



A CASE CONTROL STUDY ON ECHOCARDIOGRAPHIC EVALUATION OF LEFT VENTRICULAR DIASTOLIC FUNCTION IN ANTENATAL WOMEN WITH PREGNANCY INDUCED HYPERTENSION (PIH) BEFORE AND AFTER DELIVERY

Cardiology

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ABSTRACT

Background: Pregnancy-induced hypertension (PIH) is a common cause of maternal and fetal mortality and morbidity. This study aims to evaluate left ventricular diastolic dysfunction using echocardiographic E/A and E/e' in antenatal patients. **Methods:** This is a case-control study conducted at the Government Chengalpattu Medical College Hospital. We studied 150 cases, 75 of which had PIH, and 75 of which were controls. Controls were both age and gestational age matched with cases. **Results:** The average E/A ratio of cases vs. controls in the third trimester, 2-4 days postpartum, and 6 weeks postpartum were 0.96 vs. 1.39, 1.24 vs. 1.45, and 1.3 vs. 1.42, respectively. Average E/e' values of cases vs. controls in the third trimester, 2-4 days, and 6 weeks postpartum were 7.9 vs. 6.4, 7.72 vs. 6.24, and 7.15 vs. 5.85, respectively. 17% had persistent diastolic dysfunction at 6 weeks postpartum. 9 out of 13 cases with severe pre-eclampsia went for peripartum cardiomyopathy (PPCM), and all of them had grade II LVDD before delivery. Among the 9 cases with PPCM, 7 were over the age of 33. **Conclusion:** There is a statistically significant relationship between the E/e' of cases and controls. E/e' and E/A are useful parameters to detect diastolic dysfunction in PIH patients. Careful evaluation, early diagnosis of PIH/LVDD, optimizing blood pressure levels, and follow-up may help reduce the future risk of heart failure/PPCM.

KEYWORDS

pregnancy, echocardiography, diastolic function, pregnancy-induced hypertension.

INTRODUCTION

Pregnancy-induced hypertension (PIH) is a new-onset hypertension after 20 weeks of gestation. PIH affects 5–8% of pregnant women [1]. Usually, cardiac output increases up to 20% by eight weeks of gestation [2]. Pre-eclampsia is a risk for future hypertension, stroke, and ischemic heart disease. [3]. The thickness and mass of the left ventricular wall is increased and there is remodeling changes in the heart [4]. Systolic dysfunction usually occurs after the diastolic dysfunction [5, 6]. There is risk of heart failure which is linked to preclinical left ventricular diastolic dysfunction and it is also a all-cause mortality predictor [8]. This study aims to evaluate left ventricular diastolic dysfunction using echocardiographic E/A and E/e' in antenatal patients with PIH (cases) before and after delivery, and compare it with controls.

METHODOLOGY

This is a case-control study done at the Government Chengalpattu Medical College Hospital on 150 antenatal women (75 cases and 75 controls). We assessed antenatal women with PIH (cases) and without PIH (controls) aged between 24 and 35 years for a period of 6 months. We included antenatal patients with and without PIH brought to the hospital during the study period. We excluded patients with hypertensive pregnancy disorders, known heart disease, rheumatoid arthritis, anemia, and renal disease complicating pregnancy.

We conducted the assessment once in the third trimester before delivery, twice in the next 2-3 days after delivery, and again at 6 weeks post-partum. Gestational hypertension is when high blood pressure (SBP $\geq$ 140 mmHg or DBP $\geq$ 90 mmHg) starts up for the first time at least 20 weeks into pregnancy without any new signs of end-organ dysfunction or proteinuria [8]. The controls were antenatal patients (age and gestational age-matched cases) who were brought to the hospital in the third trimester without PIH. We measured the pulse wave doppler mitral inflow velocities (E and A), tissue doppler mitral annulus velocities (e' and a'), and the E/A and E/e' ratios. We compared and analyzed the parameters of the cases with their corresponding age

and gestational age-matched controls.

Table 1 - Normal Parameters And Grading Of Left Ventricular Diastolic Dysfunction*

PARAMETER	NORMAL	GRADE I	GRADE II	GRADE III
Mitral E/A	>0.8	<0.8	>0.8 to < 2	> 2
Average E/e'	<10	<10	10-14	>14

RESULTS

150 cases (75 cases and 75 controls) were assessed during the study period. All the cases were age and gestational age matched with that of controls. The mean age was 28.12 for cases and 28.09 for controls. All 150 antenatal patients were primigravid and non-smokers. The average gestation at delivery was 36.2 weeks and 37.4 weeks. The mean birth weight in the cases and control group was 2.42 and 2.85 kgs respectively. Average heart rate in cases at third trimester, 2-4 days and 6 weeks postpartum (pp) were 94, 93 and 88.5 respectively. The average heart rate in the control group at third trimester, 2-4 days and 6 weeks postpartum were 84.2, 75.5 and 72.5 respectively. Left ventricular systolic function was preserved in all 150 patients.

