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PREVALENCE OF LEFT VENTRICULAR CLOT AND ITS ASSOCIATED FACTORS IN ANTERIOR WALL MYOCARDIAL INFARCTION PATIENT PRESENTING TO MARDAN MEDICAL COMPLEX MARDAN

Original Research

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ABSTRACT

Background: Coronary heart disease continues to be a major global cause of morbidity and mortality, with anterior wall myocardial infarction (MI) posing a heightened risk of complications such as left ventricular (LV) thrombus. LV thrombus can result in systemic embolization, stroke, and worsened cardiac outcomes. Despite advancements in reperfusion therapy, early detection and management of LV thrombus remain limited in many low-resource settings, particularly in South Asia, where access to timely interventions is still developing.

Objective: To determine the prevalence of left ventricular thrombus in patients with anterior wall myocardial infarction and identify clinical and demographic factors associated with its development.

Methods: A cross-sectional study was conducted at the Cardiology Department of Mardan Medical Complex from September 2024 to March 2025. A total of 227 patients diagnosed with acute anterior wall MI were enrolled based on ECG findings and elevated cardiac biomarkers. Transthoracic echocardiography was performed within 72 hours of admission to evaluate LV thrombus and ejection fraction. Data on age, gender, comorbidities, thrombolytic therapy, and lifestyle factors were collected using a structured proforma. Statistical analysis was conducted using SPSS version 26, with chi-square and t-tests applied to assess associations ($p \leq 0.05$).

Results: The mean age was 57.4 ± 11.49 years, with 66.1% males and 83.7% rural residents. Hypertension was noted in 58.6%, diabetes mellitus in 41.9%, and dyslipidemia in 56.8%. Smoking was reported in 22.5%, and obesity in 30.8%. Thrombolytic therapy was given to 41.9% of patients, and 20.3% were physically inactive. Reduced LVEF (<40%) was observed in 50.7% of patients. LV thrombus was detected in 15 patients (6.6%). Significant associations were found with obesity ($p=0.001$), absence of thrombolysis ($p=0.001$), physical inactivity ($p=0.016$), and reduced LVEF ($p=0.001$).

Conclusion: LV thrombus is a critical complication in anterior wall MI, with a notable association with reduced ejection fraction and modifiable risk factors such as obesity and delayed reperfusion. Focused interventions including early thrombolysis, lifestyle modification, and vigilant cardiac monitoring are essential to mitigate thrombotic risks and improve patient outcomes.

Keywords: Diabetes Mellitus, Echocardiography, Left Ventricular Dysfunction, Myocardial Infarction, Obesity, Risk Factors, Thromboembolism.

INTRODUCTION

Acute ST-segment elevation myocardial infarction (STEMI) remains a critical cardiovascular emergency, contributing significantly to global morbidity and mortality. With its rising prevalence and potential for life-threatening complications, STEMI continues to pose substantial clinical and economic challenges worldwide (1,2). Although advancements in reperfusion strategies—particularly primary percutaneous coronary intervention (PCI)—and the widespread adoption of dual antiplatelet therapy (DAPT) have improved survival rates over recent decades, a substantial proportion of patients still develop post-infarction complications that adversely affect outcomes. Among these, left ventricular thrombus (LVT) stands out due to its high embolic potential, capacity to cause sudden cardiac events, and association with extended hospital stays and increased healthcare utilization (3,4). LVT typically develops as a consequence of impaired regional wall motion, endothelial injury, and hypercoagulable states following myocardial infarction—particularly in large anterior wall infarctions where the risk of thrombus formation is greatest. If undetected or inadequately managed, LVT can lead to devastating complications, including systemic embolism and long-term cardiac dysfunction (5). The gold standard for LVT detection is cardiac magnetic resonance imaging (CMR), owing to its high spatial resolution and ability to differentiate thrombus from myocardium (6). However, the limited accessibility and higher cost of CMR restrict its routine use in clinical practice, especially in low-resource settings.

