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STUDY OF ECHOCARDIOGRAPHY FINDINGS IN PATIENTS OF ACUTE MYOCARDIAL INFARCTION AT A TERTIARY HOSPITAL

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Abstract

Background: Echocardiography is a non-invasive diagnostic technique which provides information regarding cardiac function and hemodynamics. Present study was aimed to study echocardiography findings in patients of acute myocardial infarction at a tertiary hospital. **Material and Methods:** Present study was single-center, prospective, observational study, conducted in patients of Acute myocardial infarction (on the basis of the clinical symptoms, 12 lead ECG and the laboratory findings), Acute ST elevation myocardial infarction OR Acute Non ST elevation myocardial infarction. We carried out the transthoracic echocardiography in all patients. **Results:** In our study 76(70.4%) were male patient and 32(29.6%) were female patient. Minimum age of patient was 24, maximum age was 85 years, mean age of patient was 56.87 ±13.81 years. All of our patients had angina on presentation. Common risk factors observed were smoking (44.4%), diabetes (37%), sedentary lifestyle (31.5%), hypertension (24.1%) & dyslipidemia (7.4%). In our study of 108 patients majority had anterior wall myocardial infarction (AWMI) (30.6%) & inferior wall myocardial infarction (IWMI) (30.6%) followed by anterior wall-non ST elevation myocardial infarction (AWMI-NSTEMI) (22.2%). In our study 88 patients (81.5%) were having troponin T positive & 94 patients (87%) had CPK-MB levels ≥26. In our study, 80 patients (74.07%) had ST elevation myocardial infarction and 28 patients (25.93%) had non ST elevation myocardial infarction. Echocardiography showed regional wall motion abnormalities (RWMA) in 102 patients (94.4%) and did not show any regional wall motion abnormalities (RWMA) in 6 patients (5.6%). Majority had RWMA in RCA territory (36.1%) followed by RWMA in LAD territory (34.3%), RWMA in LAD and LCx territory (14.8 %), RWMA in LAD and RCA territory (5.6%) & RWMA in RCA and LCx territory (3.7%). **Conclusion:** 2D Echocardiography has a very high sensitivity in detecting myocardial ischemia in the form of regional wall motion abnormalities (RWMA).

Keywords: 2D Echocardiography, myocardial ischemia, regional wall motion abnormalities (RWMA), acute myocardial infarction

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Introduction

It is well-known that nowadays myocardial infarction is one of the most important mortality factors. The diagnosis of an acute myocardial infarction (MI) is typically based upon the history, ECG and cardiac enzymes, particularly serum troponins and creatine kinase MB fraction (CK-MB).[1] Although not routinely performed for diagnosis, echocardiography is an accurate, noninvasive test that is able to detect evidence of myocardial ischemia or necrosis.

Echocardiography is a non-invasive diagnostic technique which provides information regarding cardiac function and hemodynamics. It is the most frequently used cardiovascular diagnostic test after electrocardiography and chest X-ray.[2] However, in a patient with acute chest pain, Transthoracic Echocardiography is essential both for diagnosing acute coronary syndrome, zeroing on the evaluation of ventricular function and the presence of regional wall motion abnormalities, and for ruling out other etiologies of acute chest pain or dyspnea, including aortic dissection and pericardial effusion.[3,4]

The echocardiogram is a standard tool in the management of patients with acute myocardial infarction (MI). The role of echocardiography in establishing the diagnosis, location, and extent of MI, in diagnosing mechanical complications of infarction, and in providing prognostic information that is important for risk stratification will be reviewed. Present study was aimed to study echocardiography findings in patients of acute myocardial infarction at a tertiary hospital.

Material And Methods

Present study was single-center, prospective, observational study, conducted in department of general medicine, at National Heart Institute, East of Kailash, New Delhi., India. Study duration was of 2 years (September 2014 to September 2016). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients of Acute myocardial infarction (on the basis of the clinical symptoms, 12 lead ECG and the laboratory findings), Acute ST elevation myocardial infarction OR Acute Non ST elevation myocardial infarction, willing to participate in present study

Exclusion criteria

- Patients who are haemodynamically unstable or they are in cardiogenic shock.
- Patients of acute MI with arrhythmias.

