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## LEFT VENTRICULAR EJECTION FRACTION AFTER ACUTE MYOCARDIAL INFARCTION.



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**ABSTRACT...** [mugheesather@hotmail.com](mailto:mugheesather@hotmail.com). **Objective:** (1). To measure and compare Left Ventricular Ejection Fraction (LVEF) after acute anterior wall and inferior wall myocardial Infarction and correlate LVEF with clinical findings in the patients. (2) To see prevalence of Left Ventricular Failure (LVF) after AMI. **Design:** Prospective observational echocardiography based study. **Setting:** Sheikh Zayed Hospital Lahore. **Period:** From 2001 to 2002. A total of 60 (sixty) patients of (anterior or inferior) Acute Myocardial infarction (AMI) were included in the study. Patients were divided in two groups on the basis of anterior myocardial wall MI (AWMI) or inferior myocardial wall MI (IWMI). Echocardiography was done on all cases and ejection fraction was calculated by applying Simpson's Rule and patients were examined at the same time to see the presence of signs of left ventricular failure (LVF). (LVEF) was correlated with the findings of LVF in these patients. **Results:** In patients with LVF mean ejection fraction (EF) was 37.13 with standard deviation (SD) of 8.4 %. In patients without failure the mean EF was 56.29% with SD of 3.75. In 30 patients of IWMI, mean EF was 54.93% with SD of 6.86. In 30 patients of AWMI it was 46.07% with SD of 11.72. In all 60 patients minimum EF was 30% and maximum was 60% with a mean of 50.50 with SD of 10.52. In AWMI, 53% patients had signs of left ventricular failure. In patients of IWMI, 13.3% had signs of LVF. **Conclusions:** AWMI causes more decrease in LVEF. LVF is more commonly associated with AWMI than IWMI. There is statistically significant difference in LVEF of patients with and without LVF.

**Key words:** Acute myocardial infarction, left ventricular failure, left ventricular ejection fraction, echocardiography

### INTRODUCTION

At the beginning of 20<sup>th</sup> century, ischemic heart disease (IHD) accounted for less than 10% of all deaths worldwide. At its end, it accounted for nearly half of all deaths in the developed world and 25% in developing world<sup>1</sup>.

IHD will claim 25 million deaths annually and it will surpass infectious diseases as world's number one cause of death and disability in future. It will be accounting for 36.3% of all deaths by year 2020.

AMI continues to be a major health problem and one of the most common diagnoses in hospitalized patients in

industrialized world. In US 1.5 million patients suffer from AMI every year (one patient in every 20 minutes)<sup>1</sup>. When myocardium undergoes ischemic injury, left ventricular pump function becomes depressed, cardiac output, stroke volume, and BP is decreased. AMI frequently causes heart failure, characterized by either systolic dysfunction alone or by both systolic and diastolic dysfunction. Heart failure has increased risk of mortality. LV dysfunction and increased systolic volume are important predictors of mortality after AMI<sup>1</sup>. LV diastolic dysfunction leads to pulmonary congestion and pulmonary venous hypertension whereas systolic dysfunction is principally responsible for the depression of cardiac output and of ejection fraction. Clinical manifestations of LV failure become more common as the extent of the injury to LV increases. In addition to infarct size, the important predictors of the development of symptomatic LV dysfunction include age and DM. Mortality increases in association with the severity of the hemodynamic deficit.

Echocardiography is a standard tool in the management of patients with AMI. With color flow Doppler it can assess left and right ventricular function, and other important cardiac parameters. It is usually the preferred test to measure the LVEF, since it can detect other abnormalities that are associated with a worse prognosis including diastolic dysfunction, concurrent right ventricular involvement, increased left atrial volume, mitral regurgitation, and a high wall motion score index. (LVEF) is a major predictor of long-term prognosis after both ST elevation and non-ST elevation infarctions. For those with an LVEF <28 percent, survival at one year is 24 percent (versus 56 percent for those with a higher LVEF).

The 2003 American Heart Association task force gave a class I recommendation to the use of echocardiography for the in-hospital assessment of ventricular function after AMI.

This study was single center, echocardiography based, observational study.

The purpose of study was

1. To measure and compare LVEF after acute

anterior wall and inferior wall myocardial infarction.

2. To correlate LVEF with clinical findings in the patients.
3. To see prevalence of left ventricular failure (LVF) after AMI.
4. To identify those patients who are more prone to develop LVF after AMI, so that extra precautionary measures can be taken to prevent it.

## MATERIALS AND METHODS

It was a prospective observational echocardiography based study which was carried out in the department of coronary care unit at Sheikh Zayed Hospital Lahore from 2001 to 2002.

All the patients with isolated acute anterior or inferior wall myocardial infarction that present within five days of onset of symptoms were included in the study. There was no discrimination for age and sex. The diagnostic criteria for myocardial infarction were presence of any two (2) of the followings:

- i. History suggesting AMI,
- ii. ECG changes in anterior or inferior leads suggesting acute MI of that area.
- iii. Raised cardiac enzymes.

Following patients were excluded from the study.

