

Recovery of Left Ventricular Function in Cases of Primary Angioplasty for Acute Myocardial Infarction

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ABSTRACT

Background: This study is to investigate the recovery in left ventricular ejection fraction in the first 3 months after acute myocardial infarction treated with primary angioplasty. Left ventricular function (LVF) is the main predictor of long term prognosis in cases of survival after acute myocardial infarction. Study aims to investigate successful improvement in left ventricular ejection fraction after primary angioplasty.

Methodology: A cross sectional study was conducted at Chaudhary Pervaiz Ellahi Institute of Cardiology, Multan from 1stSeptember 2019 to 30thSeptember 2020. Left ventricular ejection fraction was evaluated in 100 patients treated with primary angioplasty. Primary angioplasty is a very 1st treatment to re-open the locked artery after acute myocardial infarction. Ejection fraction was measured with Echocardiography Simpson's biplane method at 3rd day and 3 months after angioplasty. Collected data was analyzed by using SPSS version 23. Chi square test was applied to see association among variables.

Results: One hundred patients were included this study. The mean age and BMI of the patients was 59.45±6.01 years and 24.76±8.02 kg/m², respectively. Male 70 (70%) and female 30 (30%) ratio was 7:3. LVEF at 3rd month was observed in ≤40% in 223 (23.0%) patients and >40% in 77 (77%) patients. Male patients were greater in number that's why LVEF is also observed in greater in male gender (p<0.001). Increase in age also have no impact on procedure success (p>0.050).

Conclusion: Results of this study reveal that primary angioplasty is successful treatment plan in patients with acute myocardial infarction. A significant recovery of left ventricular function during 3 months after primary angioplasty in acute Myocardial infarction (MI) patients was observed.

Keywords:

Primary angioplasty, Left ventricular function, Acute myocardial infarction, Ejection fraction, Echocardiography

INTRODUCTION

Acute myocardial infarction is a life-threatening condition caused by a sudden cut in blood flow to the heart muscle¹, which causes damage to the heart muscle and begins to die. Commonly it is caused by blockage in one or more arteries of the heart.^{1,2} Prolonged blockage of arteries leads to a lack of oxygen to the heart muscle, which may result to the death of a particular part of the heart.³

Left ventricular function (LVF) is the main predictor of long-term prognosis in cases of survival after acute myocardial infarction⁴. But, LVF may change after few months of MI due to gradual relief of stunning and remodelling mechanisms. Through the determinants of improvement in LVF it becomes easier

to decide therapeutic plan with better outcomes and prognostic significance.⁵ In addition to established benefits these determinants give insight into the changing mechanisms of ventricular function and output.⁶

Limited literature is available on benefits of primary angioplasty regarding improvement in LVF if performed within 6 months after myocardial infarction.⁷ Early attainment of perfusion or LVF recovery is the primary goal of clinicians after acute myocardial infarction and preferred treatment for this purpose is angioplasty through which drug eluting stent can be placed.⁸ Along with advantages like reduction in infarct size and salvage of myocardium angioplasty is also associated with risk of micro vascular plugging and embolization that may lead to micro-vascular obstruction.⁹ Outcomes of angioplasty vary with the timing of angioplasty and experience of the performing specialists.¹⁰

Conflict of Interest: The authors declared no conflict of interest exists.

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PATIENTS AND METHODS

This cross sectional study was conducted on 100 patients at Choudhary Pervaiz Ellahi Institute of cardiology, Multan from 01 September 2019 to 30 October 2020 in one year duration. Ethical approval from hospital ethical board was obtained and patients were informed about study purpose. Written informed consent was obtained from patients. Non probability consecutive sampling technique was used. Patients having acute myocardial infarction (ST segment elevation) and presented within 6 hours of onset of symptoms and planned for angioplasty were included in the study. Sample size was calculated by using openepi.com with 95% confidence interval, 80% power of study and 89%¹³ successful reperfusion after primary angioplasty as described in previous study. Patients were treated immediately after admission in angioplasty ward. Baseline features of patients' coronary anatomy and time to angioplasty were recorded. Patient who had re-infarction within six months after angioplasty and who died were excluded from the study. In accordance with treatment guidelines of acute myocardial infarction all patients were given aspirin, nitro-glycerine orally and heparin intravenously. ACE inhibitors were started in cases of large infarct and Beta blockers were also started unless contraindicated. Left ventricular systolic function assessment was done with echocardiography **Simpson's biplane method**. Patient's baseline information regarding site of infarct related artery, single vessel disease, BMI was recorded. Echo was done

at day-3 and 3-months after primary PCI. A significant change in left ventricular ejection fraction was defined as an increase or decrease of more than 4-6%. Ejection fraction of $\leq 40\%$ was considered as clinically significant and difference was calculated from formula of $LVEF_{3months} - LVEF_{3rd\ day} = \Delta LVEF$. SPSS version 23 was used for data analysis. Continuous variables were presented as mean and standard deviation like age and BMI. Discrete values were presented as frequency and percentages like gender **ejection fraction $\leq 40\%$, $>40\%$** , Single vessel disease and infarct site. Test of significance t-test and chi-square test were applied to see association among variables. **P value ≤ 0.05 was taken as significant.**

RESULTS

One hundred patients were included this study. Mean age and BMI of the patients was 59.45 ± 6.01 years and 24.76 ± 8.02 kg/m², respectively. Male and female ratio was 7:3 (Table I). LVEF is the main measurement of procedure success which is measured at 3rd day after primary angioplasty and at 3 months after procedure. LVEF at 3rd day was observed $<40\%$ in 44 (44%) patients and $>40\%$ in 56 (56%) patients.