Average E/A ratio of cases vs controls in third trimester, 2-4 days postpartum and 6 weeks post-partum were 0.96 vs 1.39, 1.24 vs 1.45 and 1.3 vs 1.42 respectively. Peak E trans mitral inflow velocity during early diastole decreased during 3rd trimester compared to controls and increased again in the postpartum period. Decline in Peak E trans mitral inflow velocity in cases correlated with increasing age ($p < .001$). Tissue doppler e' early diastolic velocity was decreased in the 3rd trimester and recovered postpartum while E/E' ratio was increased before delivery in third trimester and also recovered postpartum.

Before delivery at third trimester among 75 cases, 30.6% (N=23) had normal Left ventricular diastolic function, 69.4% (N= 52) had abnormal Left ventricular diastolic dysfunction (LVDD). Among cases with LVDD 52% (N=39) had grade I and 17% (N=13) had grade II LVDD. All the patients who had grade II LVDD had severe pre-eclampsia. No case had Grade III LVDD. Persistent LVDD was seen

in 13 patients (17%) at 6 weeks postpartum. 9 patients (12%) had persistent Grade II LVDD at 6 weeks postpartum [table – 2].

Table 2: Left Ventricular Diastolic Dysfunction In Cases And Controls

	Cases			Controls		
	Third trimester %	2-4 days pp %	6 weeks pp %	Third trimester %	2-4 days pp %	6 weeks pp %
Normal	31	40	83	100	100	100
Grade I	52	43	5	0	0	0
Grade II	17	17	12	0	0	0
Grade III	0	0	0	0	0	0

Table 3 - E/E' Values In All Three Assessments

	Cases E/e'	Control E/e'	p value
Third Trimester	7.9	6.4	p< .001
2-4 days postpartum	7.72	6.24	p< .001
6 weeks postpartum	7.15	5.85	p< .001

The mean E/e' of cases in the third trimester, 2-4 days, and six weeks postpartum were statistically significant ($p < .001$) compared to the corresponding controls [Table 3]. 13 cases had grade II left ventricular diastolic dysfunction. Nine patients (12%) out of 75 cases developed peripartum cardiomyopathy (PPCM). All patients had poor control of BP. Six out of nine patients with PPCM had poor drug compliance and had irregular follow-up. 7 out of 9 cases of PPCM were over 33 years old.

DISCUSSION

The controls were both age and gestational age matched with cases, so the mean age was 28.12 for cases and 28.09 for controls. In this study, mitral inflow peak E velocity decreased in the third trimester, but there was no significant change in the A wave compared to the control group. Compared to controls, the E/A ratio decreased in the third trimester. This is in agreement with studies by Tryfou et al. [10] and Lin et al. [11]. Zhu et al. [12] and Kimura et al. [13] found that increasing maternal age significantly affected the decline in diastolic function in cases with PIH. In hypertension, diastolic dysfunction generally occurs before systolic dysfunction can lead to heart failure or pulmonary oedema [14]. 12% of cases developed peripartum cardiomyopathy. All were over 30 years old and had poorly controlled blood pressures. Poor drug compliance and irregular follow-up were the most common (66.7%) causes of poor BP control. In 7 out of 9 cases with PPCM, the maternal age was over 33 years.

This study found that the TDI E' early diastolic velocity decreased in the third trimester compared to controls and recovered postpartum, whereas the E/E' ratio increased in the same trimester and also recovered postpartum. This is in agreement with the study by Tryfou et al. [10]. There was a statistically significant difference ($p < .001$) in the mean E/e' values between cases and controls in all corresponding groups, as seen in the study by Lin et al. [11].

CONCLUSION

There is a statistically significant relationship ($p < .001$) between the E/e' of cases and controls. E/e' and E/A are useful parameters to detect diastolic dysfunction in PIH patients. Therefore, we must closely monitor patients with PIH who have moderate diastolic dysfunction and an increased maternal age (33 years in this study) to prevent or intervene earlier in cardiovascular complications. Careful evaluation, early diagnosis of PIH/LVDD, optimizing blood pressure levels, and follow-up may help reduce the future risk of heart failure/PPCM.

Conflict of Interest – Nil

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