Study was explained to patients in local language & written consent was taken for participation & study. We carried out the transthoracic echocardiography with Philips appliance with a 2.5 and 3.75 MHz transducers and the examination completed with colour pulsatile Doppler and continuous wave (CW) Doppler. The diameter of the cardiac cavities and the left ventricular mural thickness were measured along the parasternal longitudinal axis on the two-dimensional M-mode echocardiographic images.

Abnormalities in the left ventricular wall motion were evaluated both qualitatively and quantitatively. By using the 16 segment model suggested by the American Society of Echocardiography Committee. We examined four segments from the parasternal longitudinal view, 6-6 segments from the apical four and two chamber views. The above listed segments could be repeatedly delineated with parasternal short axis view. The wall motion index was calculated on the basis of a generally used score system, by which normokinetic equals 1, hypokinetic 2, akinetic 3, dyskinesia 4, aneurysm 5 scores. Dividing the added up score by the number of the visible segments we get the wall motion abnormality index.

The systolic and diastolic protrusion of the left ventricular wall involved is considered as the criterion of the left ventricular aneurysm. The global systolic left ventricular function is characterized via the linear ejection fraction (EF) calculated with the adjusted Quinones-formula. Ejection fraction less than 40% was considered as diminished left ventricular

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ejection fraction. A LV Thrombus is diagnosed when an echo dense mass adjacent to an abnormally contracting myocardial segment, it is clearly distinguished from the underlying myocardium and will be seen in at least two different transducer positions. The echocardiographic images will be recorded with a videorecorder, and they will be archived on a videocassette.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

In our study 76(70.4%) were male patient and 32(29.6%) were female patient. Minimum age of patient was 24, maximum age was 85 years, mean age of patient was 56.87 ±13.81 years.

Table 1: General characteristics

Characteristics	**No. of patients**	**Percentage**
Gender		
Female	32	29.6
Male	76	70.4
Mean age (mean ± SD)	56.87 ± 13.811	

All of our patients had angina on presentation. Other symptoms were sweating (53.7%), dyspnea (22.2%) & palpitation or syncope. Sweating was more common in males (63.2 %) while dyspnea was more common in females (37.5 %). In our study palpitation were reported in 8 patients (7.4%). All 8 patients were male.

Table 2: Frequency of symptoms

Symptoms	**Male (n=76)**	**Female (n=32)**	**Percentage**
Angina	76 (100%)	32 (100%)	108 (100%)
Sweating	48 (63.2%)	10 (31.2%)	58 (53.7%)
Dyspnea	12 (15.8%)	12 (37.5%)	24 (22.2%)
Palpitation	8 (10.6 %)	0	8 (7.4%)

Common risk factors observed were smoking (44.4%), diabetes (37%), sedentary lifestyle (31.5%), hypertension (24.1%) & dyslipidemia (7.4%). All **smokers were male patients (63.2 %) & dyslipidemia was more common (7.9 %)** than females. Female had high incidence of **diabetes (50%), history of sedentary lifestyle (43.8%) & hypertension (31.2%) compared to males.**

Table 3: Risk factors

Risk factors	**Male (n=76)**	**Female (n=32)**	**Percentage**
Smoking	**48 (63.2%)**	**0**	**48 (44.4%)**
Diabetes Mellitus	**24 (31.6%)**	**16 (50%)**	**40 (37%)**
Sedentary lifestyle	**20 (26.3%)**	**14 (43.8%)**	34 (31.5 %)
Hypertension	**16 (21.1%)**	**10 (31.2%)**	**26 (24.1%)**
Dyslipidemia	**6 (7.9%)**	**2 (6.2%)**	8 **(7.4%)**

In our study of 108 patients majority had anterior wall myocardial infarction (AWMI) (30.6%) & inferior wall myocardial infarction (IWMI) (30.6%) followed by anterior wall-non

