusions: Diastolic parameter worsened in Pre-eclamptic. Identifying these changes early who are at higher risk of developing cardiovascular complication later in life by undergoing Two-Dimensional echocardiography.

Keywords: Diastolic parameters, Echocardiography, Pre-eclampsia

Introduction

Preeclampsia is a pregnancy-specific disease. It is defined as new onset hypertension after twenty weeks of pregnancy plus involvement of at least one organ system : renal, hepatic, neurological, hematological, pulmonary or cardiac system or as utero-placental dysfunction. Diagnostic criteria for pre-eclampsia in woman with new-onset hypertension without proteinuria have been defined in the following way: Platelet count < 100,000/μL, serum creatinine level > 1.1 mg/dL or a doubling of serum creatinine (if evidence of other kidney disease is not available), an increased level of liver transaminases to at least twice the normal level, and pulmonary edema, as well as cerebral or visual symptoms. [1,2,3]. Proteinuria is no mandatory diagnostic criteria in most guidelines.

Page 145

Pre-eclampsia (PE), complicates 3-5% of the pregnancies [4] and is the leading cause of maternal and fetal morbidity and mortality [5]. It is also related with endothelial dysfunction [6], which is also one of the pathogenic mechanisms in coronary artery disease (CAD) and in other atherosclerotic vascular diseases. Pre-eclampsia is associated both immediate and long-term complication due to cardiac related issues. In pregnancy the cardiovascular system has to adapt to a state of volume overload. [7]. In Pre- eclampsia mal-adaptation more pronounced. [8] Echocardiography finding in healthy pregnant women which changes in pre-eclampsia do not resolved entirely. [9,10]

Material and Methods

The hospital based comparative observational study was carried out in Department of Obstetrics & Gynaecology of SMS Medical College, Jaipur from June 2018 to August 2019. Total 60 women are included in this study. 30 Pre-eclamptic with singleton pregnancy recruited as case and 30 normotensive pregnant women without any co-morbidities as control from routine ante-natal clinic.

Methodology

- After applying inclusion and exclusion criteria informed and written consent was taken.
- Approval from Institutional Research, Review Board and Ethical Committee was taken.
- Detail history, examination and routine antenatal investigations were done.
- Height and weight were measured and body mass index (BMI) was calculated.
- Women were instructed to rest for 15 min (in supine position), then blood pressure (BP) measurement was taken on the right upper arm with automated or manual blood pressure equipment.

- Maternal echocardiography was performed by cardiologist under slandered condition in left lateral position during quite expiration. Diastolic parameters studied were E wave, A wave E/A ratio, IVRT, E'.

- Results were noted and compared.

Inclusion Criteria

- Singleton pregnancy
- Women with more than ≥20 weeks gestation with preeclampsia and normotensive pregnant women.

Exclusion Criteria

- Chronic hypertension
- Congenital cardiac diseases
- Chronic renal disease
- Diagnosed patient of diabetes mellitus type 1, type 2
- Rheumatoid Arthritis
- Obesity

Observations and Results

Table 1: Distribution of Subjects According to E Wave

E Wave (in m/sec)	Cases		Controls	
	No.	%	No.	%
<0.5	2	6.67	8	26.67
0.5 - 1	10	33.33	16	53.33
1 - 1.5	18	60.00	6	20.00
Total	30	100.00	30	100.00

p = 0.02

The above table shows the distribution of study group according to E wave. In study group, majority i.e. 18 (60.00%) of patients had E wave between 1-1.5 m/sec

In the control group, Maximum number 16 (53.33%) patients had E wave between 0.5-1 m/sec.

The difference in two groups was statistically significant.

Table 2 :Distribution of Subjects According to A Wave (Late Ventricular filling)

A Wave (in m/sec)	Cases		Controls	
	No.	%	No.	%
0.2 - 0.5	6	20.00	11	36.67
0.5 - 0.75	7	23.33	11	36.67
0.75 - 1	8	26.67	3	10.00
>1	9	30.00	5	16.66
Total	30	100.00	30	100.00

p = 0.12

The above table shows the distribution of patients according to A wave. In study group maximum 17 (56.67%) number of patients had A wave above 0.75 m/sec.

In control group, majority 22 (73.34%) of patients had A wave below 0.75 m/sec.

Mean A wave was higher in Pre-eclamptic as compare to control although p-value was not significant due to smaller sample size.

Table 3: Distribution of Subjects According to E/A Wave

E/A Wave (in m/sec)	Cases		Controls	
	No.	%	No.	%
1 - 1.2	7	23.33	2	6.67
1.2 - 1.3	4	13.33	17	56.67
1.3 - 1.4	12	40.00	8	26.67
1.4 - 1.5	7	23.33	3	10.00
Total	30	100.00	30	100.00

p = 0.004

The above table shows the distribution of patients according to E/A ratio. In study group, the maximum 19 (63.33%) patients had E/A ratio >1.3.