Table 1: Demographic characteristics of the patients

Characteristic	Presence
Age (years)	59.45±6.01
BMI (kg/m ²)	24.76±8.02
Gender	
Male	N=70 (70%)
Female	N=30 (30%)

Table 2: Association of LVEF at 3rd day with effect modifiers

Effect Modifier	LVEF at 3 rd day		Odds ratio	P-value
	$\leq 40\%$	$>40\%$		
Gender	Male	32	1.26	0.598
	Female	12		
Age	<40 years	18	2.83	0.020
	>40 years	26		
BMI	<26 kg/m ²	11	0.56	0.183
	>26 kg/m ²	33		
Anterior infarct location	Yes	4	0.17	0.001
	No	40		
Single vessel disease	Yes	5	0.16	0.000
	No	39		

Table 3: Association of LVEF at 3rd month with effect modifiers

Effect Modifier	LVEF at 3 rd month		Odds ratio	P-value
	$\leq 40\%$	$>40\%$		
Gender	Male	5	0.05	0.000
	Female	18		
Age	<40 years	6	0.24	0.004
	>40 years	17		
BMI	<26 kg/m ²	9	1.34	0.553
	>26 kg/m ²	14		
Anterior infarct location	Yes	15	1.65	0.310
	No	8		
Single vessel disease	Yes	12	0.74	0.519
	No	11		

Four out of 44 (9.1%) patients had LVEF <40% and anterior infarct location. Location of infarct site and single vessel involvement has no effect on success of primary angioplasty (Table II)

Similarly, LVEF at 3rd month was observed in <40% in 3 (23.0%) patients and >40% in 77 (77%) patients. Even in patients with single vessel disease majority of patients found with improved LVEF. Location of infarct also has no impact on improvement of LVEF after primary angioplasty (Table. II).

LVEF at 3rd month was observed in $\leq 40\%$ in 223 (23.0%) patients and >40% in 77 (77%) patients. Male patients were greater in number that's why LVEF is also observed in greater in male gender ($p < 0.001$). Increase in age also have no impact on procedure success ($p > 0.050$). ($p = 0.519$) (Table III).

DISCUSSION

Assuming that coronary angioplasty is directed to preserve LVF, but its role in long term recovery of ejection fraction is not known. Thus, in this study we evaluated the improvement of LVEF after long time of angioplasty. Expansion of infarcted zone is the earliest change after acute myocardial infarction that can cause compensatory hypertrophy of non-infarcted segments and enlargement of ventricular muscles. Some factors are involved in alteration of this remodelling process that can be treated with reperfusion therapy or angioplasty.^{11,12} In this study a significant improvement was observed at 3 months follow up echocardiography.

In this study a significant improvement was observed after 3 months of primary angioplasty. A similar study was conducted by Ottervanger and coauthors on recovery of LVEF at 6 months follow up and reported similar findings that 50% improvement in ejection fraction at 6 months follow up which means similar finding like our study.¹³ The authors reported that ejection fraction improved from 43.7% at discharge time to 46.3% at 6 months follow up. Another study reported findings in contrast to our findings that preferred thrombolytic therapy over angioplasty to regain perfusion after acute myocardial infarction.¹⁴

In this study it was observed that better outcomes of angioplasty or improved ejection fraction associated with multiple clinical factors through which outcomes can be predicted. Some of these factors include anterior infarction, single vessel disease, early age and low BMI. Christian and colleagues reported anterior infarct location is associated with improved ejection fraction of left ventricle after angioplasty.¹⁵ Kearney and colleagues completed a study on predictors of LVEF recovery and

reported that anterior infarct location is an important predictor of early recovery of LVEF after angioplasty.¹⁶ This variable was also observed in this study. In this study patients presented to emergency department within 6 hours of onset of symptoms and planned for angioplasty were evaluated with hypothesis that early angioplasty after onsets of symptoms give better outcomes regarding LVEF. Oh and co-workers reported similar findings that aggressive approach and treatment should be considered in acute myocardial infarction patient.¹⁷ Similar findings were reported in an earlier study that angioplasty performed within 4 hours of infarction restores left ventricular function more accurately than those patients proceeded after 4 hours.¹⁸

One previous report compared primary angioplasty and streptokinase therapy in acute myocardial infarction patients and supported early angioplasty for long terms benefits.¹⁹ This trial was completed in five year duration and outcomes like mortality reinfarction and readmissions are less in patients treated with angioplasty. Another study compared left ventricular ejection fraction in three groups, PCI, CABG and medical therapy (MT).²⁰ After 10 year follow up (6 months per follow up) PCI found reduction in LVEF -7.2 ± 17.13 , CABG -9.08 ± 18.77 and MT -7.54 ± 22.74 but non-significant values ($p = 0.631$).

Some of the limitations of the present study include that only left ventricular ejection fraction was measured, data on ventricular dimensions, diastolic dysfunction, systolic volumes and end diastolic volume was not included. Follow up echocardiography was performed at 3 months after primary angioplasty but in some reports echocardiography was performed beyond this period of remodeling. Moreover, no data about extent of stunned, viability of infarct zone and echocardiography estimation of dobutamine stress was available.

CONCLUSION

Primary angioplasty is successful treatment plan in patients with acute myocardial infarction. A significant recovery of left ventricular function during 3 months after primary angioplasty in acute Myocardial infarction (MI) patients was observed.

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