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Original Article

PREDICTORS OF LEFT VENTRICULAR DYSFUNCTION (LVD) IN PATIENTS WITH ACUTE MYOCARDIAL INFRACTION (AMI) UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION (PPCI)

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ABSTRACT:

Acute Myocardial Infarction (AMI) leads to significant myocardial damage if not promptly addressed. The aim of this study was to determine the frequency, predictors and assessing the associated factors with LV dysfunction in patients with AMI undergoing PPCI. This descriptive cross-sectional study conducted at department of Cardiology SICVD hospital, Larkana, Pakistan for the period of six month including 340 patients. All the patients from the age range between 30 to 70 years old with confirmed diagnosis of AMI based on angiography and undergone PPCI were included in the study. Primary PCI procedures were performed by senior cardiologists; pre- and post-procedure clinical and pharmacological management were kept uniform. The results showed a male majority in the sample, with 264 (77.6%) of these being male and 76 (22.4%) being female. Only 6 patients (1.8%) were under 30 years old. The mean age score for patients with intact LVEF (>50%) was 3.76, while the averages for gender and hypertension were 1.23 and 1.36, respectively. The mean age of those with slightly decreased LVEF (40–50%) was 3.85, whereas the averages for gender and hypertension were 1.23 and 1.32, respectively. A significant percentage of patients experienced severe LV systolic dysfunction, which is linked to unfavourable clinical outcomes. This dysfunction following PPCI is independently predicted by larger myocardial infarction, renal impairment, and severe coronary artery disease.

Keywords: Left ventricular Dysfunction, Acute Myocardial Infraction, primary percutaneous coronary intervention, myocardial infarction

INTRODUCTION

Left ventricular thrombus (LVT) is a severe consequence of myocardial infarction (MI), leading to systemic embolism and heightened morbidity and mortality (1). Despite the use of quick reperfusion and effective anticoagulant therapy, the occurrence of LVT remains between 2.5% to 15% in patients with acute myocardial infarction (AMI) (2). Primary Percutaneous Coronary Intervention (PPCI) is the gold standard for treating STEMI, aiming to restore blood flow and minimize myocardial injury. Despite PPCI success in salvaging myocardial tissue and improving survival rates, a notable proportion of patients continue to experience left ventricular (LV) dysfunction, which can complicate recovery and affect long-term outcomes (3).

Nevertheless, information about the incidence and outcome of LVT in patients with LV dysfunction and post-MI who received PCI is rarely available. To assess the determinants and clinical prognosis of LVT in a high-risk population of post-MI and LV dysfunction patients who received modern PCI treatment, in the current study, we examined the consecutive patients from a prospectively enrolled single centre PCI database. In several contexts, the epidemiology of heart failure and ventricular dysfunction has been investigated (4).

The ”Implantable cardioverter defibrillator (ICD) implantation” early after myocardial infarction (MI) showed mortality benefit in patients with impaired LV ejection fraction (LVEF), according to earlier randomised trials investigating early primary prevention measures (5), Probably for a variety of reasons: First, because the same causes are linked to an increased risk of both arrhythmic and non-arrhythmic mortality, the decrease in life-threatening arrhythmias was counterbalanced by a concurrent increase in non-arrhythmic death(6). There is a shortage of recent research on accurate prevalence data based on sufficient echocardiographic evaluation in the general older population. Furthermore, the epidemic of heart failure appears to be shifting as a result of population ageing, better therapy for heart failure, increased comorbidities, and greater survival of acute coronary disease (7).

By evaluating a comprehensive range of variables, including patient demographics, clinical characteristics, procedural details, and biochemical markers, this study aims to elucidate the factors most strongly associated with LV dysfunction. Insights from this research could lead to more targeted and personalised treatment strategies, ultimately improving outcomes and quality of life for patients undergoing PPCI (8). The aim of this study is to determine the frequency and factors associated with LV Dysfunction in patients with AMI undergoing PPCI.

METHODS

A descriptive cross-sectional study was conducted at Department of Adult Cardiology, Sindh Institute of Cardiovascular Diseases (SICVD) Larkana, Pakistan for the period of six months (January 2025 to June 2025). The calculated minimum required sample size was 355. All the patients aged between 30 to 70 years, confirmed diagnosed cases of AMI based on angiography and underwent PPCI were included in the study. Whereas the patients having serious comorbid conditions and poor cognitive potentials, and patients not willing to participate were excluded from the study. The data was collected after the approval obtained from the ethical review committee, the patient undergoing PPCI meeting with inclusion criteria were enrolled in the study. Informed consent was obtained for study participation and publication of collected data without disclosing patients' identity.

Primary PCI procedures were performed by senior cardiologists; pre- and post-procedure clinical and pharmacological management were standardised for all patients as per clinical practice guidelines and institutional policies. Data was collected for various patient, system, and procedure-related characteristics with the help of a predefined structured proforma that consisted of demographic data, clinical presentation, history and co-morbid conditions, and angiographic and procedural characteristics. Post-procedure transthoracic echocardiography (TTE) was performed, and left ventricular dysfunction (LVD) was documented.

