Echocardiographic Assessment of Left Ventricular Function in Acute Myocardial Infarction

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ABSTRACT

Introduction: Myocardial Infarction is one of the leading cause of deaths & mortality worldwide. Echocardiography is the key investigation in cases of myocardial infarction and confirms the presence of regional wall motion abnormality, presence of left ventricular dysfunction and to assess ejection fraction, as left ventricular ejection fraction has both therapeutic and prognostic significance. Study aimed to Assess Left Ventricular Function In Case Of Acute Myocardial Infarction With Comparison Between Non ST Elevation Myocardial Infarction And ST Elevation Myocardial Infarction.

Material and methods: Fifty consecutive patients of STEMI and NSTEMI admitted from the outdoor patient department / emergency ward /cardiology unit in MMIMSR Mullana, Ambala, were considered for the study. The echocardiographic measurement were done and comparative analysis were done. Chi square test was applied and values less than 0.05 was taken as significant.

Result: A statistically significant difference between two groups was observed for ventricular dimensions (LVIDd and LVPWd), EF%/FS/CO, In this study smoking emerged as a major risk factor with preponderance of inferior wall MI in patients with no other cardiovascular risk factor.

Conclusion: In this study STEMI was more common in younger age group with male preponderance. LVEF/CO/ left ventricular dimension were more compromised in STEMI than NSTEMI. Left ventricular dysfunction after acute myocardial infarction predicts long term mortality, and reduced LVEF may prompt greater consideration of invasive treatment and to guide care strategy.

Keywords: Echocardiography, Left Ventricular Function, Acute Myocardial Infarction, Smoking.

INTRODUCTION

Myocardial infarction is one of the commonest conditions in hospitalized patients in our country. Mortality rate of acute Myocardial Infarction is approximately 30% with more 32% of all deaths in 2017 is due to myocardial infarction.

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 .In case of NSTEMI, ST segment depression more than 1 mm, 0.08 sec after J point T wave inversion.

Echocardiographic and left ventricular systolic function - Echocardiography is helpful in the assessment of systolic dysfunction include left ventricular systolic volume, left ventricular ejection fraction (LVEF), assessment of diastolic dysfunction/ filling pressure E:A Ratio and left atrial volume.[1-2]

LVEF is generated by using the Simpson' Biplane method[3], left ventricular ejection fraction identified with echocardiography have been well validated[4] and gives important information on the relationship between the location and size of RWMA present, ECG location and size, the status of the patient, complication and survival.[5]

Echocardiography and diastolic dysfunction - When diastolic dysfunction precedes systolic dysfunction,[6] it has been validated as an early indication of CCF after an AMI.[7] Diastolic dysfunction can be graded as 4 main grades. GRADE 1/ -Mildly impaired diastolic dysfunction with abnormal relaxation pattern. GRADE 2/- Moderately impaired diastolic dysfunction with pseudo normal relaxation pattern. GRADE 3 AND GRADE 4 – Are severely impaired diastolic dysfunction with restrictive relaxation pattern. GRADE 3 is reversible while grade 4 is not.[8]

Our aim is to do the Echocardiographic assessment of left ventricular function in patients of acute myocardial infarction and compare the function in between patients of STEMI and NSTEMI. This assessment will lead to know that, how intensive management is required for both types of myocardial infarction – STEMI/NSTEMI.

Echocardiographic Study was done to assess left ventricular function in cases of acute myocardial infarction with comparison between non ST elevation myocardial infarction and ST elevation myocardial infarction.

MATERIAL AND METHODS

A Prospective, Observational, Clinical Study was conducted on fifty consecutive patients of STEMI and NSTEMI admitted in MMIMSR, Mullana, Ambala from December 2017 to July 2019. Ethical clearance was taken from institutional ethical board before start of the study.

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Inclusion criteria

1. Patients age more than 18 year and less than 80 years.
2. First time presented with myocardial infarction.

Exclusion criteria

1. Previous history of Myocardial Infarction.
2. Those who denied for admission and further treatment.

Diagnosis of acute myocardial infarction was considered if at least two of the following criteria are satisfied:

1. Chest pain typical of MI, i.e lasting more than 20 minutes and not relieved by nitrates or rest
2. Elevation of serum cardiac enzymes level, i.e CPK-MB, Trop-T/I and LDH.
3. Electrocardiography changes-
   Diagnostic criteria for STEMI- any of the following:
   a. New ST elevation at the J point in to contiguous leads of >0.1 mv in all leads other than leads V2-V3.For leads V2-V3 the following cut points apply ≥0.2mv in men ≥40 years, ≥0.25 mv in men <40 years or ≥0.15mv in women
   b. Other conditions which are treated as ST elevation MI
      - New or presumed new LBBB
      - Isolated posterior myocardial infarction

Diagnostic criteria for NSTEMI: Any one of the following

1. New horizontal or down sloping ST segment depression ≥0.5 mm in at least two anatomically contiguous leads.
2. T wave inversion ≥1mm in at least two anatomically contiguous leads. These leads must have evident R waves or R waves larger than S waves

2 D Echocardiography

Echocardiographic assessment was done by using model VIVID-E colour doppler echocardiography machine of GE. Echocardiographic assessment was done in M mode two dimensional and Doppler mode using colour flow mapping.