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ST elevation myocardial infarction (AWMI-NSTEMI) (22.2%), inferior and posterior wall myocardial infarction (IWMI and PWMI) (5.6%), lateral wall myocardial infarction (LWMI) (3.7%) & inferior wall-non ST elevation myocardial infarction (IWMI-NSTEMI) (3.7%). ‘

Table 4: ECG abnormality

ECG findings	Frequency (108)	Percent (100%)
AWMI	33	30.6
IWMI	33	30.6
AWMI-NSTEMI	24	22.2
IWMI AND PWMI	6	5.6
IWMI-NSTEMI	4	3.7
LWMI	4	3.7
ALWMI	2	1.9
Anteroseptal and IWMI	2	1.9

In our study 88 patients (81.5%) were having troponin T positive & 94 patients (87%) had CPK-MB levels ≥26.

Table 5: Laboratory values

Parameter	No. of patients	Percentage
Troponin T		
POS	88	81.5
NEG	20	18.5
CPK-MB level		
≤ 25	14	13.0
≥26	94	87.0

In our study, 80 patients (74.07%) had ST elevation myocardial infarction and 28 patients (25.93%) had non ST elevation myocardial infarction.

Table 6: STEMI and NSTEMI

STEMI/NSTEMI	Frequency	Percent
STEMI	80	74.07
NSTEMI	28	25.93

In our study of 108 patients, echocardiography showed regional wall motion abnormalities (RWMA) in 102 patients (94.4%) and did not show any regional wall motion abnormalities (RWMA) in 6 patients (5.6%). Majority had RWMA in RCA territory (36.1%) followed by RWMA in LAD territory (34.3%), RWMA in LAD and LCx territory (14.8 %), RWMA in LAD and RCA territory (5.6%) & RWMA in RCA and LCx territory (3.7%).

Table 7: Regional wall motion abnormalities (RWMA)

Regional wall motion abnormalities (RWMA)	No. of patients	Percentage
RCA	39	36.1
LAD	37	34.3
LAD AND LCX	16	14.8
LAD AND RCA	6	5.6
RCA AND LCX	4	3.7
No abnormality	6	5.6

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In our study, 96 patients (88.9 %) had elevated left ventricular end diastolic pressure (LVEDP), 2 patients (1.9%) developed ventricular septal rupture (VSR), 2 patients (1.9%) developed pericardial effusion (PE), 2 patients (1.9%) developed left ventricular free wall rupture & 4 patients (3.7%) developed left ventricular aneurysm. In our study no patient developed left ventricular thrombus.

Table 8: ECHO characteristics

Characteristics	No. of patients	Percentage
Elevated LVEDP	96	88.9
Ventricular septal rupture (VSR)	2	1.9
Pericardial Effusion	2	1.9
LV free wall rupture	2	1.9
LV aneurysm	4	3.7

In our study of 108 patients, 14/108 patients (13%) had ischemic MR. Out of 14 patients who had ischemic MR, 4 patients had moderate MR and 10 patients had severe MR.

Table 9: Ischemic MR

Ischemic MR	Frequency	Percent
Moderate MR	4	3.7
Severe MR	10	9.3
No MR	94	87.0

In our study of 108 patients, 32 patients (29.6%) had TAPSE≤15 mm and hence 32/108 patients (29.6%) had RV dysfunction. 76/108 patients (70.4%) had TAPSE ≥16 mm and hence 76/108 patients (70.4%) had good RV function. Out of 32 patients who had RV dysfunction, 24 patients had inferior wall myocardial infarction, 4 patients had anterior wall myocardial infarction and 4 patients had lateral wall myocardial infarction. Incidence of RV dysfunction in inferior wall MI was 53.33%. Incidence of RV dysfunction in anterior wall MI was 6.56%.

Table 10: TAPSE (Tricuspid annular plane systolic excursion)

TAPSE	Frequency	Percent
≤ 15	32	29.6
≥16	76	70.4

Discussion

Inappropriate discharge from the emergency room of patients with acute chest pain may have serious consequences. Regional asynergy is one of the first signs of myocardial ischemia in patients with acute myocardial infarction and can be detected with 2-dimensional echocardiography.[5] This study determines the value of 2-dimensional echocardiography in the emergency room for immediate detection of myocardial ischemia causing acute chest pain and detection of any further mechanical complications associated with myocardial infarction and hence giving proper direction to the subsequent treatment options.

