Original Article

Improvement in Left Ventricular Function in Patients Having Percutaneous Coronary Intervention (PCI) for Acute ST-Elevation Myocardial Infarction (STEMI) with Late Presentation

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ABSTRACT

Objective: To assess the improvement in left ventricular functions after percutaneous coronary interventions (PCI) performed in individuals with ST- segment elevation MI with late presentation.

Study Design: Prospective descriptive study

Place and Duration of Study: This study was conducted at the Department of Cardiology, Peshawar Institute of Cardiology, Peshawar from 1st January 2022 to 31st December 2022.

Methods: 136 individuals with ST segment elevation MI having history of chest pain >3 hours were recruited. Baseline left ventricular functions (EF, EDD, ESD and WMSI) were assessed using echocardiography performed within an hour of admission. All patients subsequently received revascularization procedure. A follow up echo was performed at 3 months. Mean difference in the baseline and follow up LV functions were compared using paired sample t test.

Results: Age of the participants ranged from 40 to 80 years with mean age of 57.39 ± 13.204 years. The number of male participants were 91 (72.2%) and male to female ratio was 2.0: 1. The p values for mean difference in follow up versus baseline EF, EDD, ESD and WMSI were <0.001, 0.739, 0.039 and 0.310 respectively.

Conclusion: Despite late presentation, revascularization intervention still proved beneficial for acute STEMI patients as evident from enhancement in LV functions.

Key Words: Acute ST Segment Elevation MI (STEMI), Percutaneous Coronary Intervention (PCI), Late Presentation, LV Functions

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INTRODUCTION

The interval between the onset of chest pain to presentation at the hospital is called critical hour. It is a reliable prognostic factor for mortality in individuals diagnosed with acute MI.[1] The majority of MI related deaths tend to occur during the initial hours of chest pain, comprising roughly 50% of all MI related mortalities.[2]

The clinical outcome of patients is improved by myocardial reperfusion, and the extent of this benefit is influenced by the timing of restoring coronary flow, with earlier intervention yielding better results. Despite significant mortality reducing advancements in interventional cardiology, treatment delay arising from delayed medical care remains a prominent challenge in routine clinical settings.[3]

The postponement of treatment owing to the delay in seeking medical care is still a significant issue in everyday clinical practice. The matter turns even grave when analyzing the data in developing countries. As a result, death a result of cardiovascular accidents is still the leading cause of mortality and morbidity.[4]

While providing health care facilities related primary PCI at door step or near door step, may be challenging even in industrialized countries, extending the time limit for offering primary revascularization procedures for patients with acute cardiovascular accidents beyond the critical hours, may be an alternative.[5] Offering revascularization intervention to individuals with late presentation with AMI may potentially reduce mortality in our context. The fundamental goal of reperfusion treatment is to improve left ventricular (LV) function by conserving the survival of myocardial cells, while simultaneously restoring blood flow through the

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occluded artery that is linked with the myocardial infarction. This is accomplished by restoring blood flow via the coronary microcirculation.[6]

The identification of high-risk subgroups with late presentation in the general population may help to improve methods for speeding up access to the healthcare system and maybe lower the likelihood of unfavorable cardiac outcomes and assessing the possible beneficial effects of revascularization on LV functions.[7] The purpose of this research was to assess enhancements in left ventricles functions after percutaneous coronary intervention performed in individuals with acute ST segment elevation MI with late presentation.

METHODS

Study Population: Inclusion Criteria: The study enrolled patients in the age range 40 to 80 years, diagnosed with ST segment elevation MI (STEMI) with late presentation. Diagnosis of STEMI was established by considering the characteristic clinical symptoms including cardiac type chest, together with the presence ST segment elevation on ECG and elevation of cardiac specific enzymes. The term "late for primary percutaneous coronary intervention (PCI)" was referred to interval between onset of chest pain and presentation of hospital more than three hours.

Exclusion criteria: Participants were excluded who had prior history of left ventricular dysfunction, previous percutaneous coronary intervention (PCI)/CABG on medical record, and congenital heart disease.

