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ECHOCARDIOGRAPHIC ASSESSMENT OF DIASTOLIC DYSFUNCTION IN ST ELEVATION MYOCARDIAL INFARCTION (STEMI) PATIENTS AT A TERTIARY CARE CENTRE

Cardiology

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ABSTRACT

Acute myocardial infarction, which is commonly known as a heart attack, is a significant cause of death in developing countries. It affects a large number of people worldwide, with an estimated prevalence of approximately three million individuals. Acute myocardial infarction can be categorized into two main types: non-ST-segment elevation MI (NSTEMI) and ST-segment elevation MI (STEMI) (1) (2).Classically E.C.G in STEMI, ST elevation occurs in 2-3 hours, T wave inversion occurs within 8-12 hours and develops pathological Q wave over next 18-24 hours to days later. Echocardiography is helpful in the assessment of systolic dysfunction including left ventricular systolic volume, left ventricular ejection fraction (LVEF), assessment of diastolic dysfunction/ filling pressure E: A Ratio and left atrial volume.

KEYWORDS

STEMI, Diastolic dysfunction, Echocardiographic evaluation

INTRODUCTION

Echocardiography is helpful in the assessment of systolic dysfunction including left ventricular systolic volume, left ventricular ejection fraction (LVEF), assessment of diastolic dysfunction/ filling pressure E: A Ratio and left atrial volume. The left ventricular ejection fraction (LVEF) is a commonly used measure to assess the function of the left ventricle, which is available in clinical settings. It is known that patients with decreased LVEF during the acute phase of a heart attack (AMI) have a higher risk of experiencing negative outcomes(3)(4). Additionally, the LVEF can change over time after an AMI, and these changes can also impact the prognosis. Therefore, even patients without systolic dysfunction during the acute phase of AMI can develop chronic left ventricular systolic dysfunction, which increases the risk of adverse events in the long term (5) (6). E/E' ratio is a non-invasive measure of left ventricular filling pressure and can be used to assess diastolic function. In the context of acute myocardial infarction (AMI), E/E' can provide valuable information for risk stratification. Elevated E/E' ratio may indicate increased left ventricular filling pressure, increased LVEDP and diastolic dysfunction, which can have prognostic implications in patients with AMI.

Left ventricular end-diastolic pressure (LVEDP) is a key metric assessed during cardiac catheterization, offering essential insights into left ventricular compliance and filling conditions. LVEDP is subject to rapid changes in response to pathophysiological changes, fluid levels, and medication effects. Conditions such as left ventricular hypertrophy, restrictive heart conditions, aging, and ischemic heart disease can cause elevated LVEDP. Furthermore, LVEDP can serve as an indirect indicator of left ventricular systolic function by affecting the diastolic pressure-volume relationship, moving the end-diastolic pressure point higher

Aims & Objectives: Echocardiographic assessment of diastolic dysfunction in STEMI and its clinical outcome.

Methodology :

A prospective cross sectional study conducted done on a sample size of 75 patients in a tertiary care centre over a period of 6 months in patients above 18 years of age who presented with Acute STEMI, without prior history of heart failure admission, or valvular disease or underlying cardiomyopathy. The echocardiographic assessment was done with systolic and diastolic function assessment done in patients at the time of admission. All the patients had received the same modality of treatment.

RESULT :

The study included a total of 75 participants, with a male predominance. Specifically, 56 participants (74.7%) were male, while 19 participants (25.3%) were female. The age distribution of the study participants showed that the majority were between 51 and 70 years old, accounting for 38 individuals (50.7%). Participants aged 31 to 50 years made up 18 cases (24.0%), while those over 70 years comprised 16 cases (21.3%). Only 3 participants (4.0%) were under 30 years of age. The ages ranged from 28 to 85 years, with a mean age of 59.23 ± 13.63 years, indicating that most participants were in the middle to older age groups.

Left ventricular ejection fraction (LVEF), 19 patients (25.3%) presented with normal LVEF (≥ 50-55%). The LVEF was mildly reduced (41-49%) in 25 patients (33.3%), moderately reduced (30-40%) in 21 patients (28.0%), and severely reduced (<30%) in 10 patients (13.3%).

For the ratio of early mitral inflow velocity to mitral annular early diastolic velocity (E/E'), the majority of the study participants, 69 patients (92.0%), had an E/E' ratio ≤15, indicating less diastolic dysfunction, whereas 6 patients (8.0%) had an E/E' ratio >15, suggestive of more pronounced diastolic dysfunction.

