

ORIGINAL ARTICLE

Comparison of Left Ventricular Systolic Function between Thrombolysed and Non-thrombolysed patients presenting with ST-Elevation Myocardial Infarction to a Tertiary Care Hospital.

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Abstract

Background: ST elevation myocardial infarction (STEMI) is a critical condition that requires prompt intervention to minimize myocardial damage and improve outcomes. Understanding the impact of thrombolysis on left ventricular systolic function in comparison to non-thrombolysed patients is crucial for optimizing treatment strategies and improving patient care in the post-STEMI period. This study aims to contribute valuable insights into the management of STEMI patients by evaluating the differences in left ventricular systolic function between thrombolysed and non-thrombolysed patients.

Methodology: This cohort study was conducted through non-probability consecutive sampling at Emergency Department, Faisalabad Institute of Cardiology, Faisalabad. Informed consent was obtained from attendant of patients. Demographic profile was also obtained including name, age, sex, h/o diabetes, IHD, smoking, family history and duration of pain. Two groups were formed on the basis of timing of presentation. Thrombolysed group consisted of patients who presented within 12 hours of onset of symptoms with ST-elevation on surface ECG and got thrombolytic. Non-Thrombolysed group consisted of patients presenting after 12 hours and didn't get thrombolytic. Transthoracic echocardiography using Biplane Simpson's method of these patients was done at the time of discharge and 6 weeks post discharge to assess Left ventricular systolic function. Data so collected was entered in predesigned Performa.

Results: In this study the mean age of the patients was 54.03 ± 10.163 years with male to female ratio of 3.17:1. Mean value of LV systolic function among non-thrombolysed group patients was 31.58 ± 10.53 while the mean value of LV systolic function among thrombolysed group patients was 47.77 ± 9.24 . The thrombolysis group showed better outcome than to non thrombolysed group.

Conclusion: According to the present study results it can be said that the non-thrombolytic patients showed significantly higher risk in terms of LV systolic dysfunction at 6 weeks post-discharge period as compared with the thrombolysed patients after ST elevation MI.

Keywords

STEMI, Left Ventricle, Thrombolysis, Dysfunction.

Introduction

Coronary heart disease, especially acute coronary disorder, is the world's leading cause of death¹. Every year, it represents 16.7 million deaths. According to World Health Organization, deaths related to coronary artery disease by 2020 will reach 25 million a year². Around 25% to 35% of all acute myocardial infarction (MI) patients die from ventricular fibrillation before getting medical treatment.³ Coronary artery disease causes greater than 100,000 deaths yearly in Pakistan.⁴ The major manifestations of acute coronary syndrome are ST-segment elevation myocardial infarction (STEMI), Unstable angina or Non-STEMI (NSTEMI).

Universal definition of STEMI describes it as cardiomyocyte necrosis in a clinical setting consistent with myocardial ischemia where ischemia is characterized by detection of rise/fall in cardiac sensitive Troponin (cs-Tn) with at least one value above the 99th percentile of upper reference value along with specific criteria like, New ischemic ECG alterations, indications of myocardial ischemia, Pathological Q wave development on ECG, New regional wall motion aberration in a pattern dependable with an ischemic origin or imaging evidence of loss of viable myocardium, Detection of intra-coronary thrombus on autopsy or angiography. (ESC guidelines 2020)⁵.

STEMI is initiated by an acute blocking of an epicardial coronary artery usually due to disruption of an atherosclerotic plaque with formation of an occluding thrombus. Left ventricle dysfunction and arrhythmias resulting from acute MI are responsible for increased mortality. Rapid and effective restoration of blood flow to ischemic myocardial tissue is the most important initial goal in the treatment of patients with STEMI and can enhance long-term prognosis by preventing LV dysfunction. Various means for the restoration of blood flow include primary percutaneous coronary intervention (PPCI) of infarct related artery and institution of fibrinolytic therapy. As per American Heart Association guidelines primary PCI, if available, is considered as the gold standard

tool for the revascularization of infarct related artery. A fibrinolytic agent (Streptokinase, available in Pakistan) in the absence of any contraindication is an alternative in patients presenting to hospital with STEMI when facility of primary PCI is not available. Lesser the time of primary PCI to infarct related artery or thrombolytic therapy better would be the outcome.

The issue that this study addresses is evaluating the comparison of left ventricular systolic function between thrombolysed and non-thrombolysed patients presenting with STEMI at tertiary care hospitals. To address this problem, patients coming with symptoms suggestive of acute coronary syndrome and ECG evidence of STEMI were admitted at Faisalabad Institute of Cardiology, Faisalabad. Left ventricular systolic function was measured using Biplane Simpson method echocardiography and analyzed in both groups.