STATISTICAL ANALYSIS

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 21.0 statistical Analysis Software. The values were represented in Number (%) and Mean ±SD.

RESULTS

The present study in which a total of 25 patients with confirmed diagnosis of ST-elevated myocardial infarction (Group I) and a total of 25 patients with confirmed diagnosis of non-ST-elevated myocardial infarction (Group II) were enrolled.

Age of patients ranged from 38 to 70 years. Mean age of patients was 54.08±9.55 years and 56.12±7.20 years respectively. Though the proportion of those aged <50 years was higher in Group I (40%) as compared to that in Group II (32%) yet this difference was not significant statistically (p=0.556) (table-1).

In both the groups majority of patients (72%) were males and remaining 28% were females. The male-to-female ratio was 2.57:1.

Mean body surface area of patients in Group I was 1.63±0.11 m^2 as compared to 1.66±0.11 m^2 in Group II.

Statistically, no significant difference was observed between two groups for any of the left ventricular dimensions except for LVIDd and LVPWd. Mean LVIDd was found to be significantly higher in Group I (45.52±9.28 mm) as compared to that in Group II (40.84±6.64 mm) (p=0.046) whereas LVPWd was found to be significantly lower in Group I (8.94±1.74 mm) as compared to that in Group II (10.03±1.51 mm) (p=0.022) (table-2).

In Group I, mean left ventricular volumetric measurements like EDV, ESV and SV were 104.16±36.33, 57.58±37.32 and 46.44±17.11 ml respectively as compared to 93.24±17.04, 51.56±14.80 and 42.08±11.62 ml respectively in Group II. On comparing the data between two groups, the difference was not found to be significant statistically for any of the three volumetric measurements (p>0.05) (table-3).

It was observed that mean ejection fraction, fractionated

SN	Characteristic	Group I (STEMI) (n=25)	Group II (NSTEMI) (n=25)	Statistical significance
1.	Mean Age±SD (Range) in years	54.08±9.55 (38-70)	56.12±7.20 (42-68)	't'=0.843; p=0.398
	Age <50 years Age > 50 years	10 (40.0%) 15 (60.0%)	8 (32.0%) 17 (68.0%)	χ^2=0.347; p=0.556
2.	Gender Male Female	 18 (72.0%) 7 (28.0%)	 18 (72.0%) 7 (28.0%)	χ^2=0; p=1
3.	Mean BSA±SD (m^2)	1.63±0.11	1.66±0.10	't'=1.165; p=0.250

Table-1: Comparison of Demographic and Anthropometric profile of patients enrolled in the study

SN	Parameter	Group I (n=25)		Group II (n=25)		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
1.	LVIDd	45.52	9.28	40.84	6.64	2.050	0.046
2.	LVIDs	34.28	10.66	31.12	5.55	1.315	0.195
3.	IVSd	8.99	1.85	9.67	1.77	-1.329	0.190
4.	IVSs	11.30	1.52	11.02	1.96	0.572	0.570
5.	LVPWd	8.94	1.74	10.03	1.51	-2.372	0.022
6.	LVPWs	11.90	1.84	11.82	1.52	0.168	0.867

Table-2: Comparison of Left Ventricular Dimensions between two study groups (mm)

SN	Parameter	Group I (n=25)		Group II (n=25)		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
1.	EDV	104.16	36.33	93.24	17.04	1.361	0.180
2.	ESV	57.58	37.32	51.56	14.80	0.749	0.457
3.	SV	46.44	17.11	42.08	11.62	1.054	0.297

Table-3: Comparison of Left Ventricular Volumetric measurements between two study groups (ml)

SN	Parameter	Group I (n=25)		Group II (n=25)		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
1.	EF(%)	42.00	10.02	50.12	10.63	-2.780	0.008
2.	FS (%)	21.65	5.55	24.84	5.37	-2.066	0.044
3.	E:A	1.04	0.44	0.97	0.29	0.641	0.525
4.	DT(msec)	150.6	22.58	141.40	31.75	1.181	0.244
5.	IVRT(msec)	97.74	13.99	99.89	7.09	-0.686	0.496
6.	HR(b/min)	75.16	14.04	81.04	15.21	-1.420	0.162
7.	CO(L/min)	2.98	0.69	3.45	0.83	-2.167	0.035

Table-4: Comparison of Left Ventricular Functional measurements between two study groups

SN	RWMA Abnormality	Group I (n=25)		Group II (n=25)	
		No.	%	No.	%
1.	Anterior wall	10	40	4	16
2.	Inferior wall	14	56	3	12
3.	Lateral wall	0	0	0	0
4.	No RWMA	1	4	11	44
5.	Multiple*	0	0	7	28

