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EARLY DETECTION OF SUBCLINICAL LV DYSFUNCTION IN HYPERTENSIVE PATIENTS WITH MYOCARDIAL PERFORMANCE INDEX ON DOPPLER ECHO

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ABSTRACT:

INTRODUCTION: *Doppler echocardiography can detect early diastolic dysfunction, which is a risk factor for the development of heart failure and death, even in those who are not showing any symptoms.*

AIMS & OBJECTIVE: *To use the myocardial performance index on Doppler echo to detect early subclinical LV dysfunction.*

MATERIAL & METHODS: *This cross-sectional study was conducted in Gulab Devi Teaching Hospital, Lahore. Data collected after the approval from hospital's ethics committee. The research was divided into two groups, the first of which was made up of 50 healthy adult volunteers with normal echocardiograms and no cardiovascular issues. The second group included 45 people who were hypertensive and also had left ventricular diastolic dysfunction.*

RESULTS: *The mean age of the participants in the research was 50 + 5.3 years. Patients had an average age of 47.83 + 5.61 years.*

CONCLUSION: *Examinations of hypertensive individuals having normal ejection fraction using MPI with conventional pulsed-wave & tissue Doppler imaging demonstrated a high level of clinical agreement, and a high degree of diagnostic accuracy for detecting diastolic dysfunction.*

KEY WORDS: *Myocardial performance index, Doppler echocardiography, subclinical left ventricular dysfunction*

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INTRODUCTION

Doppler echocardiography has revealed that early diastolic dysfunction is a threat factor for heart failure and death, indeed in those who aren't flaunting any symptoms. The myocardial exhibition train (MPI) or Tei Record has been conceded in previous studies as the prognostic and movement marker for multitudinous heart affections since its original preface further than 10 times agony. The maturity of MPI studies, on the other hand, included actors who had both systolic and diastolic dysfunction.[1] The use of MPI in isolated LV diastolic dysfunction has entered fairly little published study.[2]

Hypertension affects a substantial portion of the population, with an estimated prevalence of 30% to 45%. Having high blood pressure substantially increases your risk of developing ischemic cardiovascular disorders including stroke, heart disease, and peripheral artery disease. There is no proof of a lower threshold, given that the risk of ICVD rises steadily with blood pressure. It's important to note that hypertension may cause damage to the heart, eyes, blood vessels, kidneys, and brain even in the absence of any symptoms.[3]

Between high blood pressure and severe ICVD, asymptomatic organ damage develops. The start of fulminant ICVD is signaled by asymptomatic cardiac organ deterioration. As a result, asymptomatic organ damage raises the likelihood of ICVD.[4] Hypertension and high blood pressure cause two distinct cardiac changes: left ventricular hypertrophy (LVH) and diastolic dysfunction. Although echocardiography has been shown to be beneficial in measuring patients' hypertensive risk, it is not recommended as the initial step in the diagnostic procedure.[5] The ideal echocardiographic marker for risk stratification in hypertension-related diseases would detect changes in the severity of hypertension and in LV geometry, enhance existing risk prediction models, and identify early cardiovascular impairment before asymptomatic heart organ damage develops. This is because the risk of ICVD rises with greater blood pressure and LVH.[6] The bulk of previously published echocardiographic studies produced inconsistent results on LV function due to variations in echocardiographic recordings and the distinctive left ventricular shape.[7] As a result, more dependable and operator-independent diagnostics for early ventricular dysfunction should be used. Previous research has demonstrated that, while tissue Doppler imaging can detect minor myocardial abnormalities, systolic functions, notably left ventricular ejection fraction (LVEF), frequently remain below safe values.[8, 9]

Rationale of this study is to find the subclinical LV dysfunction in hypertensive patients. In routine, LV dysfunction is an important factor to measure, so that early measures can be taken to prevent adverse events in hypertensive patients.

OBJECTIVE:

To discover the subclinical LV dysfunction in hypertensive patients with myocardial performance index on Doppler echocardiography.