Methodology

The study was conducted at the Emergency Department, Cardiology Ward, and Echocardiography Department of Faisalabad Institute of Cardiology, Faisalabad, Pakistan, over a six-month period from March 13, 2019, to September 13, 2019. A non-probability consecutive sampling technique was used to enroll the participants.

The sample size was calculated to be 200 patients, with 100 patients in each group, based on an 80% power of the study, a 5% level of significance, and an expected percentage of thrombolysis of 46.3% in patients with left ventricular (LV) dysfunction and 28.5% with normal LV function after ST-elevation myocardial infarction (STEMI).

$$n = \frac{\left\{ z_{1-\alpha} \sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right\}^2}{(P_1 - P_2)^2}$$

The inclusion criteria were patients aged between 30 and 70 years of both genders presenting with STEMI. Patients were excluded if their ECG suggested left ventricular hypertrophy or left bundle branch block, they had a previous history of

coronary artery bypass surgery or angioplasty, previous myocardial infarction, or were unable to provide informed consent. Patients who underwent percutaneous coronary intervention (PCI) during their hospital stay were also excluded.

The approval from ethics committee of the hospital was taken. It is a routine of the institute to get informed written consent at time of admission and before start of every procedure. Patients fulfilling selection criteria were enrolled in the study through Emergency Department, Faisalabad Institute of Cardiology, Faisalabad. Informed consent was obtained from attendant of patients. Demographic profile was also obtained including name, age, sex, h/o diabetes, IHD, smoking, family history and duration of pain. Then patients were admitted in cardiology wards and were followed-up there. Patients stayed in hospital for 5 days. Patients were discharged on guide line directed medication consisting of Dispirin 75mg, Clopidogrel 75mg, Metoprolol 25mg, Lisinopril 5mg and diuretics where needed. Two groups were formed on the basis of timing of presentation. Thrombolysed group consisted of patients who presented within 12 hours of onset of symptoms with ST-elevation on surface ECG and got thrombolytic. Non-Thrombolysed group consisted of patients who presented after 12 hours of onset of symptoms and didn't get thrombolytic. Transthoracic echocardiography using Biplane Simpson's method of these patients was done at the time of discharge and 6 weeks post discharge to assess Left ventricular systolic function. The echocardiography study was conducted by a senior cardiologist. Data so collected was entered in predesigned Performa.

All the information was recorded in a Proforma devised by the principal investigator. Data was entered and analyzed through SPSS v. 21. Quantitative variables like age, weight, height, body mass index, duration of chest pain was calculated as mean \pm SD. Qualitative variables like gender, H/o diabetes, ischemic heart disease, smoking, family history, thrombolysis (given or not) and LV systolic function presented as frequency

and percentage. To measure association between LV systolic function and thrombolysis, relative risk was calculated. $RR > 1$ was considered as significant. Data was stratified for age, gender, body mass index, H/o diabetes, ischemic heart disease, smoking, family history. Post-stratification, RR was calculated to measure association between LV dysfunction and thrombolysis. $RR > 1$ was considered as significant.

Results

Total 200 cases had been enrolled in our study. The patients' mean age was 54.03 ± 10.163 years with minimum and maximum ages of 24 & 78 years respectively. In this study the mean age of patients from thrombolysed group patients was 53.52 ± 1.07 years while the mean age of the patients from non-thrombolysed patients group was 54.55 ± 10.28 years. According to the study 152 (76%) patients were male while 48 (24%) patients were female. The male & female ratio was 3.17:1. The mean value of patients' LV function was 39.18 ± 13.11 with lowest and highest values of 17% & 61% respectively. This study represented the mean value of LV systolic function (Ejection fraction) among non-thrombolysed group patients was 31.58 ± 10.53 while the mean value of LV systolic function (Ejection fraction) among thrombolysed group patients was 47.77 ± 9.24 . This was a statistically significant difference. i.e. p value = < 0.001 . According to this study at discharge amongst both groups normal LV function was found in 37 (18.5%) patients, mild LV dysfunction was found in 47 (23.5%) patients, moderate LV dysfunction was found in 35 (17.5%) patients and severe LV dysfunction was found in 81 (40.5%) patients. According to this study at 6th week amongst both groups normal LV systolic function was found in 40 (20.0%) patients, mild LV dysfunction was found in 37 (18.5%) patients, moderate LV dysfunction found in 38 (19.0%) patients and severe LV dysfunction was found in 85 (42.5%) patients. Results of the study showed that at discharge among non-thrombolysed patients, LV systolic dysfunction (mild, moderate and severe) was noted in 84 (84%) patients while left ventricular systolic dysfunction (mild, moderate and severe) was found in 80 (80%) patients among thrombolysed group. At discharge