Statistical methods

Descriptive analysis was conducted to evaluate the association between LVD and various demographic and clinical characteristics, using the Chi-square test, t-test, or Mann-Whitney U test, as appropriate. The statistical significance criteria are set as p-value<0.05.

RESULTS

A total of 340 patients were enrolled, based on the research population's demographic profile. The sample was male-majority, with 264 (77.6%) of these being male and 76 (22.4%) female. Only 6 patients (1.8%) were under 30 years old, whereas the majority of cases occurred in middle-aged and older age groups.

Table 1. Demographic details of patients

Variable	Category	n (%)
Gender	Male	264 (77.6%)
	Female	76 (22.4%)
Age Groups	<30	6 (1.8%)
	30–40	31 (9.1%)
	41–50	94 (27.6%)
	51–60	113 (33.2%)
	61–70	74 (21.8%)
	>70	22 (6.5%)
	Total	340 (100%)
Family History of CVD	Yes	126 (37.1%)
	No	214 (62.9%)
Marital Status	–	–
Procedure Performed	Angiography	3 (0.9%)
	POBA	11 (3.2%)
	Stenting	326 (95.9%)

Table 2. comparison of means with dependent variables

Age Gender Hypertension * Left Ventricular LVEF				
Left Ventricular LVEF		**Age**	**Gender**	**Hypertension**
- > 50%	**Mean**	3.7612	1.2388	1.3582
	n	67	67	67
	Std. Deviation	1.10220	.42957	.48309
- 40-50%	**Mean**	3.8496	1.2256	1.3158
	n	133	133	133
	Std. Deviation	1.16448	.41953	.46659
- 30-39%	**Mean**	3.8130	1.2358	1.3008
	n	123	123	123
	Std. Deviation	1.09656	.42622	.46049
- < 30%	**Mean**	4.1765	1.0588	1.1765
	n	17	17	17
	Std. Deviation	1.01460	.24254	.39295
Total	**Mean**	3.8353	1.2235	1.3118
	n	340	340	340
	Std. Deviation	1.11939	.41722	.46390

A total of 9.1% of the patients in the study were between the ages of 30 and 40, while 27.6% were between the ages of 41 and 50. The age group of 51–60 years old had the highest frequency, making up 33.2% of the research population. Patients between the ages of 61 and 70 made up 21.8% of the total, while those above 70 made up 6.5%. Correlation analysis was performed between age, gender, and hypertension and left ventricular ejection fraction (LVEF). The mean age score for patients with normal LVEF (>50%) was 3.76, while the averages for gender and hypertension were 1.23 and 1.36, respectively. The mean age of those with mildly reduced LVEF (40–50%) was 3.85, whereas the averages for gender and hypertension were 1.23 and 1.32, respectively. The considerably decreased group (LVEF 30–39%), with mean age score of 3.81, gender 1.24, and hypertension 1.30. On the other hand, patients with LVEF <30% had lower mean gender (1.06) and hypertension (1.18) ratings, as well as a higher mean age of 4.17. The findings show that a slight variance in the distribution of hypertension and gender, as well as growing age, are linked to decreasing LVEF. The distribution of left ventricular (LV) dysfunction across patients in different age groups undergoing various treatments is shown in the table. The most common intervention was primary PCI (n=337), which was more common in patients between the ages of 51 and 60. A total of 142 patients had LV dysfunction, with the majority being between the ages of 41 and 60. Rarely were thrombolysis (n=2) and medical management alone (n=1) carried out. The table summarizes the distribution of left ventricular (LV) dysfunction across different interventions and age groups. Primary PCI was the most frequently performed intervention (n=337), with LV dysfunction present in 42.1% of cases, most commonly in the 41–60-year age range. Thrombolysis (n=2) and medical management (n=1) were rarely used, with no LV dysfunction observed. Overall, LV dysfunction was present in 41.8% of the study population (n=340). Chi-square analysis showed no statistically significant association between age and LV dysfunction in either the PCI subgroup (p=0.373) or the total study population (p=0.413).

Table 3. Statistical presentation and details of procedures

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Killip Classification at presentation	50.030	339	.000	1.13235	1.0878	1.1769
No of stents used	29.117	339	.000	1.18824	1.1080	1.2685
Procedure	212.801	339	.000	2.95000	2.9227	2.9773
Initial Electrocardiogram ECG	45.457	339	.000	1.62647	1.5561	1.6969

DISCUSSION

Left Ventricular dysfunction following STEMI is associated with increased morbidity and mortality, underscoring the importance of identifying factors that predict adverse LV remodelling (9-10). A variety of clinical, procedural, and biochemical parameters have been identified as potential predictors of LV dysfunction. For example, pre-existing conditions such as diabetes mellitus and hypertension, as well as the extent of myocardial damage indicated by biomarkers like troponin and creatine kinase, are shown to correlate with LV dysfunction (11). Additionally, procedural factors such as the duration of ischaemia and the efficacy of thrombus aspiration can impact post-procedural LV function (12).

