

**Original research article****Left ventricular dysfunction in preeclampsia: An echo cardio-graphic study****<sup>1</sup>Dr. Backialakshmi P, <sup>2</sup>Dr. J Srimathi, <sup>3</sup>Dr. Sujatha K, <sup>4</sup>Dr. Vilva Priya S**<sup>1</sup>Senior Resident, Department of OBG, Government Kilpauk Medical College Hospital, Chennai, Tamil Nadu, India<sup>2,3,4</sup>Associate Professor, Institute of Obstetrics and Gynecology, Madras Medical College, Chennai, Tamil Nadu, India**Corresponding Author:**

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**Date of submission:** 20-02-23**Date of acceptance:** 26-02-23**Abstract**

**Introduction:** Cardiac dysfunction is a predominant complication of hypertensive disease complicating pregnancy especially affecting left ventricular systolic and diastolic function example Ejection fraction, Fractional shortening, E/A ratio, Isovolumetric relaxation time, Deceleration time. These changes usually return to normalcy after delivery by six weeks postpartum in Normotensive patients. **Aim:** To study the cardiac function in preeclamptic pregnant women by transthoracic echo in comparison with normal pregnant women in 32-38 weeks of gestation. **Methodology:** This is a prospective observational study conducted in government institute of obstetrics and gynecology hospital Egmore, Chennai and government ISO Kasthurba Gandhi hospital Chennai in 125 pregnant women and 125 preeclamptic women. The study subjects underwent echo at 32 38 weeks by using parameters such as ejection fraction I, factional shortening isovolumetric relaxation and deceleration time. This study also evaluated bmi, age, gestational age blood pressure and time of delivery. All preeclamptic patients were followed up to 6 weeks postpartum with echocardiography.

**Results:** The average values of the following parameters were high in preeclamptic women as compared to normotensive controls. BMI in preeclampsia women 28.71 +/- 4.89 and in Normotensive 27.9 +/- 2.9 (with p value 0.13). Fractional shortening was 28.5 +/- 2 in preeclamptic women and in Normotensive 33.26 +/- 1.62 with P value <0.01. Isovolumetric relaxation time was in 126.02 +/- 58.6 in preeclamptic women and in Normotensive 99.76 +/- 4.66 with P value <0.001. Deceleration time was in 230.06 +/- 17.23 in preeclamptic women and in Normotensive 203.34 +/- 6.74 with P value<0.001. All echo values were highly significant. **Conclusion:** Echocardiograph was rarely performed on all preeclamptic pregnant patients in developing countries like India. By performing echo on preeclamptic patients we will be able to detect left ventricular dysfunction early, start treatment, prevent complications and reduce morbidity and mortality. This study shows that echocardiography is extreme valuable and should compulsorily be made a part of all antenatal investigations.

**Keywords:** Echocardiography, pregnancy, ventricular dysfunction, preeclampsia

**Introduction**

Preeclampsia is one of the most frequent and potentially life-threatening complications of pregnancy. It is a multi-organ syndrome that affects 8% to 10% of pregnancy and it is the primary cause for maternal mortality and morbidity and it is the most important cause of preterm delivery <sup>[1]</sup>.

Despite normalization of the maternal vascular disturbances after birth, it has become obvious that formerly preeclamptic women experience an increased risk to develop cardiovascular and kidney disease later in their life. Given the connections between preeclampsia and long-term complications, preeclampsia is recognized as woman-specific risk factor for cardiovascular disease <sup>[2]</sup>.

Cardiac dysfunction is a predominant complication of hypertensive disease complicating pregnancy especially affecting left ventricular systolic and diastolic function example Ejection fraction, Fractional shortening, E/A ratio, Isovolumetric relaxation time, Deceleration time. These changes usually return to normalcy after delivery by six weeks postpartum in Normotensive patients.

**Aims and Objectives**

To study the cardiac function in preeclamptic pregnant women by transthoracic echocardiography and to compare these features with normal pregnant women, belonging to 32 to 38weeks of gestation, follow-up Echocardiography was done in all preeclamptic patient sat 6th week postpartum.

The study results may form the basis to decide if echo may be incorporated into routine antenatal screening especially in preeclamptic patients with respect to their long-term cardiac morbidity and associated mortality.

