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Assesment of Right Ventricular Function in Patients with Acute Myocardial Infarction

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Abstract

Background: The prognosis of patients after acute myocardial infarction (AMI) is determined by the interaction of a large number of factors. The presence of left ventricular (LV) dysfunction, on echocardiography shortly after AMI, is one of the most important prognostic parameters. The relevance of right ventricular (RV) function is poorly defined in post-AMI patients. The aim of the present study was to evaluate the right ventricular dysfunction in MI using echocardiography and also to study the association between outcomes with MI patients

Methods: The present study was an retrospective study, which enrolled a total of 100 patients with chest pain of <24 hours who were diagnosed with acute ST-segment elevation myocardial infarction (MI) for the first time. Echocardiography was performed with a special emphasis on the tricuspid annular plane systolic excursion (TAPSE) score.

Results: The mean age of enrolled patients was 54.66±15.79 years. The male to female ratio of 1 : 1.33. 42.00% patients were present with diabetes and 44.00% patients were present with diabetes. The mean TAPSE was 16.86±4.09 mm, Tricuspid S' Velocity was 10.18±1.99 cm/s and Ejection fraction was 46.37±8.50%. The association between 2D Echo finding and type of MI was found statistically Insignificant. The association between outcome and type of MI was found statistically significant. Death was more in posterior

wall MI (14.71%) as compare to inferior wall (11.76%) & anterior wall MI (6.25%).

Conclusion: The present study was found that association between 2D Echo finding and type of MI was found statistically Insignificant but association between outcome and type of MI was found statistically significant. This study throws light on the importance of meticulous assessment of right ventricular function in all patients of AMI, regardless of the site of infarction. Early diagnosis of right ventricular involvement is essential for prompt management of the patient.

Keywords: Coronary heart disease (CHD), Myocardial infarction (MI), Cardiovasucular disease (CVD), World health organization (WHO).

Introduction

Coronary heart disease (CHD) is epidemic in India and one of the major causes of disease-burden and deaths. Mortality data from the Registrar General of India shows that cardiovascular diseases are a major cause of death in India now.[1]

The data from the WHO state that India accounts for 1/5th of global deaths associated with CVD, specifically in the younger population. As per the Global Burden of Disease study, the Indian population reports 272 CVD deaths per 100,000 population compared to the global average of 235 CVD deaths[2]

Diabetes mellitus, hypertension, smoking, stress, obesity, sedentary lifestyle, vulnerable genetics, and a poor diet are the primary causes of CAD in the Indian population.[3] Acute coronary syndrome is the most common cause of morbidity and death in people with CAD and anterior wall myocardial infarction (AWMI) and inferior wall myocardial infarction (IWMI) are by far the leading cause of severe myocardial infarction (MI). Clinical and hemodynamic features of acute myocardial infarction (AMI) are, to a large extent, determined by the territory of the coronary artery involved. Right ventricular MI is frequently associated with inferoposterior wall MI. In recent years, right ventricular function in patients with CAD has received more importance. Right ventricular infarction more frequently causes low cardiac output and shock, which is an important cause of mortality.[4-6]

Generally, the right ventricular function is preserved in AWMI; however, in recent years, many studies have shown right ventricular dysfunction in isolated AWMI. Furthermore, in patients with left ventricular dysfunction after MI, an important predictor of cardiovascular mortality is the right ventricular function. [7] There is a significant contribution of the interventricular septum apart from the right ventricular free wall in the function of the right ventricle and hence right ventricular dysfunction is expected in septal involvement in AWMI. Heightened sympathetic drive caused by AMI is another plausible mechanism that could affect the right ventricular function.[8]

Left anterior descending coronary artery branches supply blood to the anterior wall of the right ventricle, and several autopsy studies have shown that acute left anterior descending coronary artery occlusion causes right ventricular infarction. But this relation has not been studied adequately so far [9-10] Hence the purpose to conduct this study is to evaluate right ventricular function in AMI patients, to correlate it with the clinical outcome of the patients.

Thus, this study aims to evaluate the right ventricular dysfunction in MI using echocardiography and also to study the association between outcomes with MI patients

Material and methods

Study design – Retrospective

Sample size- 100 patients

Inclusion criteria

- All patients with AMI.
- All patients admitted within 7 days of MI.

Exclusion criteria

- Patients with associated structural heart disease.
- Patients with past history of HF, IHD, COPD, PH, or any disease involving lung or right heart in the past.
- Patient with old MI.
- Patient with past history of PTCA or CABG.