According to research, the incidence of LVDD in individuals with type 2 diabetes ranges from 23 to 75% (13), while the prevalence of HF in these patients is reported to be 12–57%. The variations in patient cohorts (demographics, inclusion/exclusion criteria, and prescribed drugs) and diagnostic techniques were explained by this variability. In the general population with type 2 diabetes, the prevalence of LVDD was 35.0%, according to a study conducted on LV dysfunctions (14). The frequency of LVD in Asian populations ranges from 54.3% to 65.0%, according to a small number of studies (patient population <150).

These data are consistent with our finding that 70.1% of Malaysian patients with established type 2 diabetes under therapy have asymptomatic, mostly Grade 1/mild LVDD (15).

Table 4. Comparison of clinical intervention and Left Ventricular dysfunction of patients

Intervention	Age Group	No LV Dysfunction (%)	LV Dysfunction n (%	Total n (%)	χ^2 Value	df	p-value
Primary PCI	<30	2 (33.3%)	4 (66.7%)	6 (100%)			
	30–40	16 (53.3%)	14 (46.7%)	30 (100%)			
	41–50	59 (62.8%)	35 (37.2%)	94 (100%)			
	51–60	63 (56.3%)	49 (43.7%)	112 (100%)			
	61–70	39 (53.4%)	34 (46.6%)	73 (100%)			
	>70	16 (72.7%)	6 (27.3%)	22 (100%)			
	Subtotal	**195 (57.9%)**	**142 (42.1%)**	**337 (100%)**	**5.363**	5	0.373
Thrombolysis	51–60	1 (100%)	0 (0%)	1 (100%)			
	61–70	1 (100%)	0 (0%)	1 (100%)			
	Subtotal	**2 (100%)**	**0 (0%)**	**2 (100%)**	–	–	–
Medical Management Only	30–40	1 (100%)	0 (0%)	1 (100%)			
	Subtotal	**1 (100%)**	**0 (0%)**	**1 (100%)**	–	–	–
Total	<30	2 (33.3%)	4 (66.7%)	6 (100%)			
	30–40	17 (54.8%)	14 (45.2%)	31 (100%)			
	41–50	59 (62.8%)	35 (37.2%)	94 (100%)			
	51–60	64 (56.6%)	49 (43.4%)	113 (100%)			
	61–70	40 (54.1%)	34 (45.9%)	74 (100%)			
	>70	16 (72.7%)	6 (27.3%)	22 (100%)			
	Grand Total	**198 (58.2%)**	**142 (41.8%)**	**340 (100%)**	**5.020**	5	0.413

According to several Western researches, among individuals without documented coronary artery disease, LVDD is more common than LVSD. In this cohort, 3.6% had EF < 50%, and 42% had verified LVDD, most with Grade 1 dysfunction. This sample had a mean age of over 60 and a short duration of type 2 diabetes (mean of 4–5 years). Statins were used by 45% of patients, and renin-angiotensin system (RAS) blockers by 72%. The short mean duration of type 2 diabetes, the extensive use of RAS blockers, and the elimination of inducible ischaemia by stress echocardiography all contribute to the low prevalence of LVSD and LVDD in this study (16).

However, the prevalence of Grade 2 LVDD was somewhat greater (18%) and the total LVDD was lower (40%) in a cohort studyT2DM patients who did not have overt heart disease or coronary artery disease. These patients' mean age was comparable to that of our study, but their mean duration of T2DM was shorter (4.5 years), which could explain why it was less common in this group (17).

The AMI-related mortality rates have dramatically dropped in recent years. Furthermore, it has been demonstrated that early reperfusion therapy, which includes mechanical methods and adjuvant antithrombotic treatment, reduces mortality. Notably, in patients with AMI, the mechanical reperfusion approach combined with PPCI can reduce the size of the infarct and maintain left ventricular systolic function. Even after a successful PPCI procedure, certain patients may still exhibit diminished cardiac function and be at risk for developing congestive heart failure (18). Significant early impairment and varied recovery are also noted in studies monitoring LVEF trajectories following STEMI, which is in line with your greater in-hospital proportion (19).

the study showed Age group and LV dysfunction did not significantly correlate, according to your chi-square tests (PCI subgroup p=0.373; overall p=0.413). Previous research indicates that ischaemia time, infarct location, and disease burden are stronger predictors of decreased LVEF than age alone, which makes a non-significant univariate age–LVEF correlation conceivable (20). The clinical significance

stratified reporting is supported by the fact that, regardless of age, lower LVEF following MI is still a significant prognostic marker for mortality and hospital readmission and improves with efficient reperfusion and/or optimal therapy (21).

CONCLUSION

After undergoing PPCI, a significant percentage of patients experience severe LV systolic dysfunction, which is linked to unfavourable clinical outcomes. significant LV systolic dysfunction after PPCI is independently predicted by larger myocardial infarction, renal impairment, and significant coronary artery disease. The clinical significance stratified reporting is supported by the fact that, regardless of age, lower LVEF following MI is still a significant prognostic marker for mortality/readmission and improves with efficient reperfusion/optimal therapy.

Conflict of Interest

Authors declare no conflict of interest.

Ethical consideration

The study was approved by local research ethics committee.

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