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Original Research Article

A study on echocardiography findings in severe pre-eclampsia and their maternal and fetal outcome

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ABSTRACT

Background: Pre-eclampsia includes elevated blood pressure after 20 weeks of gestation with proteinuria. It constitutes the major reason behind maternal mortality in developing countries. It is one of the major reasons of maternal mortality and morbidity having greater effect on fetal morbidity and mortality also. The objectives of the study were to study the echocardiography changes in severe pre-eclampsia; to determine the left ventricular (LV) dysfunction in pre-eclamptic women by measuring the LV systolic and diastolic indices using echocardiography; to compare normal and abnormal ECHO findings in severe pre-eclampsia in terms of maternal and perinatal outcome.
Methods: Prospective observational study conducted in department of obstetrics and gynaecology, Government Theni medical college from August 2019 to October 2020 to study normal and abnormal echocardiography changes in severe pre-eclamptic patients and to study maternal and fetal outcome in those two groups.
Results: LV systolic function was within normal limits in our control and study group population of severe pre-eclampsia. Statistically significant LV diastolic dysfunction was seen Pulmonary edema and cardiac failure did not occur in any patient of our study population.
Conclusions: From our study of ECHO in severe pre-eclampsia patients we came to a conclusion that left ventricular dysfunction occurs in many of the patients with severe pre-eclampsia and identification of diastolic dysfunction at an early stage could be of much use in preventing the complication which can arise due to the cardiac problems.

Keywords: Pre-eclampsia, Maternal mortality, ECHO, Pulmonary hypertension, Foetal outcome

INTRODUCTION

Pregnancy is a beautiful voyage with birth of two lives (baby and rebirth of mother). If affected by pre-eclampsia, it is a journey through a ring of fire. It constitutes one among the member of deadly triad of haemorrhage and infection. One of the most common medical disorders in pregnancy is pre-eclampsia with the incidence being 2-7%.[1] Pre-eclampsia is a disorder specific to pregnancy. It is a multisystem disorder of unknown etiology. Pre-eclampsia includes elevated blood pressure after 20 weeks of gestation with proteinuria. It constitutes the major reason behind maternal mortality. In developing countries, it stands next to anemia as the major reasons of maternal mortality and morbidity. It also has greater effect on fetal morbidity and mortality. Cardiac failure and pulmonary edema are more common in pre eclamptic women compared to others. Even women with no cardiac diseases develop pulmonary edema, when they have pre-eclampsia. Pre-eclampsia also predisposes to peripartum cardiomyopathy and they also have a future risk of developing cardiac problems.

Systolic and diastolic dysfunction both occurs in pre-eclampsia. Systolic dysfunction follows diastolic dysfunction.[2,3]

If cardiac dysfunction severity could be identified in early pregnancy, it may be possible to prevent progression of the problem. It also saves the mother from morbidity due to the cardiac problem.[4] In preeclampsia, cardiovascular system disturbances are related to increased cardiac after load caused by hypertension which leads to reduced cardiac output.[5] Cardiac preload is affected by diminished hypervolemia of pregnancy. Extravasation of intravascular fluid into extracellular space by decrease in oncotic pressure from a low serum albumin concentration leads onto pulmonary oedema.[6]

Cardiovascular disturbances are common in preeclampsia syndrome.[7] These are related to: greater cardiac afterload caused by hypertension; cardiac preload, reduced by diminished volume expansion during pregnancy; endothelial activation which leads on to inter endothelial extravasation of intravascular fluid into the extracellular space mainly to lungs.

In women with pre-eclampsia, diastolic dysfunction is present in 40 to 45 percent.[8] With this dysfunction, ventricles cannot properly relax and fill properly. In some of these women, functional differences may persist up to 4 years after delivery. Ventricular remodelling leads onto diastolic dysfunction which occurs as an adaptive response to maintain normal contractility in women of preeclampsia with increased afterload.[9]

Aims and objectives

The aims and objectives of this study were to study the echocardiography changes in severe pre-eclampsia; to determine the LV dysfunction in pre eclamptic women by measuring the left ventricular systolic and diastolic indices using echocardiography; to compare normal and abnormal ECHO (echocardiography) findings in severe pre-eclampsia in terms of maternal and perinatal outcome.