MATERIALS & METHODS:

This cross-sectional survey was done at Gulab Devi Teaching Hospital, Lahore for 6 months from 01-09-2022 to 01-03-2023. The study was carried out after the permission from ethical review board. Sample size of 95 patients is calculated with 95% confidence level, 30% percentage of LV dysfunction in patients with hypertension and 9% margin of error. 3 Patients were enrolled by using non-probability, consecutive sampling who fulfilled selection criteria: patients of age 40 years and above, both genders, hypertensive and were divided in two groups. There were two groups of participants: Group I was made up of 50 healthy adult volunteers with no history of cardiovascular illness, and Group II was made up of 45 hypertension patients. Using a modified Simpson's technique, an extensive echocardiography was performed to calculate the left ventricular mass and ejection fraction. The apical four-chamber view was used to gather data on the mitral flux- haste pattern and towel Doppler imaging; the sample volume was put at the points of the mitral circulars and the septum and side sides of the mitral annulus. In addition, findings were computed after the data was dissected using the help of the Statistical Package for the Social Sciences, version 25.0.

RESULTS:

The mean age of the participants in the study was 50 ± 5.3 years in hypertensive groups. On average, the patients were 47.83 ± 5.61 years old in normotensive group. Diabetes lasts 2.5 to 5.61 years on average. This data set included 30 females and 20 males. The fasting glucose levels between the two groups were comparable. There was insignificant variation in both groups in terms of left atrial estimation, aortic root estimation, LV end-diastolic estimation, send off, and LV mass. In diabetics, there was a reduced augmentation of E' speed (12.12 ± 1.5 cm/sec vs. 16.07 ± 1.13 cm/s, p-value<0.0001), and a little augmentation of A' speed (p-value<0.0001) differed with control patients. Table 1

Stress exercise was positive in 46.7% cases and in 0% controls (P-value < 0.001). The functional capacity of heart in cases was poor in 8.9% cases and in 2% controls, but excellent in 11.1% vs. 50%

Table-1: Tissue Doppler Echocardiography Findings after a stress test.

Parameters	Case	Control	p-value
n	**50**	**45**	
E' (cm/sec)	12.12 ± 1.5	16.07 ± 1.13	<0.0001
A' (cm/sec)	12.35 ± 1.8	13.1 ± 1.2	0.018
E'/A'	0.89 ± 0.1	1.8 ± 1.2	<0.0001
S' (cm/sec)	10.22 ± 0.95	12.92 ± 1.2	<0.0001

Table-2: Stress exercise ECG in both groups

	Case	Control	Chi-square	p-value
Exercise ECG				
Positive	21 (46.7%)	0 (0%)	29.95	<0.0001
Negative	24 (53.3%)	50 (100%)		
Functional capacity				
Poor	4 (8.9%)	1 (2.0%)	39.60	<0.0001
Average	30 (66.7%)	5 (10.0%)		
Good	6 (13.3%)	19 (38.0%)		
Excellent	5 (11.1%)	25 (50.0%)		

Table 03: Doppler measurements were taken in both study groups (mean±SD).

	Case	Control	*P*
E wave (m/s)	0.77±0.16	0.62±0.14	<0.001
A wave (m/s)	0.47±0.09	0.82±0.15	<0.001
E/A ratio	1.67±0.36	0.76±0.10	<0.001
DT (ms)	164±17	250±38	<0.001
S septal (cm/s)	7.2±1.8	6.2±1.3	<0.001
e' septal (cm/s)	11±1.5	5.2±1.4	<0.001
a' septal (cm/s)	9.2±1.1	10.2±1.3	<0.001
e'/a' septal	1.1±0.24	0.51±0.12	<0.001
E/e' septal	7.5±1.7	13.6±4.1	<0.001
ET (ms)	308±19	308±27	0.98
IVRT (ms)	80±17	105±21	<0.001
ICT (ms)	35±17	32±19	0.51
PWD-MPI	0.37±0.08	0.45±0.11	<0.001
S lateral (cm/s)	11.2±2.1	9.2±2.3	0.006
e' lateral (cm/s)	15.1±3.1	8.4±2.5	<0.001
a' lateral (cm/s)	9.8±2.2	13.6±3.5	<0.001
e'/a' lateral	1.7±0.55	0.62±0.19	<0.001
E/e' lateral	5.4±1.2	8.6±3.3	<0.001
E/e' average	6.3±1.3	10.6±3.6	<0.001
t-ET (ms)	317±20	314±28	0.51
t-IVRT (ms)	76±19	109±27	<0.001
TDI-MPI	0.40±0.09	0.49±0.14	<0.001

(p-value < 0.0001). Table 2
Table 3 showed Doppler assessment in both groups and found hypertensive group as more vulnerable to VL changes than normotensive patients.