Transthoracic echocardiography (TTE), although more feasible and widely available, suffers from low sensitivity—reported at 29%—despite its high specificity of 98% (7,8). Consequently, the true incidence of LVT after STEMI may be underreported, particularly in patients managed with PCI. While earlier reports during the thrombolytic era noted higher LVT rates, current findings suggest a downward trend in incidence, likely attributable to the effectiveness of timely reperfusion and optimized pharmacotherapy. Nonetheless, recent meta-analyses underscore the clinical significance of LVT, revealing a fourfold increased risk of embolic events and more than double the risk of long-term mortality in affected patients (9-11). These findings emphasize the necessity for continued vigilance in identifying and managing LVT, particularly in high-risk subgroups. Despite numerous studies, the data regarding predictive factors for LVT in STEMI remain heterogeneous and inconclusive, necessitating more localized and population-specific investigations. In this context, the current study was conducted to determine the prevalence of LVT and its associated risk factors in patients with anterior wall myocardial infarction presenting to the cardiology department at Mardan Medical Complex. The rationale behind this research is to bridge existing knowledge gaps, contribute to the optimization of diagnostic strategies, and enhance clinical outcomes through early recognition and targeted intervention in a resource-constrained healthcare environment.

METHODS

This study employed a cross-sectional design and was conducted at the Cardiology Department of Mardan Medical Complex, a tertiary care facility, over a period of six months, from September 2024 to March 2025. The study population comprised patients presenting with a confirmed diagnosis of acute anterior wall myocardial infarction (AWMI) during the specified timeframe. Diagnosis was established based on electrocardiographic evidence of ST-segment elevation in anterior leads, accompanied by elevated cardiac biomarkers (Troponin I or T), in accordance with established clinical guidelines. Eligible participants were adults aged 18 years or older, of either gender, who underwent transthoracic echocardiography (TTE) within 72 hours of admission. Patients were excluded if they had a prior history of myocardial infarction, known structural heart disease such as valvular pathology, atrial fibrillation, hypercoagulable states, or if suboptimal echocardiographic windows impeded adequate visualization of the left ventricular cavity. Additionally, those who declined informed consent were not enrolled. A total of 227 patients were included using a non-probability consecutive sampling technique. The sample size was determined using the standard formula for prevalence studies: $n = Z^2 \times p \times (1-p) / d^2$, where Z = 1.96 for a 95% confidence level, p = 0.25 (assumed prevalence from literature), and d = 0.05 (acceptable margin of error) (12). Ethical approval for the study was granted by the Institutional Review Board of Bacha Khan Medical College and written informed consent was obtained from all participants prior to data collection. Confidentiality of patient information was strictly maintained throughout the study by assigning unique identification codes to each participant and restricting access to the dataset.

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Data collection was carried out using a structured proforma designed to record demographic variables (age, gender, BMI), clinical history (hypertension, diabetes mellitus, smoking status), Killip classification at presentation, and symptom onset to hospital arrival time. Each patient underwent a detailed transthoracic echocardiographic examination within 72 hours of admission. These evaluations were conducted by an experienced cardiologist using a standard cardiac ultrasound system. LVT was defined as a discrete echogenic mass within the left ventricular cavity, distinct from the endocardial surface and persistently visualized throughout the cardiac cycle. Left ventricular ejection fraction (LVEF) and regional wall motion abnormalities were also assessed as part of the echocardiographic evaluation (13,14). Data were reviewed for completeness and accuracy prior to analysis. All entries were anonymized and stored in a secure digital database. Statistical analysis was conducted using SPSS version 26. Descriptive statistics, including mean and standard deviation, were applied to continuous variables such as age, BMI, and LVEF. Categorical variables—such as gender, comorbidities, smoking status, Killip class, and LVT presence—were reported as frequencies and percentages. The prevalence of LVT in the study population was calculated. Comparative analysis to identify associations between potential risk factors and the development of LVT involved the use of Chi-square tests for categorical data and independent t-tests for continuous data. A p-value of ≤0.05 was considered statistically significant.