1. Patients having evidence of previous myocardial infarction by history or ECG.
2. Patients who were having all other MI or presented later than five days of onset of severe symptoms.
3. Patients having combined anterior and inferior wall MI or with non-Q wave MI.
4. Patients having isolated pericardial disease, gross valvular heart disease, inflammatory heart disease because these conditions independently decrease EF, however presence or absence of signs of LVF was not an inclusion or exclusion criteria.

A total of 60 patients, 30 consecutive patients of each

type (anterior or inferior) of AMI were under study. Patients were divided in two groups. One group included patients of AWMI (group I), and other included patients of IWMI (group II). Echocardiography was done on all cases on the fifth post MI day. Left ventricular internal diameter during diastole as well as during systole were measured by applying Simpson's Rule and ejection fraction was calculated in apical two chamber and four chamber views separately. Mean ejection fraction was calculated. Patients were examined at the same time to see the presence of signs of LVF. Patients in each group were further subdivided into two groups each based on the clinical signs of LVF. Group Ia and IIa were having signs of left ventricular failure and groups Ib and IIb having no findings of LVF. Mean LVEF and standard deviation for each group was calculated and compared by applying independent sample t-test. Group comparison of mean LVEF was done. Proportion of the patients with left ventricular failure was calculated in each group and compared by using chi-square test.

LVEF of patients with failure was compared with LVEF of patients without failure by using independent sample t-test. Similarly age of all patients was compared collectively and separately in anterior and inferior wall MI. Sex proportion of patients of both groups of anterior wall and inferior wall MI was noted separately and collectively.

### **INSTRUMENT (ECHO MACHINE)**

The echocardiography machine of department of cardiology was used for calculation of LVEF. This is high technology stuff with built-in computer and advanced software.

### **RESULTS**

In 30 patients of anterior wall MI, 18 (60%) were male and 12 (40%) were female. In inferior wall MI, 28 (93.3%) were male and 2 (6.7%) were female. In all 60 patients (76.7%) patients were male and (23.3%) were females. In anterior wall MI, (6.7%) were in 30 to 40 years of age, (33.3%) were in 41 to 50 years of age, (33.3%) were in 51 to 60 years of age, (20.0%) were in 61 to 70 years of age, and (6.7%) were in 71 to 80 years of age. Minimum age was 39 years; maximum was 72 years, with mean of

54.57 and SD of 9.22. In inferior wall MI, (13.1%) were between 30 to 40 years, (23.3%) were between 41 to 50 years, (40.0%) were between 51 to 60 years, and (3.3%) were between 71 to 80 years. Minimum age was 38 years; maximum was 71 years with mean of 52.50 and SD of 9.69. In all 60 patients, (10%) patients were in age group of 30 to 40 years, (28.3%) patients were in 41 to 50 years, 22 (36.7%) were in 51 to 60 years. (20%) were in 61 to 70 years. (5%) were in 71 to 80 years (Table-I).

In anterior wall MI, (6.7%) had 30% EF, (6.7%) had 31%, (20%) had 32%, (6.7%) had 32% EF, (6.7%) had EF of 45%, (6.7%) had 52%, (6.7%) had 53%, (6.7%) had EF of 54%, and another (6.7%) had 56% EF, (13.3%) had EF of 57% and lastly 2 patients having EF of 64%. The mean EF was 46.07% with standard deviation of 11.72.

In 30 patients of inferior wall MI, (6.7%) had EF of 39%, (13.3%) had 49%, (20%) had 52%, and (13.3%) had 55%, (13.3%) had 56%, (13.3%) had 57%, (6.7%) had 62%, (6.7%) had 65% and (6.7%) had 68% EF. Mean EF was 54.93% with standard deviation of 6.86. In all 60 patients minimum EF was 30% and maximum EF was 60% with a mean of 50.50 with standard deviation of 10.52 (Table-II).

In 4 (13.3%) patients of IWMI who were having cardiac failure clinically, minimum EF was 39% and maximum was 49%, mean of 44% with SD of 5.77. In 26 (86.7%) patients without failure, minimum EF was 49% and maximum EF was 68% mean of 56.62% and SD of 5.34. In 16 patients (53.0%) of AWMI who were having failure clinically, minimum EF was 30% and maximum was 54%, mean of 37.13% with SD of 8.4. In 26 (86.7%) patients without failure, minimum EF was 49% and maximum EF was 68% mean of 56.62% and SD of 5.34 (Table-IV & V).

In all patients with failure, mean EF was 37.13 with SD of 8.4 and min. was 30% and max was 54%. In patients without failure the mean EF was 56.29% with SD of 3.75, and min. of 52% and max was 64% (Table-VI).