METHODS

This study was a observational and prospective one carried out in department of obstetrics and gynaecology, Government Theni medical college, Tamil Nadu, India for one year period between August 2019 to October 2020. It was a comparitive study between normal and abnormal ECHO changes in severe pre-eclampsia and maternal and fetal outcome in those two groups.

The study population included pregnant women with severe pre-eclampsia with normal ECHO as one group and abnormal ECHO as other group. 100 cases of severe pre-eclampsia with 50 cases having normal ECHO and 50 cases showing abnormal findings in ECHO were considered.

Inclusion criteria

Pregnant women with systolic BP >160 mmhg and diastolic BP >110 mmHg with proteinuria, patients with imminent symptoms or eclampsia were included in the study.

Exclusion criteria

Antenatal patients with chronic hypertension, connective tissue disorders, vascular disorders, kidney disease, anemia, known cardiac disease, gestational diabetes and APLA syndrome were excluded from the study.

In this study, there were 2 study groups. One group of patients with severe pre-eclampsia with abnormal ECHO finding compared with other group of patients of severe pre-eclampsia with normal ECHO findings. We had admitted all patients diagnosed to have severe pre-eclampsia. Routine workup done with blood investigations of complete blood count, to look for platelet count, liver function test, renal function test, urine examination for proteinuria, ophthalmic evaluation of fundus done. Patients admitted with severe pre-eclampsia with systolic BP more than 160 mmHg, diastolic BP more than 110 mmHg, with or without imminent symptoms or elevated serum creatinine or platelet count less than 1 lakh or fetal growth restriction or pulmonary edema or deranged liver function had a screening ECHO done. Patient who had changes in ECHO were given special concern and monitored for their maternal and neonatal outcome.

RESULTS

Out of 100 cases admitted in our hospital with severe pre-eclampsia, 50 patients had ECHO changes while 50 patients had normal ECHO, their maternal and fetal outcomes were studied. There was no statistical significance between age, parity, gestational age, body mass index, between the two groups, thus the two groups were comparable. Systolic function as determined by ejection fraction was found to be normal between the two study groups. Both study and control group had significant difference in the diastolic function. Out of total 100 cases, 50 of our patients had diastolic dysfunction.

Table 1: Correlation of maternal age with ECHO.

Age	Normal ECHO	Abnormal ECHO
Mean	25.74	25
t value	0.879	
P value	0.381 not significant	

In our study, with 50 patients of severe pre-eclampsia having significant ECHO changes, 46 had grade I diastolic dysfunction, 4 had grade II diastolic dysfunction. None had diastolic dysfunction greater than grade 2 in our study. Out of 50 patients with changes in ECHO, 7 patients had abruptions, 9 patients had eclampsia, HELLP and AKI occurred in 3 and 5 patients respectively. Neonatal outcome was not statistically significant between the two groups. Patients with changes in ECHO had more of LBW babies compared to patients with normal ECHO. Most of

the patients with the echo changes were identified at the gestational age >35 weeks.

Table 2: Correlation between gestational age of foetus with maternal ECHO.

Gestational age (years)	Normal ECHO	Abnormal ECHO
<30	10	8
31-35	19	20
>35	21	22
Mean	34.14	34.42
t value	-0.411	
P value	0.682	

Table 3: Relationship of mode of delivery with diastolic dysfunction in ECHO.

S. No.	Mode of delivery	Abnormal ECHO parameter	
		Grade 1-DD (46)	Grade 2-DD (4)
1.	Labour natural	19	1
2.	LSCS	27	3

Table 4: Correlation between imminent symptoms and ECHO findings.

