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Original Research Article

# Early Echocardiography in Acute Myocardial Infarction in a Tertiary Care Hospital in Tripura

**J. Harish[1], Rajesh Kishore Debbarma[2], Swapan Sarkar[3], Bibhu Debbarma[4]**

[1]Post Graduate Trainee, Department of General Medicine, Agartala Government Medical College, Tripura.

[2]Professor, Department of General Medicine, Agartala Government Medical College, Tripura.

[3]Associate Professor, Department of General Medicine, Agartala Government Medical College, Tripura.

[4]Post Graduate Trainee, Department of General Medicine, Agartala Government Medical College, Tripura

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**Corresponding author: Dr. Rajesh Kishore Debbarma**
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**Abstract**

**Introduction:** Myocardial Infarction (STEMI), it continues to be a major public health problem in the industrialized world as well as in developing countries like India. It has been estimated that the number of years of life lost because of an AMI is 15 years. The burden of Myocardial Infarction in developing countries is approaching those now afflicting developed countries. The scarcity of available resources to treat ST Elevation Myocardial Infarction (STEMI) in developing countries mandate major efforts on an international level to strengthen primary prevention programs. This study is designed to observe the early echo changes following myocardial infarction using two-dimensional echocardiography among the myocardial infarction patients attending AGMC and GBP Hospital.

**Materials and Methodology:** This is a prospective type of study done in 100 patients admitted with acute myocardial infarction in the department of medicine between Jan 2020 to Jan 2021. Patients with pre-existing heart disease was excluded from the study. Echocardiography was carried out within 24 hours and patient was checked for LV systolic and diastolic function, RWMA, valvular dysfunctions thereby to identify high risk patients.

**Results:** Out of 100 patients 34(61.8%) were male and 21(38.2%) were female. Most of the patients were 51-60 years old. The mean age of patients was 62.2600 yrs. 26 (26.0%) patients had anterior wall, 30 (30.0%) patients had anteroseptal, 31 (31.0%) patients had inferior wall and 13 (13.0%) patients had lateral wall. 43 (43.0%) patients had mild EF, 31 (31.0%) patients had moderate EF and26 (26.0%) patients had normal EF.32 (32.0%) patients had grade 1 LVDD, 14(14.0%) patients had grade 2 LVDD, and 54 (54.0%) patients had Normal LVDD.RWMA was found in 95% of patients.28 28.0%) patients had MR in valvular dysfunction, 5 (5.0%) patients had MR/AR in valvular dysfunction and 16 (16.0%) patients had MR/TR in valvular dysfunction.

**Conclusion:** The incidence of high risk RWMA and valvular dysfunctions were higher post-acute myocardial infarction and hence the early identification of patients with high-risk complications is needed and echo within 24 hrs of admission is helps in the identification of such patients and guide in the proper management of such patients.

**Keywords:** Myocardial infarction, RWMA, LV systolic and LV diastolic function

## Introduction

Acute myocardial infarction is one of the leading causes of death in the developed world. The prevalence of the disease approaches three million people worldwide, with more than one million deaths in the United States annually. Acute myocardial infarction can be divided into two categories, non-ST-segment elevation MI (NSTEMI) and ST-segment elevation MI (STEMI). Unstable angina is similar to NSTEMI. However, cardiac markers are not elevated. [1,2,3] An MI results in irreversible damage to the heart muscle due to a lack of oxygen. An MI may lead to impairment in diastolic and systolic function and make the patient prone to arrhythmias. In addition, an MI can lead to a number of serious complications. The key is to reperfuse the heart and restore blood flow. The earlier the treatment (less than 6 hours from symptom onset), the better the prognosis.