among non-thrombolysed patients, normal LV function was found in 16(16%) patient and normal LV function among thrombolysed group was found in 20(20%) patients. This was a statistically insignificant difference (p value=0.462). According to RR the non-thrombolysis patients showed 1.15 times risk of LV dysfunction than thrombolysed patients, however this risk is insignificant i.e. RR=1.15 [0.64-2.71]. The study results showed that at 6th week follow up among non-thrombolysed patients; LV systolic dysfunction (mild, moderate and severe) was noted in 85(85%) patients while

left ventricular dysfunction (mild, moderate and severe) among thrombolysed group was found in 65(65%) patients. At 6th week among non-thrombolysed group, normal LV function was found in 15(15%) patient while normal LV function among thrombolysed group was found in 35(35%) patients. This was a statistically significant difference (p-value=<0.001). According to RR the non-thrombolysis patients showed 4.75 times risk of LV dysfunction than to thrombolysed group patients. i.e RR=4.75 [2.07-10.89].

Table 1: Patient's baseline characteristics (N=102).

		Thrombolysed (n=100)	Non- thrombolysed (n=100)	Total (n=200)
Gender	Male	82 (82%)	70 (70%)	152 (76%)
	Female	18 (18%)	30 (30%)	48 (24%)
Age in Years (Mean)		53.52±10.163	54.55±10.163	
Risk factors	Diabetes	27 (27%)	37 (37%)	64 (32%)
	Hypertension	50 (50%)	44 (44%)	94 (47%)
	Hyperlipedemia	84 (84%)	79 (79%)	163 (81.5%)
	Smoking	48 (48%)	42 (42%)	90 (45%)
	Family H/o IHD	17 (17%)	17 (17%)	34 (17%)
Time of Presentation	Chest pain	Mean 3.01±1.2 hours	Mean 18.5±1.2 hours	
KILLIP Class	KILLIP-I	61 (47%)	53 (53%)	114 (57%)
	KILLIP-II	13 (11%)	6 (6%)	19 (9.5%)
	KILLIP-III	21 (21%)	24 (24%)	45 (22.5%)
	KILLIP-IV	5 (5%)	17 (17%)	22 (11%)
LV systolic function (EF%) Mean		47.77±9.24%	31.53±10.53%	
LV systolic dysfunction at discharge	Normal	20 (20%)	16 (16%)	36 (18%)
	Mild	24 (24%)	38 (38%)	62 (31%)
	Moderate	16 (16%)	12 (12%)	28 (14%)
	Severe	42 (42%)	44 (44%)	86 (43%)
LV systolic function at 6th week	Normal	35 (34%)	5 (5%)	40 (20%)
	Mild	35 (35%)	15 (15%)	50 (25%)
	Moderate	8 (8%)	32 (32%)	40 (20%)
	Severe	22 (22%)	48 (48%)	70 (35%)
				RR4.75 p-value< 0.001

Table 2: Descriptive statistics of LV function with study groups.

	Study Groups		p-value
	Non-Thrombolysed	Thrombolysed	
LV Function	N	100	100
	Mean	31.58	47.77
	SD	10.53	9.24

Table 3: Comparison of LV dysfunction at discharge with study groups

LV Function	Study Groups		Total	RR
	Non-thrombolysed	Thrombolysed		
AT Discharge	Mild	19(19%)	27(27%)	1.15 [0.64-2.71]
	Moderate	27(27%)	25(25%)	
	Severe	38(38%)	28(28%)	
		84%	80%	
	Normal	16	20	
	16%	20%	18%	
Total	100	100	200	
	100.0%	100.0%	100.0%	

*p-value = 0.462

Table 4: Comparison of LV dysfunction at 6th week after discharge with study groups

LV Function	Study Groups		Total	RR	
	Non-thrombolysed	Thrombolysed			
AT 6 th week	Mild	15(15%)	19(19%)	4.75 [2.07-10.89]	
	Moderate	37(37%)	19(19%)		
	Severe	43(43%)	27(27%)		
		95.0%	65.0%		80.0%
	Normal	5	35		40
	5.0%	35.0%	20.0%		
Total	100	100	200		
	100.0%	100.0%	100.0%		