$\chi 2=25$; $p<0.001$; *Multiple – 3 cases having anterior+inferior wall involvement and 4 cases having anterior+lateral wall involvement

Table-4: Comparison of Left Ventricular Functional measurements between two study groups

shortening and cardiac output was significantly lesser in Group I as compared to that in Group II ($p<0.05$) (table-4). None of the cases of group I had multiple wall involvement whereas in Group II, seven (28%) had multiple wall involvement. In Group I, majority (n=14; 56%) had inferior wall involvement followed by anterior wall involvement (n=10; 40%) and one case without any RWMA involvement. In comparison, in Group II, maximum (n=11; 44%) had no RWMA followed by seven (28%) cases having multiple wall involvement – of these three cases had anterior+ inferior wall involvement while four cases had anterior + lateral wall involvement, four (16%) had anterior wall involvement and three (12%) had inferior wall involvement. On evaluating the data statistically, the difference between two groups was found to be statistically significant ($p<0.001$) (table-5).

DISCUSSION

Echocardiography was done to assess the left ventricular function, the result obtained was compared between STEMI and NSTEMI. As Echocardiography is a noninvasive test which can play an important role in recognizing cardiac dysfunction and pathology, as well as follow up response to therapy.

Age: The proportion of patients whose age is <50 years was higher in STEMI (40%) group 1, as compared to NSTEMI group 2 (32%). Yet the difference was not significant statistically ($p=0.556$). This finding is in agreement with the previous study conducted by Good man et al[9] and Murphey et al[10] in which NSTEMI Patients group was older than the group of patients with STEMI.

Sex: In the present study majority of the patients in both group (STEMI and NSTEMI) i.e. 72% were male, and 28% were female. The male to female ratio was 2.57:1. This study was in agreement with study done by Akram et al[11] in which male to female ratio was 5.25:1,other studies by Gupta et al[12], and Goodman et al[13] also reported male preponderance. But it differed from the study conducted by AlymHegazy et al[14] who noted that there was no significant difference in the sex factor of the patients.

BMI: Mean body surface area of patients in group 1 (STEMI) was $1.63+0.11m^2$ as compared to $1.66+0.11m^2$ in group 2 (NSTEMI). Statistically, the difference between two groups was not significant ($p=0.250$)

Risk-factor

Smoking: In the present study smoking was found to be major risk factor for Acute STEMI, Precisely Inferior wall MI (56%). In INTER HEART study[15] smoking is the second most important risk factor for acute MI. Another study conducted by Queck DK et al[16] in Malaysia found that the risk of acute MI found was 23.9% as compared to control i.e. 12.8%. Another study done by Sanger R.P et al[17] in year 1997-2003 observed that by implementing no smoking law at public places for six months decrease the mortality from Acute MI.

In A Retrospective study done by Vaidya CV et al[18] conducted

in Gandhinagar in 2015 of all new patient with STEMI, smoking emerged as the most important risk factor (40.7%), followed by hypertension (20.3%) and dyslipidemia (15.3%).

Echocardiographic Parameters: In comparison of left ventricular function between the two study groups, statistically no significant difference was observed between two groups except for LVIDd and LVPWd. Mean LVIDd was found to be higher in STEMI Group 1(40.52+9.28mm) as compared to that in NSTEMI Group 2 (40.84+6.64mm) with P value =(0.46). LVPWd was found to be lower in group1 (STEMI) (8.94+1.74mm) in comparison to NSTEMI GROUP 2 (10.03+1.51mm) P=(0.022). For the remaining parameters i.e. LVIDs/ IVSd/ IVSs/ LVPWs, there was no significant difference between the two groups (P>0.05).

It was observed that mean EF/FS/and CO was significantly lesser in STEMI as compared to NSTEMI.

Mean EF(%) in STEMI patient was 42+ 10.02 and 50.12+0.63 in patient with NSTEMI in present study. Similar results were observed by Amy Leigh Miller et al[19] observes STEMI has low left ventricular ejection fraction compare to NSTEMI.

In our study, no significant difference between the two groups was observed for E/A RATIO, DT, IVRT, and Heart Rate.

CONCLUSION

In this study STEMI was more common in younger age group with male preponderance. LVEF/CO/ left ventricular dimension were more compromised in STEMI than NSTEMI. As coronary flow is severely affected in cases of STEMI. The assessment of LVEF is a core performance measure for patient of STEMI and NSTEMI, because LVEF has both therapeutic and prognostic significance. Left ventricular dysfunction after acute myocardial infarction predicts long term mortality, and reduced LVEF may prompt greater consideration of invasive treatment and to guide care strategy.

In the above study, smoking has emerged as an important risk factor for acute myocardial infraction especially inferior wall myocardial infraction.

The present study highlights the immediate need to initiate measures to raise awareness about the harmfulness of smoking among the general population especially young adults. Initiative at individual and government levels are required to develop a program to control smoking especially among youth.

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