Source of data

Patients admitted in the Cardiology ward/ICCU of MGM institute of health science, Navi Mumbai.

Consents

Patients consents were taken in a language of their understanding which include English/Hindi and Marathi as well.

Methods of collection of data

Information was collected through a pre-tested and structured proforma for each patient.

Qualifying patients were undergoing, detailed history, clinical examination and Echocardiography

Detailed echocardiography assessment was done on GE VIVID T9 MACHINE.

To assess RV dimension, volume, and function, American Society of Echocardiography Guidelines suggest evaluation through apical 4-chamber, modified 4-chamber, left parasternal long-axis (PLAX) and parasternal short-axis (PSAX), left parasternal RV inflow, and subcostal views for comprehensive assessment of right ventricle[11]

Among these, the most frequently reported 2DE measurements for RV function are tricuspid annular plane systolic excursion (TAPSE) and RV fractional area change (FAC) by the apical 4-chamber view. TAPSE is defined as the distance traveled between end-diastole and end-systole at the lateral corner of the tricuspid annulus. Tricuspid annular motion can be evaluated by tissue Doppler to measure the longitudinal velocity of the tricuspid annulus. This velocity has been named the RV S' or systolic excursion velocity. To measure this parameter, RV-focused view is used with tissue Doppler region of interest placed at the lateral corner of the tricuspid annulus acquired at high frame rate.

Results

Table 1: Baseline and demographic characteristics of all patients

Mean age in years		54.66±15.79 years
Male : Female		43 : 57
ECG finding	Anterior wall MI	32 (32.00%)
	Inferior wall MI	34 (34.00%)
	Posterior wall MI	34 (34.00%)
Diabetes present		42 (42.00%)
Hypertension present		44 (44.00%)

The study enrolled a total of 100 patients who were diagnosed with acute MI. The mean age of enrolled patients was 54.66±15.79 years. The youngest patient was a 30-year-old and the oldest patient was an 80-year-old. In this study, the

number of female patients (57.00%) was considerably higher as compare to male (43.00%). The male to female ratio of 1: 1.33. 42.00% patients were present with diabetes and 44.00% patients were present with hypertension.

Graph 1:

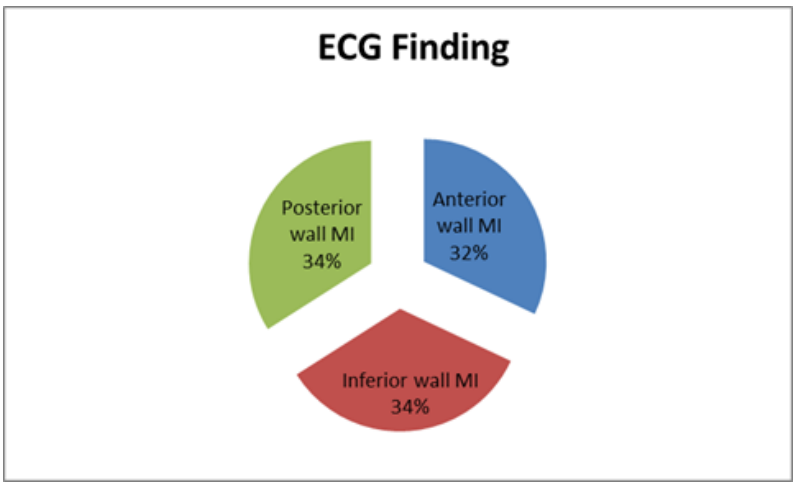


Table 2: 2D Echo finding

TAPSE (mm)	16.86±4.09 mm
Tricuspid S' Velocity (cm/s)	10.18±1.99 cm/s
Ejection fraction (%)	46.37±8.50%

The mean TAPSE was 16.86±4.09 mm, Tricuspid S' Velocity was 10.18±1.99 cm/s and Ejection fraction was 46.37±8.50%.

Table 3: Association between 2D Echo finding and type of MI

	Anterior wall MI	Inferior wall MI	Posterior wall MI	p-value
TAPSE (mm)	16.95±4.11	16.89±4.10	16.84±4.14	0.26
Tricuspid S' Velocity (cm/s)	10.20±2.00	10.21±1.98	10.18±1.99	0.41
Ejection fraction (%)	46.38±8.46	46.44±8.51	46.45±8.60	0.16