*p-value < 0.001

Discussion

This present cohort study was carried out at emergency Department and Cardiology ward of Faisalabad Institute of Cardiology, Faisalabad to determine the LV systolic dysfunction occurring due to non-thrombolysis as a result of delayed presentation of patients after ST elevation myocardial infarction. Left ventricular failure could be due to ischemia (dysfunction of cardiac muscle), LV stunning, hibernation or because of mechanical complications for example ventricular septal rupture, free-wall rupture and mitral regurgitation.¹⁹ In the present study mean value of LV systolic function (Ejection Fraction) among non-thrombolysed group patients was 31.58 ± 10.53 while the mean value of LV systolic function (EF) among thrombolysed group patients was 47.77 ± 9.24 . This difference was statistically significant. i.e $p\text{-value} < 0.001$. At discharge, among non-thrombolysed patients LV systolic dysfunction (mild, moderate, severe) was noted in 84(84%) patients while LV systolic dysfunction (mild, moderate, severe) among thrombolysed group was found in 80(80%) patients. At discharge among non-thrombolysed patients the normal LV function was found in 16(16%) patients and normal LV function among thrombolysed group found in 20(20%) patients. This difference was statistically insignificant ($p\text{-value} = 0.462$). At 6th week post-discharge among non-thrombolysed patients the LV dysfunction (mild, moderate, severe) was noted in 95(95%) patients and LV dysfunction (mild, moderate, severe) among thrombolysed group was found in 65(65%) patients. According to RR the non-thrombolysis patients showed 4.75 times higher risk of LV dysfunction than to thrombolysed group patients. i.e $RR = 4.75 [2.07-10.89]$.

A thrombolytic meta-analysis indicates that fibrinolysis was an excellent way of reperfusion with better results across subgroups except those presented after 12 hours of onset of symptom. Advantage of thrombolytic treatment is reduced in patients presenting more than 12 hours after symptom suggestive of STEMI.²⁰ The initiation of early therapy with thrombolytic agent showed beneficial effects documented by several RCTs,

lesser the time of initiation of therapy from onset of symptoms suggestive of myocardial infarction and ST-elevation on surface ECG, better would be the results. Since thrombolysis is not without associated risks (which could be life threatening at times), it should be administered only in those patients who had diagnosis of STEMI reported by a capable medical practitioner.^{20,21,22}

Early introduction of thrombolytic therapy resulted in dramatic reduction in mortality in STEMI patients. During thrombolytic period left ventricular (LV) function was deliberated the most significant prognostic factor following AMI. Both LV function and mortality benefits were seen when compared to control group. LV systolic function is the main factor in the assessment of the efficacy of adjuvant regimens and different thrombolytic.²³ "The Global Utility of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO) Trial aids these findings, with LV function being significantly associated with mortality reduction. LV function, calculated at 90 min either as infarct zone contractility, ejection fraction, closely associated with 30 day mortality ($P < 0.01$). Multicenter investigations have proposed that primary ventricular fibrillation is declined after early thrombolysis.^{28,29} Both post-hospital and in-hospital discharge death are declined by thrombolytic therapy. Early mortality is associated primarily to pump failure, while furthestmost deaths after discharge of hospital are presumably and sudden due to fatal arrhythmias alike sustained ventricular tachycardia that degenerates to ventricular fibrillation.³⁰ In a study conducted by Abid A.K. et al in 2005 found improved left ventricular systolic function in patients receiving thrombolytic therapy when compared to those who were not thrombolysed. This stressed the fact that addition of thrombolytic therapy improves left ventricular function by restoration and improvement of perfusion to injured myocardium.³¹ When compared to the above mentioned studies it is pertinent that earlier the time of initiation of thrombolytic therapy, more are the chances to salvage the myocardium at risk. This helps in the restoration of blood flow in the infarct related artery, thereby preventing left ventricular

systolic dysfunction. The present study is consistent with the above said results and trials.

The present study describes the importance of time of presentation following symptoms suggestive of STEMI and initiation of treatment. Public health education through all available media about the recognition and diversity of STEMI symptoms, in particular understanding of common symptoms, is essential for timely health seeking using print, electronic or social media. Early patient transfer to health facility using any available resources like car, ambulance, air-lift etc. can reduce the time of presentation to hospital.

Conclusion

According to the present study results it can be said that the non-thrombolysed patients showed significantly higher risk of LV systolic dysfunction at 6th week after discharge as compared to thrombolysed patients presenting with ST elevation MI.

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