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Original Research Article

Echocardiographic evaluation of wall motion abnormality and systolic left ventricular dysfunction in acute myocardial infarction within 1st week of hospitalization

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ABSTRACT

Background: Acute myocardial infarction is a leading cause of morbidity and mortality, commonly resulting in left ventricular systolic dysfunction. Early echocardiographic assessment helps identify wall motion abnormalities, guide prognosis, and optimize timely management during the first week of hospitalization. The objective was to find out cardiac wall motion abnormality and ejection fraction by echocardiography and its correlation with clinical features and ECG findings in patients of AMI.
Methods: One hundred (100) cases of acute myocardial infarction were studied in cardiology unit of RMCH from July 2008 to December 2008. Mean age (±SD) was 50.22±11.59 years (range 25-80 years). It was an observational study. All selected patients were interviewed with a preformed questionnaire and were observed up to 7 days in hospital.
Results: 88% of them were males and 12% of them were females. Males were mostly smokers (89.77%) and females were mostly hypertensive (75%). Most patients could reach in hospital within 4-12 hours of onset of symptoms due to acute left ventricular failure and cardiogenic shock. Anterior wall (49%) hypokinesia and mild systolic LV dysfunction were revealed in echocardiography among the survivors.
Conclusions: This study is a hospital-based study and most of the patients came from rural areas of Rajshahi and nearby districts (85%). Incidence of AMI was seen common among farmers who were mostly smokers. Systolic LV dysfunction was common in most patients where anterior wall involvement was present.

Keywords: Acute myocardial infarction, Echocardiography, Wall motion abnormality, Left ventricular dysfunction, Ejection fraction

INTRODUCTION

Coronary artery disease (CAD) is the 2nd most common cause of death in the developing world and acute myocardial infarction (AMI) is the most common cause of sudden arrhythmic death (85%).[1,2] About one-third of patients in AMI die before reaching the hospital.[2] Approximately 800,000 persons in the United States experience acute myocardial infarction annually, of them about 213,000 die. In Bangladesh the prevalence of ischemic heart disease was 3.4% in rural community in 2007.[3] Myocardial infarction (MI) is almost always due to

the formation of occlusive thrombus at the site of rupture or erosion of an atherosclerotic plaque in a coronary artery. The thrombus often undergoes spontaneous lysis over the course of the next few days, although by this time irreversible myocardial damage has occurred.[4,5] Approximately 40% myocardial infarctions are associated with left ventricular (LV) dysfunction in early phase.[6-8] Left ventricular dysfunction is worse where wall motion abnormality is present in anterior wall rather than lateral and inferior wall.[9,10] The immediate haemodynamic consequences of myocardial infarction include left ventricular systolic dysfunction (LVSD). Left ventricular systolic dysfunction may be defined as the condition where the left ventricle can only manage to eject <40% (occasionally <35%) of the blood with each contraction.[11] It is secondary to a loss of contractile function of the infarction and ischemic myocardium.[12] Over a period of 1 to 3 minutes, the regional disturbances of contraction progresses from dyssynchrony through hypokinesis (diminished motion) and akinesis (total lack of motion) to dyskinesia (paradoxical systolic expansion).[13] This loss of contractile function result in a decreased systolic ejection, increased end systolic volume, increased end diastolic volume and a secondary increase in diastolic filling pressure caused by the increase in ventricular volume.[14] Left ventricular systolic dysfunction with clinical signs of failure is said to occur in 30-40% of patients and usually develops when the abnormally contractile segment exceeds 30% of the left ventricular circumference.[15,16] Measurement of regional wall motion abnormality and global left ventricular systolic function have been shown to be the strongest prognostic indicator after AMI.[17,18] The regional wall motion abnormality and systolic dysfunction (determined by left ventricular ejection fraction) can be assessed with the help of two-dimensional echocardiography (2D echo). Proper management of acute MI requires careful monitoring, anti-platelet agents, coronary vasodilators, selective beta-1 blockers and ACE inhibitors etc. Early reperfusion with fibrinolytic therapy or direct angioplasty is also necessary.[19] The objective was to evaluate left ventricular wall motion abnormalities and ejection fraction using echocardiography in patients with acute myocardial infarction, and to analyze their correlation with presenting clinical features and electrocardiographic findings during the first week of hospitalization, aiming to aid early risk stratification and management decisions.

METHODS

It was an observational study which was carried out in the Cardiology unit of Rajshahi Medical College Hospital (RMCH) on consecutive 100 patients who presented with acute MI study period July 2008 to December 2008. All selected patients were interviewed with a preformed questionnaire and was observed up to 7 days in hospital. Echocardiography was done to assess the regional wall motion abnormality and assessment of left ventricular ejection fraction (LVEF) by applying Teichholz (cube) formula which assumes that left ventricle is a sphere. In every case left ventricular internal diameter in diastole (LVIDd) and left ventricular internal diameter in systole (LVIDS) were determined.

Inclusion criteria

All patients who were diagnosed as acute MI were included in the study irrespective of age, sex and risk factors.