**MI is diagnosed when two of the following criteria are met:**

1. Symptoms of ischemia

2. New ST-segment changes or a left bundle branch block (LBBB)

3. Presence of pathological Q waves on the ECG

4. Imaging study showing new regional wall motion abnormality

Cardiovascular disease is a global public health problem contributing to 30% of global mortality and 10% of the global disease burden. In 2005, from a total of 58 million deaths worldwide, 17 million were due to cardiovascular disease and, among them 7.6 million were due to coronary heart disease. In epidemiological studies, the incidence of MI in a population can be used as a proxy for estimating the coronary heart disease burden. The burden of cardiovascular disease is rising both in high-income countries and low- and middle-income countries (LMICs) because of ageing populations, but the burden is greater in LMICs because of much larger population sizes and widespread exposure to increasing levels of risk factors such as unhealthy diet, physical inactivity, obesity, tobacco use, diabetes, raised blood pressure and abnormal blood lipids. Incidence of myocardial infarction in India is 64.37/1000 people. [4] Despite the advances made in the diagnosis and management of ST Elevation. Myocardial Infarction (STEMI), it continues to be a major public health problem in the industrialized world as well as in developing countries like India. It has been estimated that the number of years of life lost because of an AMI is 15 years. [5] The burden of Myocardial Infarction in developing countries is approaching those now afflicting developed countries. The scarcity of available resources to treat ST Elevation Myocardial Infarction (STEMI) in developing countries mandate major efforts on an international level to strengthen primary prevention programs. This study is designed to observe the echo changes following myocardial infarction using two-dimensional echocardiography among the myocardial infarction patients coming to AGMC and GBP Hospital.

**Echocardiography has several important roles in patients with AMI:**

1. Diagnosis and exclusion of acute MI in patients with prolonged chest pain and non-diagnostic electrocardiographic findings.
2. Estimation of the amount of myocardium at risk and final infarct size after reperfusion therapy
3. Evaluation of patients with unstable hemodynamic findings and detection of infarct complication

4. Evaluation of myocardial viability
5. Risk stratification

The systolic parameters measured by echocardiography that are used as a marker for left ventricular systolic function of the heart are Left Ventricular Ejection Fraction (LVEF), stroke volume and cardiac index, systolic tissue velocity of the mitral annulus, fractional shortening, strain, and regional wall motion analysis. The most commonly used and universally accepted expression of global LV function is Left Ventricular Ejection Fraction (LVEF). LVEF should be measured more objectively using volumetric measurements, M-mode or two-dimensional echocardiography are used to measure LV dimensions and LVEF can also be calculated from these values. The following formula is used to calculate LVEF from the M-mode or two-dimensional echocardiographic measurement of LV dimensions from the mid-ventricular level.

**Grading of systolic function**

60. Normal- LVEF >55%
61. Mild LV dysfunction- LVEF 45-54%
62. Moderate LV dysfunction- LVEF 30-44%
63. Severe LV dysfunction -LVEF <30%

Regional wall motion analysis is the most commonly used echocardiographic parameter to evaluate coronary artery disease. From the parasternal, apical, and sometimes subcostal imaging windows, two-dimensional echocardiography can visualize all LV wall segments. For purposes of regional motion analysis, the ASE has recommended a 16- segment model or, optionally, a 17- segment model with an addition of the apical cap. The following numerical score is assigned to each wall segment on the basis of its contractile function as assessed visually:

1 = normal (>40% thickening with systole);

2 = hypokinesis (10% to 40% thickening)

3 = severe hypokinesis to akinesis (<10% thickening)

4 = dyskinesis

5 = aneurysm

The grading of the diastolic filling pattern is based on several parameters. In most cardiac diseases, the initial diastolic abnormality is impaired relaxation. With further progression of disease and a mild to moderate increase in LA pressure, the mitral inflow velocity pattern appears similar to a normal filling pattern (pseudo normalized). With further decrease in LV compliance and increase in LA pressure, diastolic filling becomes restrictive. Most patients with restrictive filling are symptomatic and have a poor prognosis.