Table-I. Comparison of age

	Minimum	Maximum	Mean	SD	P value
Anterior wall MI	39	72	54.47	9.22	0.62
Inferior wall MI	38	71	52.50	9.69	

Table-II. Comparison of LVEF in anterior and inferior wall MI

Type of MI	Left ventricular ejection fraction				
	Min	Max	Mean	SD	P value
Anterior wall MI	30	64	46.07	11.72	<0.001
Inferior wall MI	39	68	54.93	6.68	

Table-III. Proportion of patients with LVF

	LVF Present		
	Yes	No	P-value
Anterior wall MI	16	14	0.001
Inferior wall MI	04	26	
Total	20	40	

Table-IV. Left ventricular ejection fraction in patients with and without LVF in anterior wall MI

	Min	Max	Mean	SD	P value
Patients with failure	30	54	37.13	8.4	0.001
Patients without failure	52	64	56.29	3.75	

Table-V. Left ventricular ejection fraction in patients with and without LVF in inferior wall MI

	LVEF				
	Min	Max	Mean	SD	P value
Patients with failure	39	49	44	5.77	0.001
Patients without failure	49	68	57	5.34	

Table-VI. LVEF in patients with and without failure

LVF	No. of patients	Mean LVEF	SD	P value
Yes	20	38.50	8.30	0.001
No	40	56.50	4.80	

## DISCUSSION

It was noted that patients of AWMI had more decrease in LVEF as compared to patients with IWMI. More over larger proportion of patients of AWMI had clinically and statistically significant LVF. In the study of Awan ZA<sup>2</sup> et al among 210 patients 76% were males and 24% were females. In studies conducted such as Haq et al<sup>3</sup>, mean age was 54 years. In our study mean age was 53 years. In our study males were 76% and females were 23%. In anterior wall MI, 18 patients (30%) were males and 12 patients (40%) were female. In inferior wall MI, 28 (93%) were male and 2 patients (7%) were females. There were 79% males and 21% were females in the study of Haq et al<sup>3</sup>. Males and females were in the proportion of 3:1 in the study of Karim MA<sup>4</sup> and co-workers. In our study, about 53 % of patients had LVF clinically in anterior wall MI and about 13% of patients in inferior wall MI with overall proportion of 33 % in all patients. Whereas the percentage of patients having failure was 43 % without mentioning the type of MI. in the study of Kyne L<sup>5</sup> and coworkers.

The mean LVEF was 47 % in study of Sola M et al<sup>6</sup> without mentioning the type of MI from which the patients were suffering. In our study mean LVEF was 46 % in anterior wall MI and 54 % in inferior wall MI and mean of all patients was 50 %. LVEF decreased to 45% in the study of Senior R<sup>7</sup> and Coworkers. Ali AS<sup>8</sup> and co workers made pulmonary rales, S3 gallop, and interstitial edema on the chest radiograph the criteria for the presence or absence of left ventricular failure and

labeling a patient in LVF. In my study vital signs especially pulse, blood pressure, and respiratory rate were also included in the criteria. In the study of Ali AS et al<sup>8</sup>, 43% patients had LVF, whereas in our study 54% and 13% patients had LVF in AWMI and IWMI respectively. In the study of Awan ZA<sup>2</sup>, 29% patients had sign and symptoms of left ventricular failure. VAUR L<sup>9</sup> noticed mean LVEF of 50% in patients of AMI, and 17% patients had clinical failure with 35% LVEF. My findings of increased incidence of LVF in patients with AWMI are consistent with the findings of Vaur L. Darbar D<sup>10</sup> noticed that anterior infarction causes more decrease in LVEF and our findings are consistent with it. He also had the findings that the patients in which signs and symptoms of LVF are present have mean LVEF of 40%, in my studies these patients have mean LVEF of 37.13% in patients of anterior MI, and 44% in patients of inferior MI with SD of 8.4 and 5.77 respectively.

The clinical presence of LVF (killip class > 1) was noted in about 50% of cases in study of Poulsen SH<sup>11</sup>, whereas in my study it is present in 53% of AWMI and 13% of patients with IWMI and 33% of all cases. But the clear cut difference in the clinical and echocardiographical findings between the patients of anterior wall MI and that of inferior wall MI are not noted in the recent data, neither it is documented in the studies conducted in Pakistan. So our study is new in this aspect especially in Pakistan.

Councilo J<sup>12</sup>, found that Simpson's rule is the method of choice for calculating LV volumes and he has recommended this method for calculating left ventricular volumes and LVEF, this method is used in our study for calculating left ventricular volume and left ventricular ejection fraction. Moreover it is more commonly employed method as stated in the study of Yvorchuck KJ<sup>13</sup>. In my study inferior wall MI were more frequent than anterior wall MI. When 30 patients of inferior wall MI were completed and enrolled about 20 patients of anterior wall MI were enrolled at that time. But in the study of Awan ZA<sup>2</sup> 56% were of anterior wall MI and 12% patients were of inferior wall MI. We used the criteria of prolonged chest pain for more than 45 minutes, typical ECG changes of AMI, and raised cardiac enzymes for the diagnosis of acute myocardial infarction. These all criteria

were also used in the study of Awan ZA.

## CONCLUSIONS

1. Anterior wall MI causes more decrease in LVEF.
2. Left ventricular failure is more commonly associated with anterior wall MI than inferior wall MI.
3. There is statistically significant difference in LVEF of patients with LVF and without LVF.
4. Male gender is more common among patients of acute myocardial infarction
5. MI is more common in 6<sup>th</sup> decade of life.

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