Data collection procedure: After receiving ethical approval from the institution's ethical review committee, patients fulfilling the inclusion criteria were recruited from the indoor department of cardiology. All participants in the research provided their informed consent subsequent to receiving comprehensive information about the risks and benefits associated to this study.

Relevant demographic data, angiographic, echocardiographic data was collected. Parameters of interest in echo scan included left ventricular functions which were recorded in terms of ejection fractions, end diastolic diameter and end systolic diameter. Baseline transthoracic echocardiography was performed within an hour of admission to the hospital, by consultant cardiologist with expertise in Vivid 7 echo scan. Based on angiographic findings, percutaneous coronary revascularization procedure was performed as per recommended guidelines and institution protocol. Patients were discharge upon stabilization. Interval follow up was planned and final visit was scheduled at the end of three months for follow echo scan.

All echo scans and measurements were analyzed by two cardiologists. Inter observer variability was addressed by blinding the reviewers to patient clinical record, fellow reviewer findings and taking average of the two readings as final measurement.

Data analysis: The data collected was entered into IBM SPSS Version 24.0. Categorical data was recorded as frequencies and percentages, while for continuous data, means and standard deviations were computed. Chi-square test was used to examine the heterogeneity among qualitative variables, while the paired sample t-test was used to compare difference in the means of continuous variables. The criterion for defining statistical significance was set at two-tailed p value ≤ 0.05.

RESULTS

Demographics: A total of 136 patients fulfilled the inclusion criteria and recruited during the study period. However, 10 patients were lost to follow up. Hence the final analysis was carried out for 126 participants. Age-wise distribution of the participants revealed age range 40 to 80 years with mean age 57.39±13.204 years while the value for median age was 51. Majority of the participants belonged to age group 40-60 years comprising 79 patients (62.7%). Gender-wise distribution of participants showed that 91 participants (72.2%) were male and the rest were female comprising male to female ratio of 2.6: 1. The mean BMI of the patients was 23.502 kg/m^2 with SD value 1.303 kg/m^2. The most commonly recorded risk factor for STEMI among the enrolled patients was hypertension which was recorded for 64 patients (50.8%) followed by diabetes mellitus in 34 (27.0%) patients. Majority of the patients had inferior wall MI (n = 52, 41.3%) followed by anterior wall MI (n = 42, 33.3%). (Table 1)

Table No. 1: Participants and their subgroups (n = 126)

VARIABLES	FREQUENCIES AND %AGES
Gender	
Male	91 (72.2%)
Female	35 (27.8%)
Age Distribution	
40-60 years	79 (62.7%)
61-80 years	47 (37.3%)
Risk Factors	
Smoking	28 (22.2%)
Hypertension	64 (50.8%)
Diabetes mellitus	34 (27.0%)
Type of MI	
Inferior	52 (41.3%)
Lateral	14 (11.1%)
Anterior	42 (33.3%)
Posterior	18 (14.3%)

Outcome variables: The mean values for echocardiographic parameters for left ventricular functions at baseline and at three months are summarized in table 2. The mean±S.D value for

ejection fraction at baseline and at 3 months were 35.982 ± 3.350 % and 49.093 ± 6.194% respectively. The p value for mean difference in the baseline versus EF at 3 months was <0.001 which was statistically significant. Similarly, left ventricular end-diastolic dimensions were 42.049 ± 4.603mm and 44.673 ± 5.507mm respectively. The p value recorded for mean difference was 0.739. The mean baseline value for end systolic dimension at baseline was 37.517 ± 3.027 mm while the mean value for ESD at 3 months was 45.908 ± 5.673 mm. The p value for mean difference in ESD was 0.039 which was statistically significant. The mean±SD values for WMSI were 1.83 ± 0.79 and 1.59 ± 0.27 at baseline and at 3 months respectively and the p value observed was 0.310.

