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Correlation between the posterior left ventricular wall thickness and relative wall thickness with global longitudinal strain (gls) in women with preeclampsia

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ABSTRACT **Background:** Pregnancy outcomes for mothers, fetuses, and newborns are impacted by hypertensive diseases, which affect 5–10% of pregnancies. One of the main causes of pregnancy-related morbidity and mortality is hypertensive disorders of pregnancy (HDP). The effects of these diseases are extensive and go much beyond conception and the first few months after giving birth. According to the American Congress of Obstetricians and Gynecologists' (ACOG) standards, hypertensive disorders during pregnancy can be divided into four categories: gestational hypertension, preeclampsia, chronic hypertension, and chronic hypertension with preeclampsia superimposed [1]. High blood pressure and protein in the urine are signs of preeclampsia, which develops after week 20 of pregnancy. A condition known as preeclampsia can endanger the lives of both the mother and the fetus during pregnancy. Studies have demonstrated how preeclampsia directly affects several cardiac functioning indices as well as left ventricular mass (LV mass). **Aim of study:** This study aims to evaluate the correlation between posterior wall thickness (PWT) of LV and relative wall thickness (RWT) with global longitudinal strain (GLS%) in preeclampsia by conventional and advanced echocardiographic modalities. **Method:** A cross sectional study of total number 50 pregnant ladies with preeclampsia Our study reported from 2023 to 2024, at AL-Hussain teaching hospital. Two-D conventional echocardiography, Tissue Doppler Imaging and Global longitudinal strain (GLS%) by speckle-tracking echocardiography had been performed. Statistical data analysis of correlation was done and the significance value was <0.05). **Results:** There is a significant correlation between the GLS% and PWT among preeclamptic women. (N=50, r=0.7, p=0.0001) as well as between the GLS % and RWT among preeclamptic women. (N=50, r=0.3, P=0.03). **Conclusion:** the study concluded a significant correlation between GLS% with increasing in both PWT and RWT in preeclamptic women.

KEYWORDS Preeclampsia, echocardiography, global longitudinal strain, posterior wall thickness and relative wall thickness

1. INTRODUCTION

Preeclampsia is a condition that can threaten maternal and fetal lives during pregnancy. Pregnancy outcomes for mothers, fetuses, and newborns are impacted by hypertensive diseases, which affect 5–10% of pregnancies [2]. One of the main causes of pregnancy-related morbidity and mortality is hypertensive disorders of pregnancy (HDP). The effects of these diseases are extensive and go much beyond conception and the first few months after giving birth.

According to the American Congress of Obstetricians and Gynecologists' (ACOG) standards, hypertensive disorders during pregnancy can be divided into four categories: gestational hypertension, preeclampsia, chronic hypertension, and chronic hypertension with preeclampsia superimposed [1].

One of the main causes of maternal and perinatal death globally is hypertensive disorders of pregnancy. A pregnancy condition known as preeclampsia, with or without severe symptoms, is characterized by new-onset hypertension and typically proteinuria. It usually manifests after 20 weeks of gestation and is often near term [3].

Preeclampsia has a long history. It is a major cause of maternal and perinatal morbidity and mortality worldwide, preceding complications ranging from eclampsia and stroke to fetal growth restriction, prematurity, and stillbirth.

The so-called classic triad of hypertension, proteinuria, and edema has been superseded with hypertension and organ dysfunction, be it renal, hepatic, hematological, neurologic, or placental, and it is now sufficient for a diagnosis [4]. Placental factors and maternal variables that will eventually result in microvascular damage interact to create maternal preeclampsia. Maternal endothelial dysfunction may be the cause of this. This can be treated expectantly until 37 weeks of gestation since maternal preeclampsia develops later in the gestation period. The placental perfusion is maintained because maternal preeclampsia, which develops in the latter

stages of pregnancy, results in little to no change in the arterial conversion [5].

Pregnant women's cardiovascular systems undergo a particular set of physiological changes. As systemic vascular resistance decreases and blood volume increases, which raises the venous preload. The LV wall thickens as a result of these hemodynamic alterations, and cardiac remodeling causes the LV to enlarge in size and volume. Nonetheless, during a typical pregnancy, the LV's systolic and diastolic functions hardly alter. Pregnancy success depends on these changes, but the heart may have to bear an extra strain [6].

There are studies that show the direct effects of preeclampsia on the left ventricular (LV) mass and other cardiac functional indices. PE is associated with adverse left ventricular (LV) remodeling in the peri- and postpartum periods, an independent risk factor for cardiovascular disease [7].

Echocardiography plays an important role to measure LV mass and function. The conventional echocardiography (2D-echocardiography) permit the calculations of LV internal dimension, posterior wall thickness at the end diastole, and interventricular septal, allow direct measurements of LV mass, and relative wall thickness (RWT) [8].

There is little research examining the use of echocardiography to assess cardiovascular risk of preeclampsia. The studies that have been conducted are limited by small sample sizes and have reported inconsistent results. Despite many reports of maternal heart compatibility, there are discussions about changes in the LV function. Nonetheless, evidence of increase in the size of the chambers, as well as the mass and the thickness of the LV wall, is inconsistent [9].

The aim of this study is to assess the correlation between relative wall thickness and posterior wall thickness of left ventricle with global longitudinal strain of left ventricle in preeclamptic pregnant ladies.