## Materials and Methods

This study was conducted in Govt. Institute of Obstetrics and Gynaecology Hospital Egmore, Chennai and Govt. ISO-Kasthurba Gandhi hospital, Chennai over a period of 1 year from April 2019 to March 2020. In this study, I assigned and categorized the patients into two groups. There was no statistical difference between both the groups.

## Study design

This is a proposed prospective observational study consisting of two groups of patients: Group 1-125 Preeclamptic pregnant patients and Group 2-125 normotensive pregnant women. Both the above groups of patients under went echo cardiography in third trimester to study the left ventricular function by using parameters such as Ejection Fraction, Fractional Shortening, E/A ratio, Isovolumetric relaxation time and Deceleration time. This study also analysed mode of delivery, gestational age at the time of delivery and birth weight of new born. All preeclamptic patients were followed upto 6 weeks of postpartum and echo cardio graphy was performed at 6th week of postpartum.

## Inclusion criteria

- Pregnant women between age group of 20 and 35 years with systolic BP $\geq$ 140mm Hg and diastolic BP $\geq$ 90mm Hg that develops after 20 weeks of gestation period confirmed by frequent examination of at-least 4 hours apart with proteinuria of trace to 2+ or spot PCR $>$ 0.3.
- Pregnant women in gestational age starting from 32 to 38 weeks as determined by LMP and dating scan.
- No previous history of (H/O) essential hyper tension.
- No other known medical disorders complicating this pregnancy.

## Exclusion criteria

- Any previous history of hyper tension.
- Recurrent gestational hypertension.
- Women with other medical disorders of pregnancy.

O (chronic hypertension, diabetes mellitus, Anemia, cardio respiratory disease, renal disease, connective tissue disorders).

- Pregnant women in labour.

## Group 2

Normotensive Pregnant women 125 cases, between age group of 20 and 35 years.

## Study protocol

- Clinical history was recorded in detail for all patients.
- Data collection included Age, educational status, Parity, maternal weight, height and body mass index.
- Blood pressure was recorded using conventional sphygmomanometer.
- Obstetric examination was performed and Ultra-sonogram was done for all patients and all the information are documented for both the groups.
- Urine for proteinuria measurement was done in both the groups using dipstick method.
- ECG and other relevant blood investigations were done in both the groups.
- Echo cardio graphy was performed in all patients in the third trimester and repeated in preeclamptic patients 6week postpartum.

## Study Observation and Results

A total of 250 subjects were recruited to the study divided into two groups Group I served as Preeclamptic pregnant women 125 subjects and Group II Normotensive pregnant women 125 subjects in each group. There was no statistical difference in groups.

**Table 1:** Comparison of mean age between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
Age in years (Mean ± SD)	27.62 ±3.38	27.90 ±2.99	0.489(NS)

NS-Non significant

The age distribution was compared between two groups. There was no statistical difference between two groups.

**Table 2:** Comparison of mean weight between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
Weight	71.78 ± 10.36	72.11 ± 10.71	0.801(NS)

NS-Non significant

There was no statistical difference between groups with regard to mean weight.

**Table 3:** Comparison of mean height between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
Height	158.49±5.86	156.28±5.88	0.003

HS-Highly significant

Table 3. There was statistical difference between groups p=0.003 which is statistically significant.

**Table 4:** Comparison of mean BMI between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
BMI	28.71 ±4.89	29.70 ±5.42	0.131(NS)

NS-Non-significant.

The study participants had average BMI 28.71 ± 4.89 in Preeclamptic group and 29.70 ± 5.42 in normal group. There was no statistical difference between groups.

**Table 5:** Comparison of mean systolic blood pressure between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
SBP	158.22±9.85	114.14±5.41	<0.001(HS)

HS-Highly significant

The systolic BP comparable in two groups, with a P value <0.001 which is statistically highly significant.

**Table 6:** Comparison of mean diastolic blood pressure between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive(N=125)	
DBP	103.84± 6.434	71.41 ±3.31	<0.001

HS: Highly significant

The diastolic BP comparable in two groups, with a p value <0.001 which is statistically highly significant.

