

## Original Research Article

# Reduced left ventricular ejection fraction in patients with acute coronary syndrome as a risk factor for mortality

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### ABSTRACT

**Background:** The study aimed to evaluate left ventricular ejection fraction (LVEF) as the risk factor for mortality in acute coronary syndrome (ACS) patients undergoing percutaneous coronary intervention (PCI).

**Methods:** This was an observational, single centre study. The patients who were admitted at tertiary care centre in India during the period February 2014 to June 2015 who were diagnosed with ACS were included in the study. The patients were evaluated by dividing into two groups based on LVEF. The patients were followed up to 1 year.

**Results:** Total 100 patients were included in the study. Chest pain was the most prevalent complaint (60%). Seventy patients presented with STEMI (ST-segment elevation myocardial infarction) and 30 with NSTEMI (non-ST-segment elevation myocardial infarction). Seventy five patients had ejection fraction  $\geq 40\%$  and 25 patients had reduced ejection fraction. Reduced LVEF did not show any statistical difference in patients with presentation as STEMI and NSTEMI or need for revascularisation. At year follow up, total 9 patients died. However, reduced LVEF led to statistically higher deaths ( $p < 0.05\%$ ).

**Conclusions:** In our study it was observed that patients with ACS complicated by heart failure with reduced ejection fraction have a markedly increased short- and long-term mortality rates compared to ACS patients without heart failure.

**Keywords:** Acute coronary syndrome, Left ventricular ejection fraction, Percutaneous coronary intervention

### INTRODUCTION

As the years pass, ACS has transpired into brutal condition being one of the leading causes of death in the world<sup>1</sup>. The ACS encompasses various clinical conditions like STEMI, NSTEMI and unstable angina.<sup>2</sup> Prognosis of ACS becomes poor if other co-morbidities evolve along with it. One such factor is left ventricular ejection fraction (LVEF). As per literature, reduced LVEF has been allied with an escalated risk of death in patients with ACS.<sup>3,4</sup> Currently, PCI is the preferred strategy for treatment of ACS patients as it reduces mortality rates and improve quality of life of such patients. Nevertheless, the outcomes of PCI also get affected by many factors such as atrial fibrillation,

obesity, diabetes, reduced LVEF. Some previous studies reported that reduced LVEF posed as a risk factor for occurrence of adverse events during hospitalization as well as long-term outcomes in patients who underwent PCI.<sup>5</sup> Hence LVEF can be applied as an indicator of cardiac function and should be used in routine clinical practice.<sup>6-8</sup> Yet the co-existence of LVEF and ACS is not highly prevalent as the previous study states that more than two-thirds of NSTEMI patients and about one-half of STEMI patients have comparatively preserved LV function.<sup>9</sup> Therefore the data regarding outcomes of patients with reduced LVEF and ACS undergoing percutaneous coronary intervention was scarce and the association was not well-defined.<sup>4</sup> Thus, we aimed to evaluate LVEF as the risk factor for mortality in ACS patients undergoing PCI.

## METHODS

This was an observational, single centre study. The patients who were admitted at tertiary care centre in India during the period February 2014 to June 2015 who were diagnosed with ACS were included in the study.

The data pertaining to clinical features, ECG, cardiac enzymes (troponin-I), 2-D echocardiography, coronary angiography (CAG) were collected. Patients were excluded if they had congenital heart disease, valvular heart disease or idiopathic cardiomyopathy. The patients were evaluated by dividing into two groups based on LVEF. The patients were followed up to 1 year.

A detailed history was taken and complete examination was done as per the proforma. A 12 lead ECG was taken at admission with right sided leads wherever required, subsequently ECG were taken at 8 hourly intervals on 1st day, 12 hourly ECG during ICCU stay and there after once in 24 hours until discharge from the hospital and also 12 lead ECG was taken as and when indicated. Continuous cardiac monitoring was performed during ICCU stay. Vitals were monitored carefully and continuously. Cardiac enzymes (troponin-I/T) were analysed. 2-D echocardiography was performed. All willing patients were subjected to a coronary angiography

(CAG) at an appropriate time after assessing clinical and hemodynamic condition, blood parameters.

### Statistical analysis

The analysis was done using SPSS version 20. Descriptive statistical analysis was done. Results on continuous measurements are presented as mean and standard deviation. Results on categorical measurements are presented as percentages. Significance is assessed at 5% level of significance. Chi square test was used to find out the significance of study parameters on a categorical scale between two groups.