Descriptive statistics further quantified these observations with an average E/E' ratio of 11.27±2.39, indicating a general trend towards normal

Table No 1: Correlation Of Echo Parameters With Heart Failure.

Echo parameters	Heart Failure with Reduced EF (HFrEF) (N=18)		Heart Failure with Preserved EF (HFpEF): (N=27)		No Failure (N=30)		Total		P
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Left Ventricular Strain	-16.3	1.3	-11.6	1.2	-14.3	1.2	-13.8	2.2	<0.0001
Left Atrial Strain	36.1	3.2	38.5	3.6	38.1	3.1	37.7	3.4	0.05
E/E'	10.1	2.3	12.1	2.4	11.2	2.2	11.3	2.4	0.024

Diastolic function among the cohort. Descriptive statistics further quantified these observations with an average E/E' ratio of 11.27±2.39, indicating a general trend towards normal diastolic function among the cohort. Left ventricular strain was notably negative, averaging -13.79±2.21, which typically reflects myocardial contractility. Average Left atrial strain was measured at 37.73±3.42, indicating atrial deformation dynamics. The overall mean left ventricular end diastolic pressure was 18.11±3.29 mmHg, primarily reflecting a moderate elevation across the patient group.

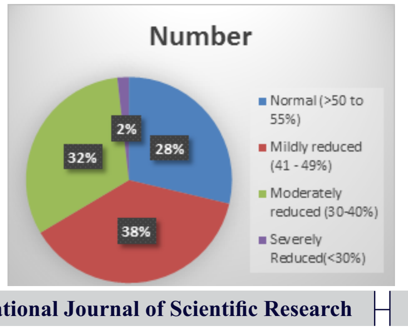

Figure 1: Demographic distribution of patients with LV Dysfunction.

DISCUSSION:

In this investigation into diastolic dysfunction among ST Elevation Myocardial Infarction (STEMI) patients using 2D echocardiography, 60% of our participants exhibited signs of heart failure, split between Heart Failure with Preserved Ejection Fraction (HFpEF) at 24% and Heart Failure with Reduced Ejection Fraction (HFrEF) at 36%. This significant incidence of heart failure is noteworthy when juxtaposed with findings from other studies, which also report a high prevalence of heart failure among similar patient populations. In the current study, the majority of STEMI patients demonstrated E/e' ratios ≤15, suggesting predominantly normal diastolic function with an average E/e' of 11.27±2.39. This indicates that most patients in this cohort exhibited only mild diastolic dysfunction. In contrast, a smaller subset (8%) had E/e' ratios >15, pointing to more significant diastolic impairment left atrial strain measured at 37.73±3.42 suggested generally preserved atrial mechanics among STEMI patients. The predictive value assessed via ROC curve analysis indicated a moderate AUC of 0.691 (95% CI: 0.546 to 0.835), establishing left atrial strain as a significant, albeit less robust, predictor of Heart Failure with Preserved Ejection Fraction (HFpEF).

Left ventricular strain demonstrated robust diagnostic potential in the context of STEMI, with a high Area Under the Curve (AUC) of 0.929, suggesting excellent predictive capacity for Heart Failure with Preserved Ejection Fraction (HFpEF). The narrow confidence interval ranging from 0.870 to 0.989 and a statistically significant p-value of less than 0.0001 further affirm its efficacy. This measure also proved reliable for predicting mortality, showing a substantial AUC of 0.74 (95% CI: 0.57 to 0.91) with a p-value of 0.01, indicating that left ventricular strain is a critical predictor of both HFpEF and mortality in STEMI patients.

CONCLUSION:

The consistent high prevalence of heart failure among STEMI patients highlighted in our study and comparative analyses underscores the critical importance of utilizing echocardiographic parameters such as Left Ventricular Ejection Fraction, E/e' ratio, and left ventricular and atrial strain measurements. These echo parameters, integral assessed in the present study are vital for assessing the cardiac function of STEMI patients at presentation. By effectively employing these diagnostic tools, crucial insights into the severity of heart failure can be gained and immediate treatment decisions and long-term management strategies can be planned. The ability to accurately evaluate these echo parameters not only aids in establishing a prognosis but also enhances the precision of therapeutic interventions, potentially improving the overall outcomes for patients experiencing acute myocardial infarctions.

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