Exclusion criteria

Patients unwilling to participate in the study; patients having other conditions e.g. old MI, valvular heart disease, cardiomyopathy, malignancy, chronic liver disease, chronic renal disease were excluded in the study.

Data collection

Data were collected through face-to-face interview with a preformed questionnaire. An informed consent was taken from all the study patients. Case history was taken from either patient or attendant. Thorough physical examination was carried out. All the relevant information from history, clinical findings and investigation results were recorded in a pre-designed questionnaire/data collection sheet. Interview schedule (data collection sheet/questionnaire), check list, Informed consent form.

Data analysis

Collected data were entered, checked and analyzed with the aid of computer software SPSS. Descriptive and analytic statistics were applied where needed. Data were shown in frequency distribution tables and map.

Ethical issues

During this study, patients were shown utmost respect. Informed written consent was taken from the patient and or attendant. Those who refused to give informed consent or to take part in the study were not included. No new treatment modalities were applied to the patients.

RESULTS

A total of 100 cases were included in this study. Mean age (SD) was 50.22 EI 1.59 years (range 25-80 years). 88 of them were male and 12 were female. Male patients were mostly smoker and involved agriculture. Anterior MI was more in number (37%) and also complications were more. AII were analyzed and presented in tabulated form.

Table 1 shows that the incidence of maximum numbers of acute myocardial infarction is in the age group of 50-59 years (34%). Another thing is also important that majority (61%) of acute myocardial infarction happened in the age group of 40- 59 years (61%) and young onset (age <40 years) acute myocardial infarction is also significant (9%).

Table 2 shows that acute myocardial infarction occurs more in male (88%) population than female (12%). Ratio of male: female is 7.3.

Table 1: Age distribution of study patients (n=100).

Age (in years)	Number of cases	Percentage
<30	02	2
30-39	07	7
40 -49	27	27
50- 59	34	34
60 - 69	18	18
>70	12	12

Table 2: Sex distribution among study patients (n=100).

Characteristics	Number of cases	Percentage
Male	88	88
Female	12	12

Table 3: Risk factors distribution among study subjects (n=100).

Risk factors	Number of cases	Percentage
Smoking	79	79
Hypertension	33	33
Diabetes mellitus	15	15
Family history of IHD	13	13
Obesity	06	6

Table 4: Distribution of occupation among study patients (n=100).

Occupation	Number of cases	Percentage
Farmer	48	48
Businessman	18	18
Service holder	15	15
Others	19	19

Table 5: Distribution of presenting symptoms among study patients (n=100).

Symptoms	Number of cases	Percentage
Chest pain	96	96
Respiratory distress	23	23
Sweating	95	95
Vomiting	28	28

Table 3 shows the risk factors among the study subjects, the most important was smoking (79%) followed by hypertension (33%).

Table 4 shows that the incidence of AMI is more common among farmers (48%) followed by businessman (18%) and service holders (15%).

Table 6: Electrocardiographic diagnosis of different wall myocardial infarction (n=100).

Walls of heart	Number of cases	Percentage
Anterior	37	37
Extensive anterior	14	14
Antero-septal	22	22
Inferior	20	20
Others	07	7

Table 7: Wall motion abnormality of different wall myocardial infarction in echocardiography (n=87).

Walls of heart	Number of cases	Percentage
Anterior	43	49
Antero-septal	18	21
Inferior	16	18
Others	10	12

Table 8: Diagnosis of acute myocardial infarction according to criteria (n=100).

Criteria	Number of cases	Percentage
Rise in CK-MB	90	90
Anginal chest pain	96	96
ECG change	100	100
Above three criteria	85	85
Pathologic findings	72	72

Table 9: Mean LV functions in different wall myocardial infarction (n=87).

Walls of heart	Number of cases	Percentage
Anterior	43	45.97
Antero-septal	18	46.90
Inferior	16	50.37
Others	10	43.25

Table 10: In hospital outcome after acute myocardial infarction (n=100).

Events	Number of cases	Percentage
Improved and discharged	87	87
Death	13	13

Table 5 shows that the main presenting symptoms of developing acute myocardial infarction were chest pain (96%) followed by sweating (95%) and vomiting (28%).

Table 6 shows that most of the patients of acute myocardial infarction have anterior wall involvement (37%), followed by anteroseptal (22%) and inferior (20%) wall.

Table 7 shows that most of the patients of acute myocardial infarction have anterior (49%) wall hypokinesia, followed by anterioseptal wall (21%) hypokinesia in echocardiography.

Table 8 shows that 90% patients were found to have raised CK-MB, ECG change was found in 100%; but pathologic changes were found in 72% patients in echocardiography.

Table 9 shows that LV function of the patients of acute myocardial infarction has been deteriorated in anterior wall myocardial infarction (45.97%) and relatively normal in inferior wall myocardial infarction (50.37%).

Table 10 shows that 87% patients were improved and discharged from the hospital and 13% patients died in the hospital.