RESULTS

The study comprised 227 patients diagnosed with anterior wall myocardial infarction, with a mean age of 57.4 ± 11.49 years. Males represented the majority (66.1%), and a significant proportion of participants (83.7%) resided in rural areas. Most patients fell within the middle-aged group (40–59 years, 55.1%), followed by elderly individuals aged 60–80 years (42.3%). The prevalence of comorbidities was notably high, with hypertension present in 58.6% of patients, dyslipidemia in 56.8%, and diabetes mellitus in 41.9%. Additionally, 22.5% of patients reported being smokers, and 30.8% were classified as obese based on body mass index. Thrombolytic therapy had been administered to 41.9% of patients. Physical inactivity was reported in 20.3%, and more than half of the patients (50.7%) exhibited a significantly reduced left ventricular ejection fraction (LVEF <40%), while 49.3% had mildly reduced LVEF (>40%). Regarding the timing of symptom onset, 40.5% of patients presented within 30–60 minutes, 31.7% within 30 minutes, and 27.8% after more than 60 minutes. Left ventricular thrombus was detected in 6.6% (n=15) of the study population, whereas 93.4% showed no evidence of thrombus on transthoracic echocardiography. On analyzing associated risk factors, statistically significant associations were observed between LV thrombus and four variables: obesity, thrombolytic therapy, physical inactivity, and reduced LVEF. Among patients with LV thrombus, 73.3% were obese compared to 27.8% in those without thrombus (p=0.001). Notably, thrombolytic therapy was received by only 46.7% of patients with thrombus versus 96.3% in the non-thrombus group (p=0.001). Similarly, physical inactivity was reported in 46.7% of patients with thrombus as opposed to 4.4% without thrombus (p=0.016). A substantially higher prevalence of thrombus (93.3%) was found in patients with LVEF <40% as compared to 6.7% in those with LVEF >40% (p=0.001). No significant associations were identified between LV thrombus formation and gender (p=0.081), age group (p=0.462), residential status (p=0.76), hypertension (p=0.082), diabetes mellitus (p=0.351), smoking (p=0.123), dyslipidemia (p=0.182), or symptom duration (p=0.663). Further subgroup analysis revealed gender-specific trends in comorbid conditions. Hypertension was significantly more prevalent in female patients (77.9%) compared to males (48.7%) (p=0.000), as was diabetes mellitus (58.4% in females vs. 33.3% in males; p=0.000). However, no statistically significant gender differences were found in dyslipidemia, obesity, physical inactivity, or symptom duration (p>0.05).

Table 1: Clinical characteristics of study participants (n=227)

S.no	Variable		Frequency	Total (%)
1	Age in year	(mean ± SD) 57.4 ± 11.49		
2	Gender	Male	150	66.1%
		Female	77	33.9%
3	Age groups	Younger (20-39) years	6	2.6%
		Middle Age (40-59) Years	125	55.1
		Elderly (60-80) years	96	42.3
4	Residence	Rural	190	83.7%
		Urban	37	16.3%

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S.no	Variable		Frequency	Total (%)
5	Hypertension	Yes	133	58.6%
		NO	94	41.4%
6	DM	Yes	95	41.9%
		No	132	58.1%
7	Smoking	Yes	51	22.5%
		No	176	77.5%
8	Dyslipidemia	Yes	129	56.8%
		No	98	43.2%
9	Obesity	Yes	70	30.8%
		No	157	69.2%
10	Thrombolytic Therapy Given	Yes	95	41.9%
		No	37	16.3%
11	Physical In Activity	Yes	46	20.3%
		N0	181	79.7%
12	LVEF	Mildly Reduce >40%	112	49.3%
		Reduced <40%)	115	50.7%
13	Duration of MI symptom	> 30 mints	72	31.7%
		30-60 mints	92	40.5%
		>60 mints	63	27.8%
14	LV clot	Yes	15	6.6%
		No	212	93.4%

Note: SD, standard deviation, MI, myocardial infarction, LVEF, left ventricular ejection fraction

Table 2: Prevalence of Left Ventricular Thrombus Formation and conventional Risk Factors after Acute Anterior Wall STEMI

S.no	Associated Factors		Patient with lv clot	Patient without lv clot	Total	p-value
1	Gender	Male	13	137	150	0.081
		Female	2	75	75	
2	Age group	Younger (20-39) Years	0	6	6	0.462
		Middle Age (40-59) Years	11	114	125	
		Elderly (60-80) Years	4	92	96	
3	Residence	Rural	10	180	190	0.76
		Urban	5	32	37	
4	Hypertension	Yes	12	121	133	0.082
		NO	3	91	94	
5	DM	Yes	8	87	95	0.351
		No	7	125	132	
6	Smoking	Yes	6	47	53	0.123
		No	9	165	174	
7	Dyslipidemia	Yes	11	118	129	0.182