In our study 76 (70.4%) were male patient and 32(29.6%) were female patient. Observational study from the National Registry of Myocardial Infarction, 1994-2006 showed female incidence of acute myocardial infarction at 42.1%.[6]

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In our study all of the 108 patients (100%) had angina as presenting complaint. 24 patients (22.2%) had dyspnea as presenting complaint. **This is in line with the study done by** KN Chowta, *et al.*,[7] whose result had 80% of patients presented with chest pain, followed by dyspnea (28.3%), sweating (21.7%) and epigastric pain (10%).

In our study, common risk factors observed were smoking (44.4%), diabetes (37%), sedentary lifestyle (31.5%), hypertension (24.1%) & dyslipidemia (7.4%). INTERHEART: A global Case-Control Study of Risk Factors for Acute Myocardial Infarction[8] shows risk factor of diabetes as 18.5%, hypertension as 39%, smoking as 45.2%. sedentary life style as 14.3%.

In our study in our study of 108 patients majority had anterior wall myocardial infarction (AWMI) (30.6%) & inferior wall myocardial infarction (IWMI) (30.6%) followed by anterior wall-non ST elevation myocardial infarction (AWMI-NSTEMI) (22.2%), inferior and posterior wall myocardial infarction (IWMI and PWMI) (5.6%), lateral wall myocardial infarction (LWMI) (3.7%) & inferior wall-non ST elevation myocardial infarction (IWMI-NSTEMI) (3.7%). In our study 88 patients (81.5%) were having troponin T positive & 94 patients (87%) had CPK-MB levels ≥26. According to systematic review of troponin T for diagnosing acute myocardial infarction Ebell MH, *et al.*,[9], it had sensitivity of 86% after 6 hours of onset of chest pain.

In our study of 108 patients, 80/108 patients (74.07%) had ST elevation myocardial infarction and 20/108 patients (25.93%) had non ST elevation myocardial infarction. 2D-Echocardiography showed regional wall motion abnormalities (RWMA) in 102/108 patients (94.4%) and did not show any regional wall motion abnormalities (RWMA) in 6/108 patients (5.6%). Sensitivity of 2D-Echocardiography was 88% in a study done by Cathinka HP *et al.*,[1]

In our study, 14 patients (13%) had ischemic MR. Out of 14 patients who had ischemic MR, 4 patients had moderate MR and 10 patients had severe MR. All 14 patients who had ischemic MR were having STEMI and no NSTEMI patient had developed ischemic MR.

Up to date there is uniform agreement on prognostic significance of age, female gender, LV dysfunction, dimensions and volumes in development of MR in post-MI setting.[10] Our study has shown that significant (moderate and severe) MR is more prevalent in the inferior MI group. Reports on whether the left ventricular (LV) infarction localization is a risk factor for MR severity differ: the incidence of ischemic MR has been reported to be higher in inferior compared to anterior MI localization;[11] however, the difference in incidence of moderate or severe MR based on MI localization was reported as insignificant by other author teams.

In our study of 108 patients, 2 patients (1.9%) developed ventricular septal rupture (VSR). Both the patients were male patients and both had anterior wall STEMI. Incidence of VSR in anterior wall myocardial infarction was 2/61 patients (3.28%) which is similar to the historical data available on VSR after acute myocardial infarction.

Limitations of present study were small sample size and hence no major conclusions can be deduced with any certainty. Also, study had no long term follow up. Hence no light could be thrown on long term prognosis and echocardiographic findings of such a condition other than in-hospital.

Conclusion

2D Echocardiography has a very high sensitivity in detecting myocardial ischemia in the form of regional wall motion abnormalities (RWMA). 2D Echocardiography is a very important diagnostic modality to detect various mechanical complications like ischemic mitral regurgitation, ventricular septal rupture, pericardial effusion, left ventricular aneurysm, right ventricular dysfunction and hence guide the proper treatment at earliest.

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