

ORIGINAL ARTICLE

The Impact of Early Successful Primary Percutaneous Coronary Intervention on Left Ventricular Systolic Function in ST Elevation Myocardial Infarction Patients

Muhammad Rehanul Haq¹, Mujeebullah Tareen², Mukesh Kumar³, Abdul Hakeem³, Rajesh Kumar³, Tahir Saqhir³, Syed Nadeem Hassan Rizvi³

¹DHQ Hospital Khar Bajaur, Khyber Pakhtunkhwa -Pakistan.

²Bolan Medical College, Quetta -Pakistan.

³National Institute of Cardiovascular Diseases (NICVD), Karachi-Pakistan.

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Corresponding Author Email:

kotki_charmang@yahoo.com

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Abstract

Background: Treatment delay is considered to be one of the important predictors of survival in ST-elevation myocardial infarction (STEMI) patients undergoing primary percutaneous coronary intervention (PCI). We investigated the impact of early successful PPCI for STEMI patients on left ventricular ejection fraction.

Methodology: This prospective study was carried out on 50 patients having STEMI undergoing PPCI in NICVD Karachi. Patients were divided into two groups, Group A, early presenter, patients received treatment with PPCI within six hours of the onset of symptoms, and group B, late presenter, patients received treatment after six hours up to twenty-four hours of the onset of symptoms.

Results: Group A patients showed promising results, having achieved TIMI grade III flow in 100%, whereas 85% of patients achieved TIMI grade III flow in group B ($P = 0.02$). There was a statistical difference between the two groups. Using Independent sample T-Test Group A patients showed improved LVEF as compared to Group B (at presentation $45.49 \pm 3.99\%$ vs. $35.25 \pm 3.85\%$; $P = 0.001$ and at 3 months follow up $55.66 \pm 0.92\%$ vs. $45.75 \pm 1.44\%$; $P = 0.001$).

Conclusion: Early PPCI treatment of STEMI patients can lead to improved TIMI grade flow and LVEF. Efforts must be made to shorten the delay in reperfusion therapy.

Keywords

ST-Segment Elevation Myocardial Infarction, Primary Percutaneous Coronary Intervention, Left Ventricular Ejection Fraction, Thrombolysis.

Introduction

Survival might be endangered with the adverse effects caused by ST-segment elevation myocardial infarction (STEMI), specifically in patients suffering from chronic left ventricular dysfunction (LVD), usually associated with unpropitious signs and symptoms¹. The impact of the primary percutaneous coronary intervention (PPCI) has promising outcomes in STEMI patients, advancing toward left ventricular systolic dysfunction (LVSD). At the same time, a decrease in the frequency of mortality in STEMI patients as a result of PPCI is also a matter of fact²⁻⁴. STEMI often leads to sudden cardiac death (SCD), more precisely in patients having LV systolic dysfunction⁵. In the majority of cases, early PPCI showed staggering results in STEMI patients having LVSD and enduring the severe phase improved left ventricular ejection fraction (LVEF) after the 3 months follow-up⁶. Systolic function comes back to normal after the 42 days in LV function after STEMI⁷.

Techniques for detecting LVSD in STEMI cases are straightforward. For the evaluation of regional and global left ventricular systolic function (LVSF), the two-dimensional transthoracic echocardiography (TTE) is used⁸. LVEF is an autonomous predictive aspect that is considered to be the condition commonly associated with LVSF⁹. For the estimation, the LVEF Simpson method is considered to be effective, and in addition, a skillful echocardiographer is mandatory for observation of the border of the endocardial line. Moreover, Tissue Doppler Echocardiography provides new additional features for observing and diagnosis of LVSD; meanwhile, it allows the benefit of myocardial function quantitative assessment with decent resolving time by having no dependency on echocardiographic assessments¹⁰. The cut-off index for peak systolic mitral annular velocity is greater than 4 cm/s for the estimation of cardiac measures after STEMI, and the value of 7.5 cm/s indicates the damage caused to the sub-endocardium due to Myocardial Infarction (MI) and after a first MI, the cut-off value in anticipating

a preserved global LVSF¹¹. Therefore, we investigated the impact of early successful PPCI for STEMI patients on left ventricular ejection fraction.

Methodology

This prospective study was conducted in NICVD hospital Karachi of the 50 patients admitted for PPCI having acute STEMI from 1st August 2019 to 31st January 2020 after taking an ethical committee certificate from the hospital. All the patients of age 40 to 75 years who had acute STEMI and underwent successful PPCI within 24 hours of the onset of symptoms were included. Patients with previous MI, previous PCIs, previous CABG, and some complications of MI as VSR, Papillary muscle rupture, free wall rupture, profound LV failure requiring IABP, and CHB requiring PPM, patients with significant multivessel diseases, patients in whom culprit's vessel is non-dominant RCA or non-dominant LCX, or only branch vessel or distal vessel was excluded from the study. Patients were divided into two groups according to their time of presentation. Group A, early presenter, patients received treatment with PPCI within 6 hours of the onset of symptoms, and Group B, late presenter, patients received treatment with PPCI after 6 to 24 hours of the onset of symptoms. There were 30 patients in Group A and 20 patients in Group B. The patients were assessed for achieved TIMI flow during the procedure and for LVEF immediately after the procedure and after 3 months by Transthoracic echo (TTE) with an assessment of left ventricle EF (LVEF) in both groups.