**Table 7:** Comparison of mean blood pressure between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
SBP	158.22±9.85	114.14±5.41	<0.001
DBP	103.84±6.434	71.41 ±3.31	<0.001

HS: Highly Significant

There was increased blood pressure observed in preeclamptic patients both systolic and diastolic. There was statistically significant increase in systolic and diastolic BP between pre eclamptic and normal groups with a p value systolic (<0.001) and diastolic (<0.001). Statistically highly significant.

**Table 8:** Comparison of mean EF (Ejection Fraction) between two groups (N=250)

Systolic	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
EF	55.53 ±4.94	67.66 ±3.13	<0.001

HS-Highly significant

The comparison between preeclamptic and normal group with regards to mean EF was statistically highly significant p value <0.001.

**Table 9:** Comparison of mean FS (Fractional Shortening) between two groups (N=250)

Systolic	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
FS	28.55 ±2.60	33.26 ±1.62	<0.001

HS-Highly significant

The comparison between preeclamptic and normal group was statistically highly significant P value <0.001.

**Table 10:** Comparison of mean systolic Function between two groups (N=250)

Systolic function	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
EF	55.53 ±4.94	67.66 ±3.13	<0.001
FS	28.55 ±2.60	33.26 ±1.62	<0.001

HS-Highly Significant

The comparison between preeclamptic and normal group was statistically highly significant P value <0.001.

**Table 11:** Comparison of mean E/A ratio between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
E/A Ratio	0.91 ±0.15	1.39 ±0.25	<0.001

HS-Highly Significant

The comparison between preeclamptic and normal patients was statistically significant. The P value in E-wave/A-waveratiowas < 0.001.

**Table 12:** Comparison of mean IVRT between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
IVRTmsec	126.02± 15.60	99.76 ±4.66	<0.001(HS)

HS: Highly Significant

The IVRT (Isovolumetric relaxation time) difference between preeclamptic and normal group was statistically highly-significant p <0.001.

**Table 13:** Comparison of mean DT (Deceleration time) msec between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
DTmsec	230.06± 17.23	203.34±6.74	<0.001(HS)

HS: Highly Significant.

The comparison between preeclamptic and normal group was statistically highly-significant p<0.001.

**Table 14:** Comparison of mean diastolic function between two groups (N=250)

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
E/ARatio	0.91 ±0.15	1.39 ±0.25	<0.001(HS)
IVRTmsec	126.02±15.60	99.76 ±4.66	<0.001(HS)
DTmsec	230.06±17.23	203.34±6.74	<0.001(HS)

HS: Highly Significant.

The comparison between pre-eclamptic and normal group was statistically highly-significant P value<0.001.

### Final analytic data

Parameter	Group		P value
	Preeclampsia (N=125)	Normotensive (N=125)	
Age in years (Mean ± SD)	27.62 ±3.38	27.90 ±2.99	0.489(NS)
BMI (Mean ± SD)	28.71 ±4.89	29.70 ±5.42	0.131(NS)
SBP (Mean ± SD)	158.22±9.85	114.14±5.41	<0.001(HS)
DBP (Mean ± SD)	103.84±6.434	71.41 ±3.31	<0.001(HS)
EF (Mean ± SD)	55.53 ±4.94	67.66 ±3.13	<0.001(HS)
FS (Mean ± SD)	28.55 ±2.60	33.26 ±1.62	<0.001(HS)
E/A Ratio (Mean ± SD)	0.91 ±0.15	1.39 ±0.25	<0.001(HS)
IVRTmsec (Mean ± SD)	126.02±15.60	99.76 ±4.66	<0.001(HS)
DTmsec (Mean ± SD)	230.06±17.23	203.34±6.74	<0.001(HS)
Primi N (%)	78(62.4%)	79(63.2%)	0.896(NS)
Multi gravid N (%)	47(37.6%)	46(36.8%)	

NS-Non-Significant, S-Significant, HS-Highly Significant.