Imminent symptoms	Normal ECHO	Abnormal ECHO
Yes (n=15)	9	6
No (n=85)	41	44
Chi square value	2.773	
P value	0.597 not significant	

Table 5: Relationship between systolic blood pressure and ECHO.

Systolic BP	Normal ECHO	Abnormal ECHO
<160	31	41
>160	19	9

Table 6: Relationship between diastolic blood pressure and ECHO.

Diastolic BP	Normal ECHO	Abnormal ECHO
<110	45	50
>110	5	0

There was an increase in the number of caesarean sections in patients with abnormal ECHO. We also had 9 of our patients with abnormal ECHO findings admitted in IMCU. We did not have any of the patient progressing to pulmonary oedema and cardiac failure. By early identification of the patients with diastolic dysfunction with echo cardiography helped us prevent the occurrence of lethal complications like pulmonary oedema and cardiac failure. Most of our patients with abnormal echo with grade 2 diastolic dysfunction had a stormy postoperative period. All the 4 patients of diastolic dysfunction had IMCU admission. 3 of the 4 patients with grade 2 diastolic dysfunction had caesarean section. 3 out of 4 patients had LBW babies. Out of 46 patients with grade 1 diastolic dysfunction, 27 had caesarean section, 5 patients had IMCU admission. 22 patients had LBW babies. The mean birth weight in normal echo was 2.43 and in the abnormal ECHO was around 2.08.

Table 7: Mean values in ECHO findings.

S. No.	Findings	Normal ECHO	Abnormal echo	P value
1.	E/A	0.866	0.776	<0.001
2.	Deceleration time	184.4	266.1	<0.001
3.	E/e'	7.98	9.92	<0.001
4.	Peak TR velocity	2.486	2.658	<0.001
5.	IVRT	92.66	132.38	<0.001
6.	EF	67.98	68.28	0.809

In our study E/A ratio of mitral valve early peak velocity to late peak velocity was significantly reduced in patients with abnormal ECHO findings. Deceleration time was prolonged in patients with abnormal ECHO findings. IVRT was significantly prolonged in patients with abnormal ECHO. But all patients had LVEF above 50%. There was no significant difference between LVEF in both subsets. Mean IVRT in patients with normal ECHO was 92.66 and in those with abnormal ECHO was 132.88. Deceleration time was also prolonged significantly in patients with abnormal ECHO 266.1.

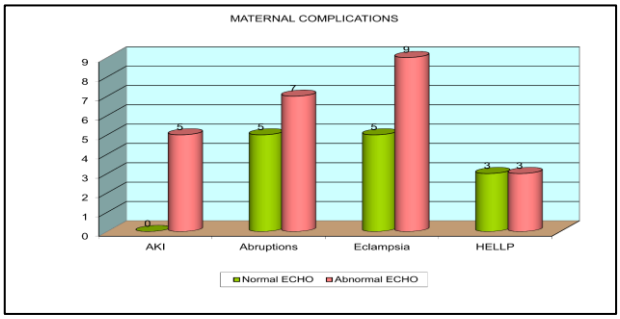

Figure 1: Maternal complications.

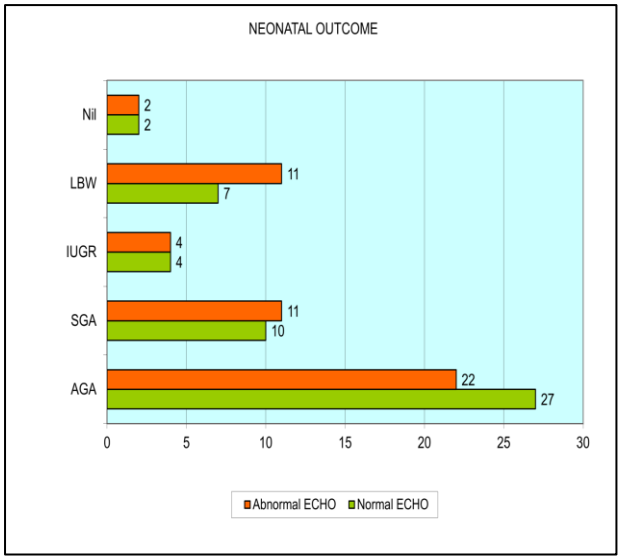

Figure 2: Neonatal outcome.