The data extracted from the records, including radiological findings and demographics, were analyzed using IBM SPSS 20. For categorical variables, percentages and frequencies were used, and for numerical data, mean and standard deviation were calculated. Independent samples T-test was applied between both groups to assess the association between LVEF in both groups; Chi-square test was applied to assess the association between TIMI 3 flow in both groups; $P < 0.05$ was considered statistically significant.

Results

A total number of 50 patients were enrolled in the study. In this study, 31 (62%) were males, and 19 (38%) were females. The average age of the patients was 61.48 ± 12.26 . 13 (26%) patients had a history of diabetes, 10 (20%) were smokers, and 20

(40%) patients had a history of hypertension (Table 1). Patients were divided into two groups, Group A, early presenter, patients who received treatment with PPCI within 6 hours of the onset of symptoms, and Group B, late presenter, patients who received treatment with PPCI after 6 to 24 hours of the onset of symptoms.

Table 1: Baseline Characteristics

Variables	N(%)	
Age (years); Mean \pm SD	61.48 \pm 12.26	
Arrival At Hospital	Early	30 (60%)
	Late	20 (40%)
Gender	Male	31(62)
	Female	19(38)
Hypertension	Yes	20(40)
	No	30(60)
Diabetes	Yes	13(26)
	No	37(74)
Smokers	Yes	10(20)
	No	40(80)

There were 30 patients in group A and 20 patients in group B. In group A the TIMI grade flow 3 was achieved in 100% of patients during PPCI, and in group B, 85% of patients achieved TIMI grade flow 3 during PPCI; both groups showed statistical significance ($p = 0.02$) (Table 2).

Table 2: TIMI 3 flow achieved during PPCI at Presentation

Groups	TIMI 3 Achieved	TIMI 3 Not Achieved	P Value
Group A (N=30)	30 (100%)	0	0.02
Group B (N=20)	17 (85%)	3 (15%)	

In group A the mean LVEF was $45.49 \pm 3.99\%$, and in group B the mean LVEF was $35.25 \pm 3.85\%$ after PCI at presentation. There was a statistical significance in LVEF between the two groups after PCI at presentation ($p = 0.0001$). After three months of follow-up, the mean LVEF in the group was $55.66 \pm 0.92\%$, and in group B, it was $45.75 \pm 1.44\%$; both groups showed statistical significance ($p = 0.0001$) (Table 3).

Table 3: LVEF immediately after PPCI at presentation and after 3 months follow-up

	Group A (N=30)	Group B (N=20)	P Value
LVEF (%) at presentation	45.49 ± 3.99	35.25 ± 3.85	0.0001
LVEF (%) after 3 months	55.66 ± 0.92	45.75 ± 1.44	0.0001

Discussion

Patients having STEMI are in real need of rapid reperfusion therapy; PCI is the standard treatment for acquiring Thrombolysis in Myocardial Infarction (TIMI) flow grade 3 in 90% of patients presenting with STEMI. Primary PCI is related to lower death rates, re-infarction and stroke when the patient is treated on time^{12,13}. The delays in the treatment can have severe adverse effects and can reduce the benefits of PCI to a minimum¹⁴. The guidelines practiced presently recommend 90 min or less door-to-balloon time; the time recommended is not achieved in many hospitals, especially when urgent PCI is required¹⁵.

In several studies, early PCI followed after thrombolysis has been projected as a successful strategy in optimizing initial reperfusion and prevention from recurrent ischemia and reinfarction¹⁶. In other studies, patients treated with early PCI after thrombolysis had shown promising clinical outcomes, including no excess bleeding complications. These positive results have played a huge part in the recommendation of early PCI treatment after thrombolysis in current European guidelines¹⁷.

In our study, we observed that early PPCI treatment within 6 hours of STEMI patients showed improved LVEF on transthoracic echo assessment at presentation (45.49 ± 3.99 vs. 35.25 ± 3.85 ; $P = 0.001$) and after 3 months of follow up (55.66 ± 0.92 vs. 45.75 ± 1.44 ; $P = 0.001$) as compared to patients treated after 6 to 24 hours. The same observations have been recorded in several studies^{18,19} regarding the improved outcome in LVEF assessment on early PPCI treatment.

Our study showed TIMI grade flow reperfusion success was higher in the early group treated within 6 hours as compared to the late group after PCI at presentation. 100% of patients achieved TIMI 3 flow in group A, and 85% of patients received TIMI 3 flow. A study²⁰ conducted in Italy showed TIMI grade 2-3 was achieved by 96.4% of patients who underwent PCI procedures within 90 minutes.

Apart from the small study population, LVEF could not be assessed after 6 weeks which is recommended as per ACC STEMI guidelines, in the event of STEMI. However, after revascularization, the best to assess LVEF is after three months as per ACC ICD guidelines, which we have done. Unfortunately, TIMI flow cannot be assessed on a follow-up basis. WMS (wall motion score) and WMSI (wall motion score index) couldn't be concluded in the study.

Conclusion

We conclude that for patients with STEMI treated by PPCI, prolonging their treatment time can lead to poor TIMI grade flow and poor LVEF on transthoracic echo assessment. Efforts are needed to shorten the time to perform PPCI as early as possible in STEMI patients. For better myocardial perfusion and salvage, time management must be prioritized in cardiac health care facilities.

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