Grade 1 (mild dysfunction) - impaired relaxation with normal filling pressure

Grade 2 (moderate dysfunction) - pseudo normalized mitral in flow pattern

Grade 3 (severe reversible dysfunction) - reversible restrictive (high filling pressure)

Grade 4 (severe irreversible dysfunction) - irreversible restrictive (high filling pressure)

The most important prognostic indicators after Myocardial Infarction are the degree of LV systolic dysfunction, left ventricular end-systolic volume index, ejection fraction, infarct size as peak cardiac enzyme release, infarct location and transmurally, LV volume, LV sphericity, Mitral Regurgitation, diastolic function, frequent ventricular arrhythmias and presence of heart failure. Therefore, it is reasonable to predict that patients with a high WMSI have a greater chance for subsequent development of cardiac events. Most patients with Killip class II-IV heart failure after acute Myocardial Infarction have a WMSI of 1.7 or higher. In addition to the WMSI, restrictive Doppler filling variables derived from mitral inflow velocities correlate well with the incidence of postinfarction heart failure and LV filling pressures. The E/e′ ratio, a reliable

parameter to estimate PCWP, was found to be a strong predictor for long-term outcome after acute Myocardial Infarction. LA volume, a surrogate for chronic diastolic dysfunction and chronic elevation of LA pressure, was also a strong predictor of outcome. Stress echocardiography is sensitive in detecting residual ischemia, myocardial viability, and multivessel disease soon after Myocardial Infarction [6]. Often, however, patients are unable to exercise adequately soon after an acute Myocardial Infarction, and the myocardium may remain akinetic for a period of days to weeks after successful reperfusion of the occluded coronary artery. Demonstration of viability by augmentation of contractility or demonstration of perfusion predicts functional recovery.

Materials and Methodology: This is a prospective type of study done in 100 patients admitted with acute myocardial infarction in the department of medicine between Jan 2020 to Jan 2021. Patients with pre-existing heart disease was excluded from the study. Echocardiography was carried out on day 3 and patient was checked for LV systolic and diastolic function, RWMA, valvular dysfunctions, thereby to identify high risk patients and referring patients for coronary angiogram and percutaneous intervention.

**Results and Analysis**

**Table 1: Distribution of Anterior wall / Inferior Wall**

| Anterior Wall / Inferior Wall | Frequency | Percentage |
|---|---|---|
| Anterior Wall | 26 | 26.0% |
| Anteroseptal | 30 | 30.0% |
| Inferior Wall | 31 | 31.0% |
| Lateral Wall | 13 | 13.0% |
| Total | 100 | 100.0% |

In our study, 26 (26.0%) patients had anterior wall, 30 (30.0%) patients had anteroseptal, 31(31.0%) patients had inferior wall and 13 (13.0%) patients had lateral wall.