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S.no	Associated Factors		Patient with lv clot	Patient without lv clot	Total	p-value
		No	4	94	98	
8	Obesity	Yes	11	59	70	0.001
		No	4	153	157	
9	Thrombolytic Therapy Given	Yes	7	183	190	0.001
		No	8	29	37	
10	Physical In Activity	Yes	7	39	46	0.016
		N0	8	173	181	
11	LVEF	Mildly Reduce >40%	1	111	112	0.001
		Reduced <40%)	14	101	115	
12	Duration of MI symptom	> 30 Mints	4	68	72	0.663
		30-60 Mints	8	84	92	
		>60 Mints	3	60	63	

Note: DM, Diabetes mellitus, MI, myocardial infarction, LVEF, left ventricular ejection fraction

Table 3: Association between Patient Gender to another associated factor.

S.NO	Associated factor		Male patient	Female patient	Total	P value
1	Hypertension	Yes	73	60	133	0.000
		No	77	17	94	
2	DM	Yes	50	45	95	0.000
		No	100	32	132	
3	Dyslipidemia	yes	80	49	129	0.138
		No	70	28	98	
4	Obesity	Yes	46	24	70	0.938
		No	104	53	157	
5	Physical inactivity	Yes	35	11	46	0.108
		No	115	66	181	
6	Duration of symptom	> 30 Mints	53	19	72	0.260
		30-60 Mints	58	34	92	
		>60 Mints	39	24	63	

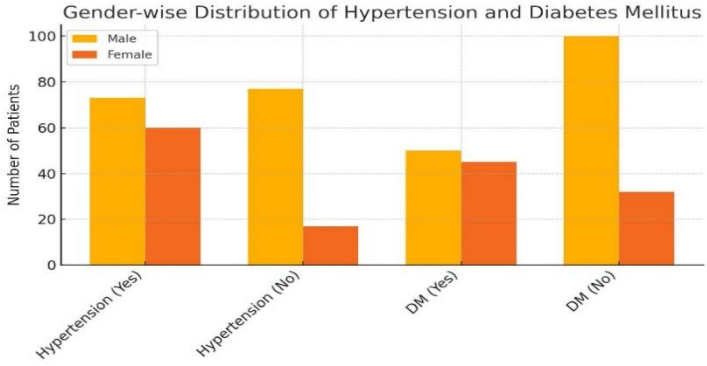

Figure 1 Gender-wise Distribution of Hypertension and Diabetes Mellitus

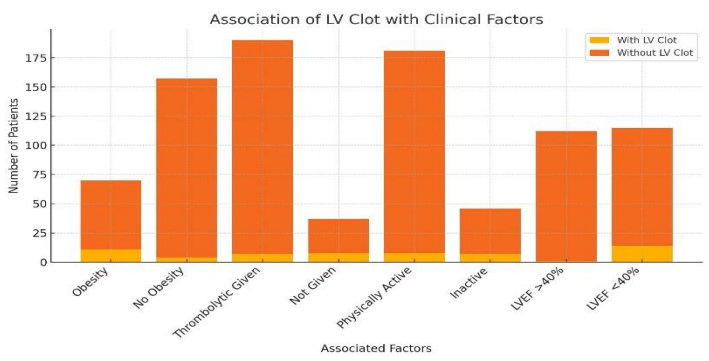

Figure 2 Association of LV Clot with Clinical Factors

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DISCUSSION

Coronary heart disease remains one of the most pressing medical and public health challenges globally. By the early 2020s, it had emerged as a leading cause of mortality worldwide, with an increasing burden particularly in low- and middle-income countries where access to timely diagnosis and advanced interventions such as thrombolysis and primary percutaneous coronary intervention remains limited (15,16). One of the well-recognized complications of ST-segment elevation myocardial infarction (STEMI), particularly anterior wall infarction, is the development of left ventricular thrombus (LVT), which is a notable precursor of embolic events such as cerebral infarction (17). The challenge is amplified in healthcare settings lacking timely reperfusion therapies and advanced cardiac imaging tools. In the present study, LVT was observed in 6.6% of patients with anterior wall myocardial infarction. This prevalence aligns with some regional reports but varies significantly from international data, which report higher LVT incidence ranging from 11.5% to over 40% among anterior wall STEMI patients (18,19). The relatively lower rate in this cohort could be attributed to the inclusion criteria, availability of early reperfusion therapy, and the diagnostic modality used. Unlike cardiac magnetic resonance imaging (CMR), which remains the gold standard for LVT detection, transthoracic echocardiography (TTE) has limited sensitivity and may underestimate the true burden of thrombus formation. Furthermore, the exclusion of patients with severe cardiac dysfunction may have contributed to a lower observed prevalence in this study. The demographic profile of patients in this study—mean age of 57.4 years with a male predominance (66.1%)—is consistent with trends observed in South Asian populations, where STEMI tends to present at a younger age compared to Western cohorts (20,21). This finding underscores the need for earlier preventive strategies and risk factor management in this population. The majority of patients were middle-aged (40–59 years), with this group also accounting for the highest proportion of LVT cases. Although no statistically significant difference in mean age was found between those with and without LVT, older age groups showed a modestly higher thrombus burden, suggesting that age alone may not be a strong independent predictor without concomitant risk factors.