DISCUSSION

Acute anterior myocardial infarction is a major killer disease. About half of the patients die within an hour of onset of symptoms. Anterior myocardial infarction is more dangerous where death rate is much more. Those who survive usually develop complications like left ventricular failure, cardiogenic shock and others, ultimately become disabled. Wall motion abnormality is present in almost all patients along with systolic left ventricular dysfunction in echocardiography. The highest incidence of acute myocardial infarction with its various complications in this study was 50- 59 years in this study (34%). It has similarity to that dissertations in which they found that maximum age incidence was 50-59 years.[20-22] The next common age group in my study was 40-49 years (27%).[20-22] This is consistent with the findings of the studies who found it 31%.[20,21] Others showed maximum incidence of myocardial infarction was in the age group 41-50 years which was a bit different from this study, but their study was mainly based on Dhaka city.[23-25] So it was evident from both studies that peak age incidence was 5th and 6th decade. About 9% of patients below 40 years of age developed MI in the present study. Among the age group below 40 years some study reported 11% of cases others reported 16.32%.[26,27] Though it is common belief that AMI inflicts the active age of life but it does not spare the younger ones. In this study male and female ratio was 7.3: 1. This is nearly similar to the finding of 6.1:1, 8.04: 1.[21,28] But others showed the ratio in their studies 14:1 and 14:1 respectively, a bit higher in comparison to this study.[26,29] In western studies though the incidence is higher in male, the male and female ratio is much lower than of ours. A very low incidence in female in this part of the world may be due to the fact that they do not get medical attention as male. In our country, this male and female ratio gradually declines which may be due to cope up with responsibility, worries and anxiety, more adherences to contraceptives. Most of my cases of acute myocardial infarction (48%) were found amongst farmers who are usually engaged in hard physical works. This is similar to works but different to those who showed people engaged in hard manual labor have a lower prevalence of coronary heart disease than those of sedentary workers.[21,30-32] The above-mentioned writers did not give any analytical information about the educational, socio-economic and psychological status of their patients and all the studies were urban based. Studies from European countries and the United States have shown that low educational status, low social class and poverty are the major coronary risk factors.[33-35] In our country the prevalence of ischemic heart disease was 3.4% in rural community which is a bit higher 10%.[36] However, the exact mechanism by which higher socio-economic group protects against coronary heart disease is not clear. 79% of patients in this study were smoker. It is consistent with findings of (75.56%), (74%) and (73.33%).[21,29,37] But others study 63% is more or less consistent.[23] Oliver et al found definite relationship between cigarette smoking and coronary heart disease.[38] Those smoking more than 20 cigars per day having significantly more coronary heart disease. 27.27% of patients in this study were found hypertensive. Incidence of hypertension in other studies 28.7% 39% 34%, 23% respectively.[21,23,26,39] Those are more or less consistent with this study. In this study 14.77% patients were found diabetic. This is consistent with 12%, 14%, and 17.78%; but a bit higher 27%.[21,23,37,39] In this study 96% patients complained of chest pain, 23% complained of dyspnoea and 96% complained of sweating. Some found chest pain in 93.33%, 92.6%, 96%.[26,27,37] Those are consistent with this study. Myocardial infarctions may be painless in 10-20% cases particularly in diabetes and old age. Anterior myocardial infarction was found in 49% of patients in this study. Other observations 55.55%, 52.00% and 47.62% respectively which are consistent with this study.[27,28,37] Incidence of anterior myocardial infarction (49%) was significantly higher than anteroseptal (18%) and inferior (16%) which are also consistent with anteroseptal MI 18%.[21] Measurement of left ventricular ejection fraction shows that ejection fraction was reduced in almost all patients after anterior myocardial infarction. Average ejection fraction in this study after anterior myocardial infarction was 45.97%, anteroseptal myocardial infarction 46.90% and inferior myocardial infarction 50.37%. This is consistent with 40-49% in anterior myocardial infarction but a bit higher than 40.28.[20,37] In this study main complication after acute myocardial infarction was left ventricular failure (26%). Other complications were cardiogenic shock (05%), arrhythmias (05%) and conduction defects (04%). In cases of left ventricular failure this is consistent with observations 27% and 23% respectively.[23,40] Thirteen patients (13%) died after hospital admission. Ten were male and most of them were smoker. Three were female. Most of the patients died within 24 hours of admission and most of them had multiple risk factors like smoking, diabetes and hypertension. This death rate was consistent with 10.7%.[28] Severe left ventricular failure and cardiogenic shock were two main complications for which death occurred.

CONCLUSION

This study is a hospital-based study but most of the patients came from rural areas of Rajshahi district and nearby districts. So, it will represent majority of population of our country except urban areas like Dhaka city Chittagong city. The most striking result is that incidence of acute myocardial infarction is very common among farmers and heavy manual workers who are mostly smokers. Young onset acute myocardial infarction is not uncommon (9%). Systolic left ventricular dysfunction was present in most patients where anterior wall involvement was present. In hospital outcome reveals that about one fourth of the acute myocardial infarction patients developed acute left ventricular failure and other complications include cardiogenic shock (5%) and arrhythmia (5%). Overall, in hospital mortality of acute myocardial infarction patients were 13%.

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