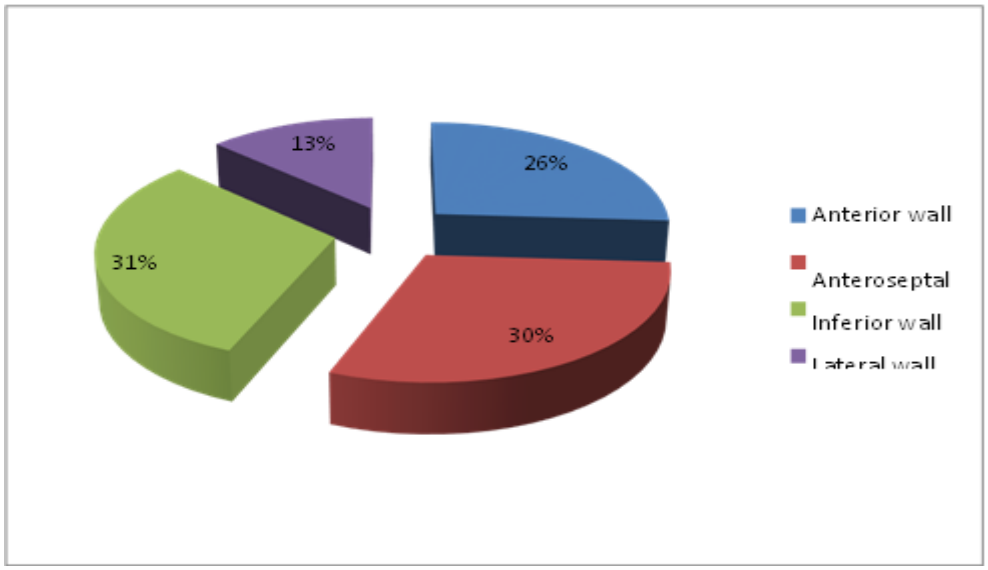


**Figure 1: Distribution of wall of infarction**

**Table 2: Distribution of Sex**

| Sex | Frequency | Percent |
|---|---|---|
| Female | 35 | 35.0% |
| Male | 65 | 65.0% |
| Total | 100 | 100.0% |

In our study, 35 (35.0%) patients were female, and 65 (65.0%) patients were male.

**Table 3: Distribution of Age in Group**

| Age in Group | Frequency | Percent |
|---|---|---|
| <= 40 | 5 | 5.0% |
| 41-50 | 8 | 8.0% |
| 51-60 | 36 | 36.0% |
| 61-70 | 27 | 27.0% |
| 71-80 | 18 | 18.0% |
| 81-90 | 6 | 6.0% |
| Total | 100 | 100.0% |

In our study, 5 (5.0%) patients were ≤40 years of age, 8 (8.0%) patients were 41-50 years of age, 36 (36.0%) patients were 51-60 years of age, 27 (27.0%) patients were 61-70 years of age, 18 (18.0%) patients were 71-80 years of age and 6 (6.0%) patients were 81-90 years of age.

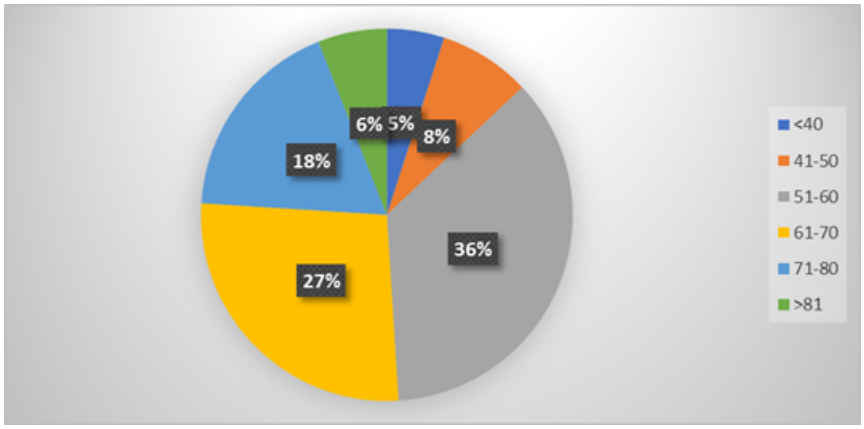


**Figure 2: Distribution of Age in group**

**Table 3: Distribution of EF Group**

| EF Group | Frequency | Percent |
|---|---|---|
| Mild | 43 | 43.0% |
| Moderate | 31 | 31.0% |
| Normal | 26 | 26.0% |
| Total | 100 | 100.0% |

In our study, 43 (43.0%) patients had mild systolic dysfunction, 31 (31.0%) patients had moderate systolic dysfunction and 26 (26.0%) patients had normal EF.