## RESULTS

Total 100 patients were included in the study with mean age of  $54.0 \pm 12.3$  years. Men constituted of 58% of total population. Chest pain was the most prevalent complaint (60%). Fifty two and 60 patients had diabetes and hypertension, respectively. Sixty six patients presented with Killip class I, followed by 21 patients with Killip class II. Troponin levels were raised in 89 patients. Mean EF as  $51.1 \pm 10.5\%$ . Seventy patients presented with STEMI and 30 with NSTEMI. Revascularization was done in 80% of patients. Detailed baseline demographics are shown in Table 1.

**Table 1: Baseline demography and clinical data.**

Variables	Values
	N (%)
<b>Age (years)</b>	$54.0 \pm 12.3$ (27-85)
<b>Gender</b>	
Male	58/100 (58)
Female	42/100 (42)
<b>Occupation</b>	
Government servant	1 /100 (1)
Business	6/100 (6)
Private sector	55/100 (55)
Housewife	38/100 (38)
<b>Chief complaints</b>	
Chest pain	60/100 (60)
Shortness of breath	39/100 (39)
Electrolyte disturbance	1/100 (1)
<b>Risk factor profile</b>	
Diabetes mellitus	52/100 (52)
Hypertension	60/100 (60)
Family history of CAD	1/100 (1)
Previous history of CAD	6/100 (6)
Cerebrovascular accident	3/100 (3)
<b>Weight (kg)</b>	$76.3 \pm 9.4$ (60-110)
<b>BMI (kg/m<sup>2</sup>)</b>	$28.4 \pm 3.5$ (23-40)
<b>Abdominal girth (inches)</b>	$34.6 \pm 3.3$ (24-44)
<b>Smoking pack-years</b>	
≤25	20/44 (25.5)
>25	24/44 (54.5)
Tobacco consumption, N (%)	13/100 (13)

Continued.

Variables	Values
Zarda consumption N (%)	22/100 (22)
Alcohol consumption (%)	0
<b>Vitals</b>	
Heart rate/min	83.0±11.4 (64-120)
SBP (mmHg)	112.8±11.2 (90-150)
DBP (mmHg)	72.9±8.7 (50-100)
SPO <sub>2</sub>	97.3±2.8 (86-99)
<b>Systemic examination</b>	
Abnormal physical assessment	4/100 (4)
Hepatomegaly	4/4 (100)
Abnormal cardiovascular system	8/100 (8)
PSM <sup>+</sup>	1/8 (12.5)
S1S2 <sup>+</sup>	2/8 (25)
S1S2 <sup>+</sup> and S3 <sup>+</sup>	1/8 (12.5)
S3 <sup>+</sup>	4/8 (50)
Respiratory system	33/100 (33)
Crept	33/33 (100)
Central nervous system	1/100 (1)
Drowsy	1/1 (100)
<b>Killip class</b>	
I	66/100 (66)
II	21/100 (21)
III	12/100 (12)
IV	1/100 (1)
<b>Need of thrombolytic therapy</b>	58/100 (58)
<b>Reteplase</b>	6/58 (10.3)
<b>Streptokinase</b>	51/58 (87.9)
<b>Urokinasem</b>	1/58 (1.7)
<b>Window period (n=42)</b>	9±3.1 (4-24)
<b>Investigations</b>	
Raised troponin level	89/100 (100)
<b>Lipid level</b>	
Raised lipid levels	79/100 (79)
Serum creatinine level	1±0.3 (0.6-2.9)
EF%	51.1±10.5 (28-70)
Presence of RWMA	83/100 (83)
<b>Clinical presentation</b>	
<b>STEMI</b>	70/100 (70)
<b>NSTEMI</b>	30/100 (30)
<b>Unstable angina</b>	0/100 (0)
<b>Need for revascularisation</b>	80/100 (80)

Data are presented as mean±SD and range or n(%).

**Table 2: Echocardiography and angiography details.**

2D-echocardiography	N (%)
<b>Presence of LV dysfunction</b>	
Mild	22/100 (22)
Moderate	20/100 (20)
Fair	6/100 (6)
Severe	7/100 (7)
Good	45/100 (45)
<b>Presence of RV dysfunction</b>	8/100 (8)
MR/TR	46/100 (46)
MR	32/46 (69.6)

Continued.

2D-echocardiography	N (%)
TR	2/46 (4.3)
MR+TR	12/46 (26.1)
<b>Diastolic dysfunction</b>	86/100 (86)
I	62/86 (72.1)
II	22/86 (25.6)
III	2/86 (2.3)
<b>Coronary angiography</b>	
SVD	42/100 (42)
DVD	23/100 (23)
TVD	18/100 (18)

**Table 3: Comparison of variables between two groups.**

Variables	EF $\geq$ 40 (n=75 patients)	EF <40 (n=25 patients)	X <sup>2</sup> and P value
STEMI	50	20	X <sup>2</sup> =1.587; p>0.005
NSTEMI	25	5	
Revascularization (-)	15	5	X <sup>2</sup> =0.000; p>0.005
Revascularization (+)	60	20	
Alive	73	18	X <sup>2</sup> =14.693; p<0.05
Death	2	7	

Total 45 patients had good LV function, 22 patients had mild LV dysfunction, 20 had moderate LV dysfunction. Single vessel disease was most prevalent (42%) and most affected vessel was left anterior descending artery (Table 2).