2. PATIENT SELECTION AND METHODOLOGY

This is cross-sectional study for 50 women with single fetus-pregnancies $\geq$ 20 weeks' gestation. Patients referred and diagnosed by cooperation with obstetricians. Exclusion criteria included: Smokers, women with history of chronic illness (as hypertension, diabetes mellitus, heart failure), women with undetermined gestational age. According to the diagnosis criteria of mild preeclampsia (which included elevated blood pressure $\geq$ 140/90 mmHg with 2 readings was at least 6hrs apart, proteinuria +2, with or without lower limb edema. Full history was obtained from all pregnant ladies. Clinical examination was performed recording HR and ABP. Maternal assessment was performed by a single examiner. The examination was done using echocardiography Device JE Vivid E9. Examination done by traditional echo to assess posterior wall thickness and left ventricular dimension, speckle tracking done to assess left ventricular global longitudinal strain.

2.1 Statistical Analysis

The data analysis were completed by means of SPSS version 26, correlational analysis were tested and statistical p-value was taken and when reached 0.05% was considered as significant.

3. RESULTS AND DISCUSSION

Figure **??** presents the correlation between left ventricular posterior wall thickness and left ventricular strain, while Figure **??** details the relationship between left ventricular relative wall thickness and left ventricular strain.

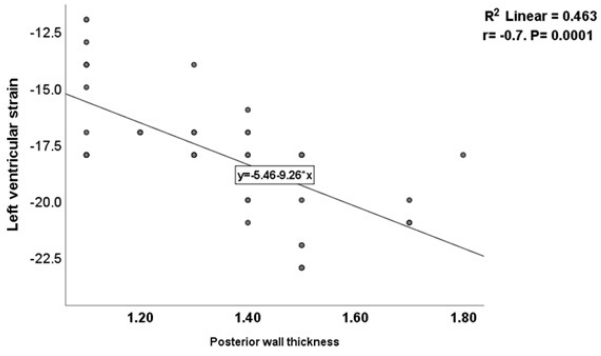

FIGURE 1. Correlation between left ventricular posterior wall thickness and left ventricular strain

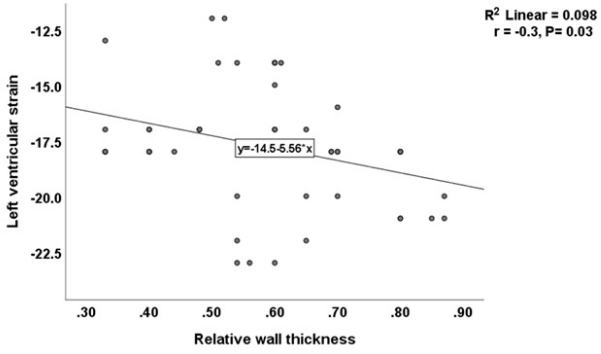

FIGURE 2. Corelation between lef ventricular relative wall thickness and left ventricular strain

The goal of the study was to use both traditional and advanced echocardiographic modalities to evaluate the relationship between left ventricular PWT and RWT with GLS in preeclampsia. The RWT and elevated PWT with changed GLS% were shown to be significantly correlated. Preeclampsia in some studies found to have an effect on left ventricular function which shown as decrease in strain as examined by speckle tracking echocardiography [10].

pregnancy-induced cardiac remodeling involves increased preload and altered myocardial mechanics, which could be relevant when analyzing parameters such as posterior LV wall thickness and relative wall thickness in preeclampsia [11].

It has been found that regardless of the presence of cardiovascular risk factors, such as chronic hypertension, preeclampsia was independently linked to left ventricular hypertrophy, and the prevalence of left ventricular hypertrophy was twice as high in women with a history of preeclampsia as in women from the general population [12].

There was no change in radial or circumferential strain between the nomal and preeclamptic pregnancies, their preeclamptic group had considerably reduced longitudinal global strain [13]. LV hypertrophy is one of the mechanical and functional changes in the myocardium brought on by the increased workload on the heart caused by increased blood pressure. Additionally exposure to pressure overload will result in a significant rise in relative wall thickness, which could be a sign of LV remodeling.

It is believed that an increase in cardiac left ventricular mass (LVM) and acorresponding increase in ventricular wall thickness result from the increase in circulation volume during pregnancy. Relative wall thickness (RWT) is an index of left ventricular (LV) concentricity. It is calculated as the ratio of LV wall thickness to the LV internal dimension at end diastole (LVDd). When the relative wall thickness is not increased, LVH is classified as eccentric. Eccentric remodeling differs from concentric remodeling, which is frequently observed in circumstances with pathologically high pressure load including pre-eclampsia. Concentric remodeling is indicated by an increased RWT and is defined by an increase in wall thickness without a corresponding increase in ventricular dimensions [14].

Other study found that myocardial deformation abnormalities preceded chamber dysfunction in this hypertensive disorder complicated pregnancy. Compared with late onset preeclampsia , women with early onset Preëclampsia demonstrated more remarkable cardiac damage [15].

According to the findings of some studies, pregnant women with term preeclampsia who showed only minor functional abnormalities on standard echocardiography also showed notable subclinical myocardial alterations on speckle tracking analysis [16].

Additionally, some research indicates that when connective tissue contents rise due to pressure over load, the LV longitudinal cardiac function is markedly reduced in the hypertrophied region [17]. However, another study found that the amount of the LV mass and pressure overload was independently correlated with decreased global longitudinal strain [18].

4. CONCLUSION

There was significant correlation between relative wall thickness posterior wall thickness with global longitudinal strain of left ventricle.

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