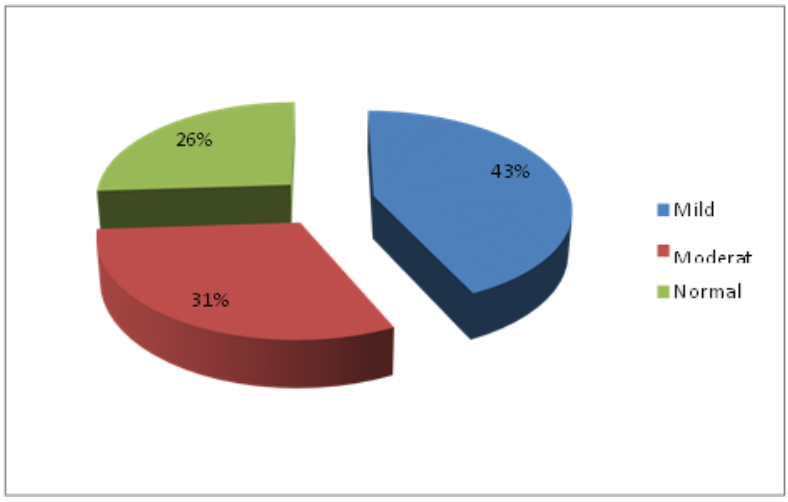


**Figure 3: Distribution of Systolic dysfunction**

**Table 4: Distribution of Valvular dysfunction**

| Valvular dysfunction | Frequency | Percent |
|---|---|---|
| Mr | 28 | 28.0% |
| Mr/ar | 5 | 5.0% |
| Mr/tr | 16 | 16.0% |
| Nil | 51 | 51.0% |
| Total | 100 | 100.0% |

In our study, 28 (28.0%) patients had MR in valvular dysfunction, 5 (5.0%) patients had MR/AR in valvular dysfunction and 16 (16.0%) patients had MR/TR in valvular dysfunction.

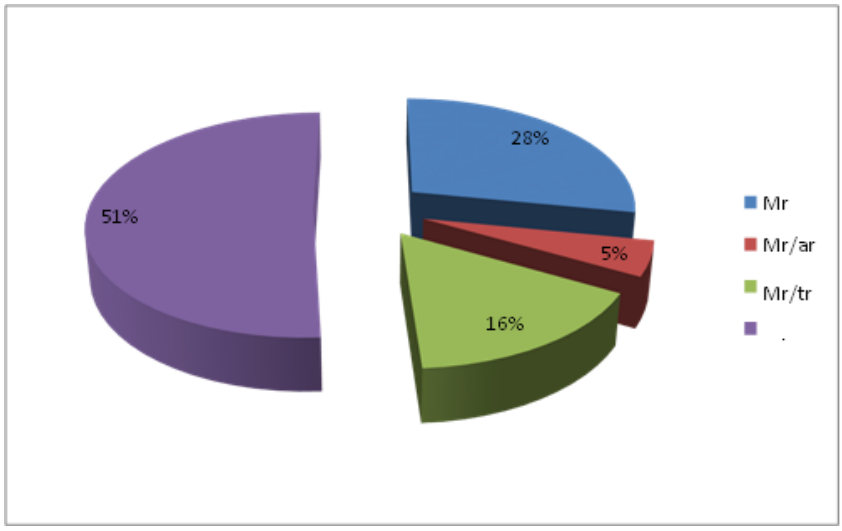


**Figure 4: Distribution of Valvular dysfunction**

**Table 5: Distribution of LVDD**

| LVDD | Frequency | Percent |
|---|---|---|
| Grade 1 | 32 | 32.0% |
| Grade 2 | 14 | 14.0% |
| Normal | 54 | 54.0% |
| Total | 100.0% | 100.0% |

In our study, 32 (32.0%) patients had grade 1 LVDD, 14 (14.0%) patients had grade 2 LVDD and 54 (54.0%) patients had Normal LVDD.