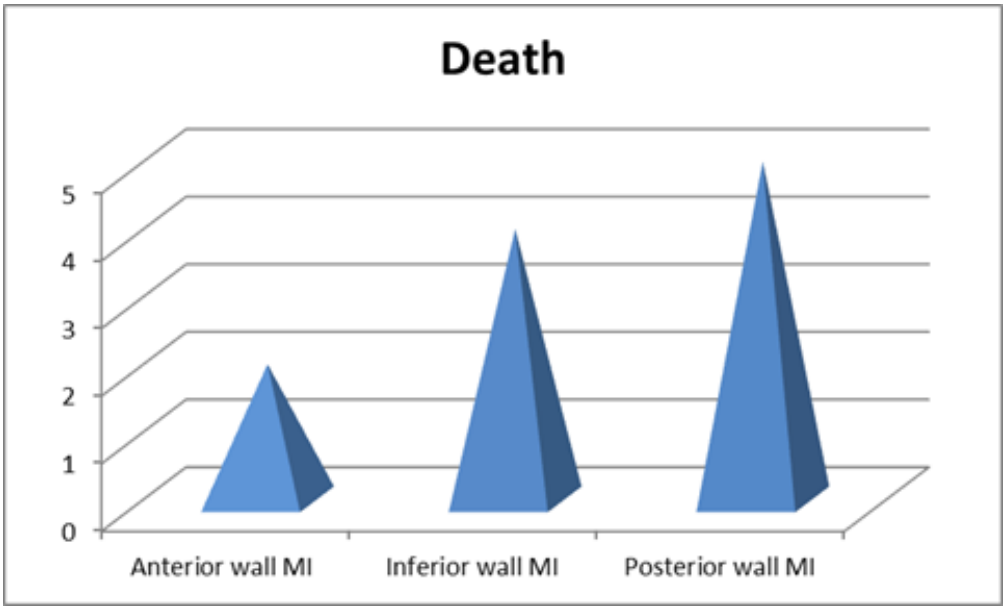
The association between 2D Echo finding and type of MI was found statistically Insignificant.

Table 4: Association between outcome and type of MI

Outcome	Anterior wall MI (32)	Inferior wall MI (34)	Posterior wall MI (34)	p-value
Death	2(6.25%)	4(11.76%)	5(14.71%)	0.01

The association between outcome and type of MI was found statistically significant. Death was more in posterior wall MI (14.71%) as compare to inferior wall (11.76%) & anterior wall MI (6.25%).

Graph 2:



Discussion

The relevance of right ventricular (RV) function is poorly defined in post-AMI patients. The aim of the present study was to evaluate the right ventricular dysfunction in MI using echocardiography and also to study the association between outcomes with MI patients In this study, mean age of enrolled patients was 54.66±15.79 years. The youngest patient was a 30-year-old and the oldest patient was an 80-year-old. The incidence of MI was observed to increase with age, and this could be due to the fact that atherosclerosis, which is associated with advancing age, is tuned by cumulative effects of lifestyle and lipid status. Indians have a higher risk of CAD at an earlier age because they have a higher prevalence of central obesity, decreased high-density lipoprotein (HDL) cholesterol, glucose intolerance, and hyperinsulinemia.[12]

In this study mean TAPSE was 16.86±4.09 mm, Tricuspid S' Velocity was 10.18±1.99 cm/s and Ejection fraction was 46.37±8.50%. The association between 2D Echo finding and type of MI was found statistically Insignificant. This suggests that contrary to the popular notion that right ventricular dysfunction is more common in IWMI, this study reveals that AWMI can result in a higher incidence of right ventricular dysfunction. This observation was in accordance with a study conducted by Aher et al.[13] However, in a study conducted by Abdelsabour et al., it was observed that IWMI cases result in a higher incidence of right ventricular dysfunction as compared to AWMI[14]. This could be because cases of AMI with associated right ventricular MI were not excluded from the study sample.

The limitation of the present study includes:

- small sample size
- We have used 2D echocardiography using TAPSE score for grading the right ventricular dysfunction; however, other modalities like tissue Doppler imaging would have helped to assess the diastolic function of the right ventricle;
- Cardiac MRI is considered the gold standard for evaluating the right ventricular function
- Lack of follow-up and thus long-term implications of the involvement of right ventricular function could not be assessed.

Hence, future studies and further research are warranted on this topic on a larger scale with a higher sample size and follow-up of patients. This would pave way for a better understanding of the implications of right ventricular dysfunction on the prognosis of patients with AMI.

Conclusion

The present study was found that association between 2D Echo finding and type of MI was found statistically Insignificant but association between outcome and type of MI was found statistically significant. This study throws light on the importance of meticulous assessment of right ventricular function in all patients of AMI, regardless of the site of infarction. Early diagnosis of right ventricular involvement is essential for prompt management of the patient.

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