Table 3 represents comparison of variables between two groups. Seventy five patients had ejection fraction  $\geq$ 40% and 25 patients had reduced ejection fraction. Reduced LVEF did not show any statistical difference in patients with presentation as STEMI and NSTEMI or need for revascularisation. At year follow up, total 9 patients died of which 2 were intraoperative deaths. However, Reduced LVEF led to statistically higher deaths (p<0.05%).

## DISCUSSION

In our study it was observed that males were more commonly affected than females, the commonest presentation was chest pain. The most prevalent presentation of ACS was STEMI. This has been in parallel to the results stated in many earlier studies.<sup>10,11</sup> It was observed that SVD (single vessel disease) was commonest diagnosis and most affected vessel was LAD. Of total, 75 patients had ejection fraction  $\geq$ 40% and 25 patients had reduced ejection fraction. Revascularization was done in 80% of the patients. Three patients who were advised CABG were not willing for it, whereas all patients who were advised PCI had undergone PCI. Therefore, it was prudent to say that revascularization with stent was a more acceptable treatment modality compared to CABG among our study population.

Mortality at the end of 1 year was 9%, highest being at the end of 1st month. It was observed that high mortality was seen in patients with high myocardial injury, thereby suggesting the importance of golden period in ACS. It was also observed that irrespective of the window period, after revascularization patients had a better quality of life and reduced morbidity and mortality. The results threw light that <40% EF was allied with significantly higher death rates in ACS patients who underwent PCI than in patients with maintained EF. However, literatures stated that the role of reduced LVEF as a predictor of poor outcome had been controversial. Few studies and meta-analyses highlighted that risk of mortality and rehospitalization for patients with heart failure and preserved or mid-range LVEF was same as reduced LVEF, while many studies exhibited lesser rate of mortality in patients with LVEF >35%.<sup>12,13</sup> Moreover, a recently published meta-analysis underlined that patients with reduced LVEF had statistically significant high mortality rates than those with mid-range LVEF or preserved LVEF.<sup>14</sup>

A real-life study documented that a lower LVEF was allied with higher mortality at 30 days, 6 months and 5 years.<sup>15</sup> In a recent study, Lombardi et al assessed prognostic variables in a real-life population of acute heart failure patients, reported that age, NYHA class IV, systolic blood pressure, creatinine levels, sodium levels and ejection fraction were independent predictors of 1 year mortality, but LVEF <40% was the only predictor of both all-cause mortality and CV mortality (40-49% versus <40%, p=0.02;  $\geq$ 50% versus <40%, p<0.001).<sup>16</sup>

Recently, Ye et al had evaluated LVEF as a risk factor in 1600 patients who underwent PCI. They reported that in-

hospital death rates in patients with LVEF  $\geq 50\%$  were significantly lower than patients with LVEF  $< 50\%$  (0.12% versus 3.68%,  $p < 0.001$ ). On the other hand, no difference was reported in revascularization and in-hospital MI between the two groups.<sup>5</sup> Another study stated that the death rates of patients with low LVEF in 1 month ( $p < 0.0001$ ) and 3 years ( $p < 0.0001$ ) were significantly greater than that of patients with normal LVEF.<sup>17</sup> Likewise, Sardi also observed that reduced LVEF upsurged the risk of stent thrombosis, which could also affected the prognosis of the patients undergoing PCI.<sup>18</sup> Moreover, a previously published prospective study, involved 304 patients to assess the relationship between LVEF and in-hospital outcomes of STEMI patients who underwent primary PCI. The result of that study specified that lowered LVEF was related with escalated incidences of in-hospital adverse events ( $p < 0.05$ ).<sup>19</sup> However, further powered studies with larger number of patients and long-term follow up would further warrant the results of the study.

### Study limitations

The study design constituted a major limitation of this study. The study was an observational and non-randomised follow up study. Only those patients who were admitted as ACS, underwent CAG, revascularization and who were on follow up for 1 year were considered in the study group. All these might result in a selection bias; therefore, it will be more informative if a large sample size was studied.

### CONCLUSION

In our study it was observed that patients with ACS complicated by heart failure with reduced ejection fraction have a markedly increased short and long-term mortality rates compared to ACS patients without heart failure.

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