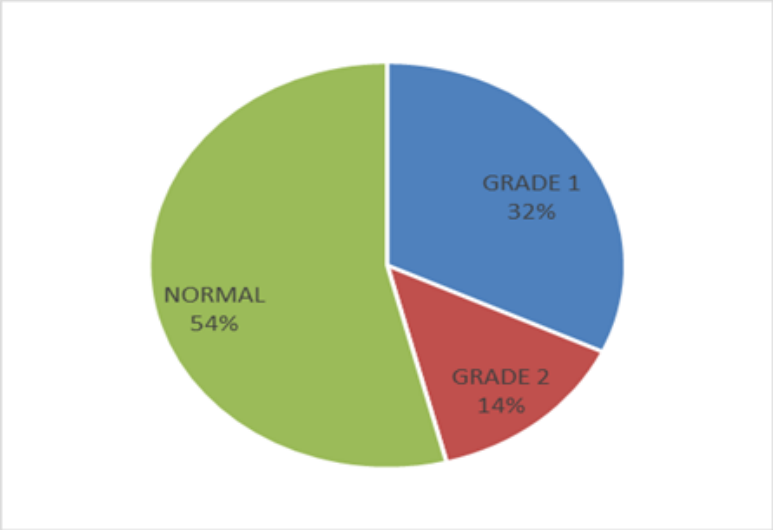


**Figure 5: Distribution of LVDD**

Our study showed that, 9(4.52%) patients had Anterior Wall Akinesis, 5(2.51%) patients had Lateral Wall Akinesis, 20(10.05%) patients had Septal Wall Akinesis, 14(7.04%) patients had Apical Wall Akinesis, 5(2.51%) patients had Inferior Wall Akinesis, 4(2.01%) patients had Posterior Wall Akinesis, 5(2.51%) patients had Septal Dyskinesia, 5(2.51%) patients had Inferior Dyskinesia, 2(1.00%) patients had Posterior Dyskinesia, 0(0.00%) patients had Anterior Wall Dyskinesia, 0(0.00%) patients had Lateral Wall Dyskinesia, 35(17.59%) patients had Anterior Wall Hypokinesia, 10(5.03%) patients had Lateral Wall Hypokinesia, 33(16.58%) patients had Septal Wall Hypokinesia, 18(9.05%) patients had Apical Hypokinesia, 22(11.06%) patients had Inferior Wall Hypokinesia, 7(3.52%) patients had Posterior Wall Hypokinesia and 5(5%) patients had no RWMA.

## Discussion

In our study, 5 (5.0%) patients were ≤40 years of age, 8 (8.0%) patients were 41-50 years of age, 36 (36.0%) patients were 51-60 years of age, 27 (27.0%) patients were 61-70 years of age, 18 (18.0%) patients were 71-80 years of age, and 6(6.0%) patients were 81-90 years of age. 35 (35.0%) patients were female, and 65 (65.0%) patients were male. Koldilkar Jet al [6] 34 (61.8%) were male and 21 (38.2%) were female. We found that, 26(26.0%) patients had anterior wall, 30 (30.0%) patients had anteroseptal, 31(31.0%) patients had inferior wall and 13 (13.0%) patients had lateral wall. It was found that, 43 (43.0%) patients had mild systolic dysfunction, 31 (31.0%) patients had moderate systolic dysfunction and 26 (26.0%) patients had normal EF findings similar to Kodilkar J et al. In total 95% had wall motion abnormality similar to findings observed in Horowitz RS et al (94%) [7] We found that, 28 (28.0%) patients had MR in valvular dysfunction, 5 (5.0%) patients had MR/AR in valvular dysfunction and 16 (16.0%) patients had MR/TR in valvular dysfunction. These findings were similar to the findings from Bursi F et al. [8] In our study, 32 (32.0%) patients had grade 1 LVDD, 14(14.0%) patients had grade 2 LVDD, and 54 (54.0%) patients had normal LVDD. [9]

## Conclusion

The incidence of high risk RWMA and valvular dysfunctions were higher post-

acute myocardial infarction and hence the early identification of patients with high-risk complications is needed. We concluded that 2D ECHO performed within 24 hours of admission helps the clinician to predict and diagnose regional wall motion abnormality, valvular dysfunction and early identification of complications in patients with acute myocardial infarction admitted in AGMC&GBP Hospital and take proper steps in the management of the patient.

## Limitations

The notable short comings of this study are:

1. The sample size was small. Only 100 cases are not sufficient for this kind of study.

2. The study has been done in a single centre.

3. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

4. Ongoing COVID 19 pandemic and lockdown has further hampered the study.

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