Male gender dominated the LVT cohort (13 out of 15 cases), which was consistent with broader epidemiological patterns reported in other regional studies. However, the association between gender and thrombus formation was not statistically significant, indicating that sex-related biological or behavioral risk variations alone may not be sufficient to predict thrombus formation in this clinical context. Interestingly, female participants in this study exhibited a significantly higher prevalence of hypertension and diabetes mellitus, but this did not translate into a higher LVT incidence, further supporting the multifactorial nature of thrombus development. Significant associations were identified between LVT formation and reduced left ventricular ejection fraction (LVEF <40%), obesity, physical inactivity, and the absence of thrombolytic therapy (22). These findings are consistent with the pathophysiological understanding that impaired ventricular function, sedentary lifestyle, and lack of early reperfusion therapy create a conducive environment for thrombus formation due to stasis, endothelial injury, and hypercoagulability. The association of physical inactivity with LVT emphasizes the importance of early mobilization and structured rehabilitation in post-MI care (23). Moreover, the absence of thrombolytic therapy in over half of the LVT-positive patients reiterates the pivotal role of timely reperfusion in mitigating post-infarction complications. This study holds clinical relevance by highlighting modifiable and non-modifiable risk factors for LVT in the local context. It provides valuable insight for clinicians to identify high-risk patients early and implement targeted thromboprophylactic strategies. The identification of LVT-related predictors using accessible clinical and echocardiographic parameters supports the feasibility of risk stratification even in resource-constrained settings.

Among the strengths of this study is its focused design, targeting a high-risk subgroup of anterior wall myocardial infarction patients and employing standardized criteria for thrombus detection. The inclusion of a relatively large sample from a single tertiary center adds coherence to the dataset and reflects real-world clinical scenarios in similar healthcare systems. However, the study also has limitations. The use of TTE as the sole imaging modality may have led to underreporting of LVT, given its lower sensitivity compared to CMR. Additionally, the cross-sectional design limits the ability to infer temporal associations or causality. The absence of multivariable regression analysis restricts adjustment for potential confounding variables, which may obscure the identification of independent predictors. Finally, data on anticoagulant use post-revascularization were not captured, which is a critical variable that may influence thrombus formation outcomes. Future studies should incorporate serial imaging using advanced modalities and a prospective design to better characterize the evolution of LVT and validate predictive models. A multicentric approach would further enhance generalizability, and integration of biomarkers or genetic predisposition could uncover novel mechanistic insights. Despite these limitations, the findings of this study contribute meaningfully to the growing body of evidence on post-infarction complications in South Asian populations and highlight the need for enhanced preventive strategies, early reperfusion therapy, and structured follow-up protocols to reduce the burden of LVT and its associated risks.

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CONCLUSION

This study concluded that the development of left ventricular thrombus in patients with anterior wall myocardial infarction is strongly influenced by modifiable clinical and lifestyle factors such as obesity, lack of thrombolytic therapy, physical inactivity, and impaired cardiac function. Although hypertension and diabetes mellitus were more frequent in female patients, they did not exhibit a direct link to thrombus formation. These findings underscore the need for timely reperfusion strategies, routine echocardiographic surveillance, and lifestyle interventions in high-risk individuals to reduce the likelihood of thrombotic complications and improve overall post-infarction outcomes.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Aqeel shah	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Asim	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Saira Mehmood	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Jafar Iqbal*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Tayyeb	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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