DISCUSSION

In our study, with 50 patients of severe pre-eclampsia having significant ECHO changes, 46 had grade I diastolic dysfunction, 4 had grade II diastolic dysfunction. None had diastolic dysfunction greater than grade II in this study. This was comparable with study by Pan et al Melchoirre.[9,10] Out of 50 patients with changes in ECHO in the severe pre-eclampsia, 7 of the patients had abruptions, 9 patients had eclampsia, HELLP and AKI in 3 and 5 patients respectively. Neonatal outcome was not statistically significant difference between the two groups. Patients with changes in ECHO had more of LBW babies compared to patients with normal ECHO. Most of the patients with the ECHO changes were identified at the gestational age >35 weeks. Even though there was a diastolic dysfunction, systolic function was not affected in our patients. Studies by Tyldum had similar findings.[11]

There was an increase in the number of caesarean sections in patients with abnormal ECHO. We also had 9 of our patients with abnormal ECHO findings admitted in IMCU. We did not have any of the patient progressing to pulmonary oedema and cardiac failure. By early identification of the patients with diastolic dysfunction with echo cardiography helped us prevent the occurrence of lethal complications like pulmonary oedema and cardiac failure. Most of our patients with abnormal echo with grade II diastolic dysfunction had a stormy postoperative period. All the 4 patients of diastolic dysfunction had IMCU admission. 3 of the 4 patients with grade II diastolic dysfunction had caesarean section. 3 out of 4 patients had LBW babies. Out of 46 patients with grade I diastolic dysfunction, 27 had caesarean section, 5 patients had IMCU admission. 22 patients had LBW babies. The mean birth weight in normal echo was 2.43 and in the abnormal echo was around 2.08.

In our study E/A ratio of mitral valve early peak velocity to late peak velocity was significantly reduced in patients with abnormal ECHO findings. Deceleration time was prolonged in patients with abnormal ECHO findings. IVRT was significantly prolonged in patients with abnormal ECHO. But all patients had LVEF above 50%. There was no significant difference between LVEF in both subsets. Mean IVRT in patients with normal ECHO was 92.66 and in those with abnormal ECHO was 132.88. This was similar to study by Chaitra et al.[12] Deceleration time was also prolonged significantly in patients with abnormal ECHO 266.1. studies by Valensise et al and Solanki et al.[13,14]

CONCLUSION

LV systolic function was within normal limits in our control and study group population of severe pre-eclampsia, statistically significant LV diastolic dysfunction was seen pulmonary edema and cardiac failure did not occur in any patient of our study population. ECHO is a valuable screening tool in the pre eclamptic patients to diagnose the diastolic dysfunction at an early stage and thus prevent the progression of the cardiac problem in those patients. The major cause of mortality and morbidity in pregnant women is the cardiac problems, which can be prevented by a screening ECHO. From our study of ECHO in severe pre-eclampsia patients we came to a conclusion that left ventricular dysfunction occurs in many of the patients with severe pre-eclampsia and identification of diastolic dysfunction at an early stage and correlates with disease severity and adverse outcome. LV diastolic dysfunction in severe pre-eclampsia patients can lead to complications like pulmonary edema. Early identifications of these complication by this simple non invasive tool can also help us prevent maternal mortality and morbidity due to severe pre-eclampsia. With increasing incidence of pr-eclampsia in recent times, ECHO can be used as one of the basic investigational tool to identify the pathologic changes in the heart and thus by prevent the maternal mortality and morbidity. Long term cardiac complications are to be followed up in these patients with diastolic dysfunction.

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