Table No. 2: Outcome variables at baseline and at 3 months

VARIABLE	BASELINE VALUES	AT 3 MONTHS	P value
LVEF (%)	35.982 ± 3.350	49.093 ± 6.194	<0.001
LVEDD (mm)	44.673 ± 5.507	42.049 ± 4.603	0.739
LVESD (mm)	45.908 ± 5.673	37.517 ± 3.027	0.039
WMSI	1.83 ± 0.79	1.59 ± 0.27	0.310

DISCUSSION

This study evaluated enhancement in left ventricular functions patients who were treated with for acute ST segment elevation MI and received delayed reperfusion treatments. Overall, intervention was well tolerated and no significant treatment related complications were observed during or after the procedure. Three months following percutaneous coronary intervention (PCI), it was found that reperfusion had a significant influence on the recovery of left ventricular ejection fraction. This enhancement may be attributed to systolic wall motion at the border zone of the infarct leading to improvement in global left ventricular ejection fraction.[8] However, it seems that the transfer of percutaneous coronary intervention did not result in improvement in left ventricular remodelling since the end-diastolic diameter observed in the left ventricle did not reveal a decrease in our study. Perhaps, follow up longer than 3 months might depict beneficial findings.

A number of studies and clinical reports [9, 10] have shown that revascularization plays an essential part in improving the contractile function of the left ventricle in patients who have recently suffered an acute myocardial infarction (AMI). Despite the lack of any significant change in ventricular volume as reported in this research, the improvement in ejection fraction after PCI, may give an explanation for the improvement. Rapid advancements in coronary revascularization procedures have lowered mortality in acute MI patients. In the context of post MI sequela, heart failure has emerged as serious clinical issue.[11] Post MI, fluctuation in ejection fraction is an ongoing phenomenon. The restoration of LV function amid the initial phases of MI is hampered by myocardium ischemia subsequent to sudden coronary artery blockages.[12] Structural and functional remodelling of left ventricle has been linked to recovery of LV ejection fraction.[13] In our study, we discovered improvement in LVEF after follow-up, indicating that the effect of myocardial infarction on LV function is a long-term process. A large body of research suggests that infarct size, as measured directly by Cardiac MR Imaging or CT, can predict left ventricular remodelling.[14]

Ottervanger et al. conducted a study in which they selected patients who had experienced acute myocardial infarction (AMI) and had undergone primary percutaneous coronary intervention (PCI) as the focus of their investigation. The research used radionuclide ventriculography to assess individuals who had survived at the sixth month after the intervention. The results revealed a 6% enhancement in left ventricular ejection fraction (LVEF), with values increasing from 43.7 ± 11.3% at the beginning of the study to 46.3 ± 11.5% after 6 months. The results obtained in this study closely resemble their findings which were largely based on echo scans.[15] In their study, Baks et al. observed a significant increase in ejection fraction, from an initial mean value of 48 ± 11% to a final mean value of 55 ± 9% (P=0.01), after a period of five months during which successful drug-eluting stents were inserted in a cohort study[16] Our analysis corroborates the findings reported in these previous investigations.

Sharif et al. observed that the immediate recovery of oxygen supply across coronary arteries enhances the LV wall motion index. We also looked at WMSI, which revealed a comparable continuous improvement from the baseline to 3 months.[17] Similarly, Niccoli et al. evaluated the influence of microvasculature on the performance of the cardiac musculature in individuals with acute coronary syndrome and found that myocardial remodelling are prognostic factors.[18]

CONCLUSION

Significant improvement was observed in left ventricular functions at 3 month follow up in individuals with ST segment elevation MI with late presentation and received reperfusion intervention (PCI) outside critical hours. Response to PCI may be effectively evaluated by measuring left ventricular functions (EF, EDD, ESD and WMSI) using echo scans which may preclude invasive techniques.

Author's Contribution:

Concept & Design of Study:	Asad Ullah Khan
Drafting:	Fazal Akbar, Hasan Zeb
Data Analysis:	Zeeshan Afzal, Musa Kakakhel
Revisiting Critically:	Asad Ullah Khan, Fazal Akbar
Final Approval of version:	Asad Ullah Khan

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