DISCUSSION:

Preventing the worsening of hypertensive heart disease requires the early identification of hypertension individuals with subclinical left ventricular (LV) systolic dysfunction.[10] It is generally accepted that normal values for global ejection fraction and fractional shortening indicate normal LV systolic function in hypertensive individuals. However, the ejection fraction and fractional shortening only represent the overall contractile function of the heart and do not account for localised systolic anomalies.[11] Left ventricular dysfunction is one symptom of the complex illness caused by high blood pressure. The improvement of patient stratification and the identification of early unfavourable changes via the establishment of echocardiographic markers may have therapeutic use.[12]

The current study set up that pulsed-wave Doppler & tissue Doppler -MPI were significantly advanced in cases with diastolic dysfunction and saved systolic functioning as compared to normal individualities. This was substantially due to a significant and conspicuous increase in the IVRT, the primary diastolic element of MPI. The iso-volumetric compression time and ejection time didn't differ significantly between the two groups. The IVRT is known to raise the insulated diastolic dysfunction due to dragged early diastolic relaxation; still, its duration is dependent on both the left ventricular relaxation speed and difference in left ventricular end-systolic pressures and atrial pressure, and it may dock or pseudo-normalize in some cases with momentous rises the left ventricular filling pressure. Advanced left ventricular stuffing pressures are associated with shorter ejection durations, indicating that MPI is less likely to be pseudo-normalized.

Research into the relationship between tissue Doppler imaging - MPI and diastolic dysfunction has been limited. Gaibazzi et al., observed in heart failure cases and set up the weak relationship in MPI observed on pulsed-wave Doppler & tissue Doppler imaging, both of which had good individual delicacy for heart failure opinion. Still, the individualities in the study had mild to severe systolic dysfunction, and no link in tissue-Doppler - MPI and diastolic dysfunction was observed.[2] Rojo et al., examined cases with a recent myocardial infarction and set up insignificant difference in MPI assessed on tissue Doppler & pulsed-wave Doppler, and only limited agreement in both methods exist. Utmost of the cases had diastolic dysfunction with normal ejection fragments, but the authors didn't assess the styles' delicacy.[13] Su et al., studied a large and different sample of diastolic dysfunction cases and reported that tissue Doppler imaging - MPI increased with diastolic dysfunction inflexibility and directly distinguished people with pseudo-normal stuffing trends from those with regular mitral flux. Still, the researchers didn't estimate the individual delicacy of the procedure in this group.[14]
Shehata et al. found that the hypertension group had a significantly larger left ventricular (LV) mass, LA volume, and early diastolic driving force than the norm. Finally, early diastolic driving force revealed a modest connection (r = 0.33, statistically proved) with E/e' ratio, and an early diastolic driving force threshold of >0.25 N was able to reliably "predict subclinical diastolic dysfunction."[15]

Global longitudinal strain was found to be lower in the hypertensive group than in the other two, despite there being no differences in LVEF between the groups and similar LVMI between the rowers and hypertensive subjects.[16] However, the hypertension group had a much higher E/e' ratio than the rowers and controls, and a significantly lower E/A ratio than the controls. Higher left ventricular mass indexes (LVMIs) and worse diastolic function (higher E/e' ratio in high-risk group compared to low-risk and mid-risk, and lower e'/a' in high-risk group compared to low-risk) were observed in the high-risk group compared to the low-risk and intermediate-risk groups, respectively.[17]

CONCLUSION:

The results of this study suggest that MPI utilizing conventional Doppler and tissues Doppler imaging has a high level of clinical agreement and a high diagnostic accuracy when it comes to diagnosing diastolic dysfunction in individuals with hypertension but ejection fraction is normal.

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