### Discussion

This study shows that echo cardio graphy performed on preeclamptic patients indicate significant changes in left ventricular systolic and diastolic function. For example, it was discovered that the parameters such as Ejection Fraction, Fractional Shortening and E/A ratio were reduced while Isovolumetric Relaxation Time (IVRT) and Deceleration time (DT) were increased in preeclamptic patients. Echo cardiography done at 6th week of postpartum for pre-eclamptic patients showed all affected parameters were returning to normal except for seven patients. These seven patients are likely to develop chronic left ventricular dysfunction in future. Blood Pressure measurement and echo cardio graphy should be done regularly for these patients, followed by medical management to prevent their future pregnancies getting

complicated by hypertension induced left ventricular dysfunction. Rizwana *et al.* (2011) <sup>[3]</sup> confirmed in a study that physiological changes in LV structure and function during normal pregnancy were exaggerated in preeclampsia during third trimester. ClinInvestetal. (1975) <sup>[4]</sup> reports preeclampsia causes chronic left ventricular (LV) pressure overload and that subsequently results in wall thickening and concentric hypertrophy. Melchiorre *et al.* (2011) <sup>[5]</sup> says preeclampsia induced left ventricular hypertrophy is typically asymmetrical, predominantly affecting the basal antero septum. Wietske *et al.* (2010) <sup>[6]</sup> reports from HTRAS (hyper tension risk assessment study), women who experience hypertensive disorders in late pregnancy may likely have cardio vascular event risks for 10 years. Clin Sci *et al.* (2016) <sup>[7]</sup> says that preeclampsia causes a two-fold increased risk of long-term cardio vascular disease (CVD) Recognizing preeclampsia as a risk factor for CVD lets identification of a young group of women at high risk of developing cardio vascular. For this reason, current guide lines recommend echo cardio graphy screening and treatment for pregnant women with history of preeclampsia. This present study also confirms that significant left ventricular systolic and diastolic dysfunction were present in preeclamptic pregnant women as was reported in the studies quoted above.

### Conclusion

In developing countries, like India, echo cardio graphy was rarely performed on all preeclamptic pregnant patients. By performing echo cardio graphy on preeclamptic patients, we will be able to detect the left ventricular dysfunction early and be able to start the treatment well in advance, to prevent complications and reduce morbidity and mortality in a group of young and socially productive women who are very valuable for the family and society.

### References

1. Clin Exp Hypertens. 1997 Jul-Aug;19(5-6):713-26. Doi: 10.3109/10641969709083181.
2. The renin-angiotensin-aldosterone system in pre-eclampsia MA Brown1, Wang J, JAWH it worth Affiliations expand PMID: 9247750 DOI: 10.3109/10641969709083181.
3. Adv. Exp. Med. Biol. 2018;1065:455-470. Doi: 10.1007/978-3-319-77932-4\_28. Cardio vascular Sequels During and After Preeclampsia Nina D Paauw1, A Titia Lely 2 Affiliations expand PMID: 30051401. DOI: 10.1007/978-3-319-77932-4\_28.
4. The Journal of Obstetrics and Gynecology of India. 2011 Sep-Oct;61(5):519-522. DOI 10.1007/s13224-011-0084-x Echocardiographic Assessment of Cardiovascular Hemodynamics in Preeclampsia Solanki Rizwana • Maitra Nandit J Clin Invest. 1975 Jul;56(1):56-64. Doi: 10.1172/JCI108079PMCID:PMC436555PMID:124746
5. Wall stress and pattern so hypertrophy in the human left ventricle. W Grossman, D Jones and LPMC

Laurin.

6. Melchiorre K, Sutherland GR, Baltabaeva A, Liberati M, Thilaganathan B. Maternal cardiac dysfunction and remodeling in women with preeclampsia at term. *Hypertension*. 2011;57:85-93.
7. 10-Year cardiovascular event risks for women who experienced hypertensive disorders in late pregnancy: the Hy-RAS study. Wietske Hermes, Arie Franx, Maria G Van Pampus, Kitty W Bloemenkamp, Joris A van der Post, Martina Porath, Gabrielle Ponjee, Jouke T Tamsma, Ben W Mol & Christianne J de Groot.
8. *Clin. Sci. (Lond.)*. 2016 Feb;130(4):239-46. Doi: 10.1042/CS20150567.
9. Long-term renal and cardiovascular risk after preeclampsia: towards screening and prevention. Nina D Paauw 1, Kim Luijken 2, Arie Franx 2, Marianne C Verhaar 3, A Titia Lely 2. Affiliations expand. PMID: 26769659. DOI: 10.1042/CS2015056.