In control group, 19 (63.34%) patients had E/A <1.3. The difference in E/A ratio between Pre-eclamptic and normotensive was statistically significant.

Table 4: Distribution of Subjects According to Isovolumetric Relaxation Time (IVRT)

IVRT (in milli/sec)	Cases		Controls	
	No.	%	No.	%
50 - 60	4	13.33	6	20.00
60 - 70	5	16.67	8	26.66
70 - 80	2	6.66	5	16.67
80 - 90	14	46.67	5	16.67
90 - 100	5	16.67	6	20.00
Total	30	100.00	30	100.00

p = 0.14

The above table shows the distribution of cases according to IVRT. In the study group, maximum i.e. 19 (63.34%) number of patients had IVRT between 80 milli/sec.

In control group, only 11 (36.67%) number of patients had IVRT above 80 milli/sec.

Table 5: Distribution of Subjects According to Early Annular Diastolic Velocity (E')

E' (in cm/sec)	Cases		Controls	
	No.	%	No.	%
5 - 6	3	10.00	1	3.33
6 - 7	7	23.33	3	10.00
7 - 8	4	13.33	2	6.67
8 - 9	4	13.33	3	10.00
9 - 10	5	16.67	6	20.0
10 - 11	2	6.67	8	26.67
11 - 12	5	16.67	7	23.33
Total	30	100.00	30	100.00

p = 0.13

The above table shows the distribution of cases according to E' wave velocity. In the study group, 7 (23.33%) women had E' above 10 cm/sec.

In control group, 15 (50%) of patients had E' above 10 cm/sec.

Mean early annular diastolic velocity E' was higher in control group compare to Pre-eclamptic. The difference was statistically borderline significant. (9.51$\pm$1.78 v/s 8.51$\pm$2.08 p-value=0.05).

Discussion

Pre-eclampsia is a major cardiovascular system disease with significant short and long term sequalae. It causes considerable maternal and fetal morbidity and mortality in women in later life. It is two stage syndrome [11]. The first stage mediated by reduced placental perfusion as result of abnormal placental lead to placental hypoxia which increase production of inflammatory markers eg. Tumor necrosis factor alpha, IL-6 and Anti Angiogenic factor eg. Soluble fms- like, tyrosine kinase -I and endoglin. [12,13]. These are released in maternal circulation where they induce endothelial dysfunction, activation of coagulation cascade and vasoconstriction. [14]

In this study echocardiography has been used for evaluation of maternal cardiac diastolic function in pre-eclamptic women.

In our study we found that Mean E wave in pre-eclamptic was 1.12$\pm$0.45 while in normotensive was 0.80$\pm$0.39 p-value <0.01 which indicate the pressure gradient along the mitral valve was higher.

Pan G et al 2019 [15] and Dharnokar SV et al 2018 [16] studied the changes in systolic and diastolic parameters of heart by echocardiography, they also observed similar results. (1.823$\pm$0.112 m/sec v/s 0.512$\pm$0.112 m/sec)

A study carried out by Buddenberg BS et al 2018 [17] assessed A wave in pre-eclamptic by echocardiography. They found mean A wave to be higher in pre-eclamptic compare to control. (0.63$\pm$0.12 v/s 0.57$\pm$0.11 m/sec).

Rizwana S et al 2011 [18] who assessed cardiovascular hemodynamics in pre-eclamptic women and reported that the E velocity, A velocity and E/A ratio were higher in pre-eclampsia.

Tangeda P et al 2015 [19] they studied the maternal left ventricular systolic and diastolic functions in 15 pre-eclamptic and 15 normotensive. They found E/A ratio was higher in pre-eclamptic. (1.40$\pm$0.3 v/s 1.18$\pm$0.5).

In our study we found that mean IVRT to be higher in study group as compare to control group (77.90$\pm$13.84 v/s 75$\pm$15.50) which confirms the reports of Dennis et al 2013. [8]

The results of our study were also supported by Kim MJ et al 2016 [20] who studied that echocardiographic assessment of structural and hemodynamic change in hypertensive disorder related pregnancy. They found E' in pre-eclamptic was 7.9$\pm$2.4 cm/sec and 9.2$\pm$2.2 cm/sec in control group.

Conclusion

This study show a significant cardiovascular dynamic changes in pre-eclampsia which can be evaluated by echocardiography. To identify high risk women who are prone to developing cardiovascular complication later in life timely underwent echocardiography.

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