

ASSOCIATION BETWEEN TIME TO THROMBOLYSIS AND LEFT VENTRICULAR SYSTOLIC FUNCTION IN PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION: UNRAVELING THE RELATIONSHIP

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ABSTRACT

OBJECTIVES

To determine the association between time to thrombolysis and left ventricular (LV) systolic function in patients with ST-elevation Myocardial Infarction (STEMI).

METHODOLOGY

This descriptive case series study compared the time to thrombolysis and LV systolic function of 149 STEMI patients. LV systolic function was evaluated following thrombolysis, and data were collected and analyzed using SPSS version 21.0 software. This study was conducted at the Ayub Teaching Hospital Cardiology Department in Abbottabad from August 2022 to January 2023.

RESULTS

The study examined how LV systolic function and symptoms in STEMI patients related to when thrombolysis was administered. The 149 patients analyzed included 28 with normal LV function, 86 with mildly impaired function, 26 with moderately impaired function, and 9 with severely impaired function. In contrast to delayed thrombolysis, which was linked to higher levels of impairment, immediate thrombolysis was correlated with a higher percentage of normal LV function. The prevalence of patients with severely compromised LV function was also higher in those who received thrombolysis within 3 to 6 hours and 9 to 12 hours. LV function was correlated with the type of myocardial infarction, with varying degrees of impairment seen in AAMI and IWMI patients. Gender had no discernible effect on LV function.

CONCLUSION

Improved LV function is associated with early thrombolysis within hours of STEMI symptoms, highlighting the significance of prompt intervention and minimizing wait times for better patient outcomes.

KEYWORDS: Thrombolysis, Left Ventricular Systolic Function, ST-Elevation, Myocardial Infarction

INTRODUCTION

A significant cause of morbidity and mortality worldwide continues to be cardiovascular diseases, particularly ST-elevation myocardial infarction (STEMI).¹ Though primary percutaneous coronary intervention (PCI) is the recommended treatment for patients with STEMI, it is not feasible in many centres. Therefore, thrombolytic therapy is used as a treatment modality to restore blood flow to the heart by dissolving blood clots. Prompt reperfusion therapy is essential in the management of STEMI. Early thrombolysis induction has been shown to significantly enhance patient outcomes, lessen myocardial ischemia, and lower Acute Coronary Syndrome (ACS) related mortality rates.² However, there is ongoing research into how the interval between the onset of symptoms and thrombolysis affects left ventricular (LV) systolic function, a crucial prognostic factor in STEMI.³ The

ability of the heart to contract and pump blood efficiently is reflected by LV systolic function. A higher risk of negative outcomes, such as heart failure, cardiogenic shock, and mortality, is linked to impaired LV systolic function.⁴ Maintaining LV function is essential in treating STEMI because it significantly impacts both short and long-term cardiovascular health. To improve treatment plans and patient outcomes, it is crucial to comprehend the connection between the timing of thrombolysis and LV systolic function.^{5,6} This study explores the association between symptoms during thrombolysis and LV systolic function in patients with STEMI. By utilizing a comprehensive analysis of available data, we seek to determine whether delays in thrombolysis initiation are associated with worse LV systolic function and to provide valuable insights into the optimal timing of thrombolysis in STEMI management.

METHODOLOGY

This descriptive case series study sought to look into the relationship between the time to thrombolysis and LV systolic function. This study was conducted between August 2022 and January 2023 in the Ayub Teaching Hospital Cardiology Department in Abbottabad. One hundred forty-nine patients made up the sample and were thrombolysed with streptokinase (SK) within 12 hours of the onset of symptoms (defined as less than 3 hours, 3 to 6 hours, 6 to 9 hours, and 9 to 12 hours).^{7,8} Following thrombolytic therapy, the LV systolic function was evaluated and classified as normal, mildly, moderately, or severely impaired. A normal left ventricular ejection fraction (LVEF) on transthoracic echocardiography (TTE) was determined to be >50%, mildly reduced to 40%-49%, moderately reduced to 30%-39%, and severely reduced to <30%.⁹ The study included male and female patients between 20 and 75. The study included all patients with a diagnosis of STEMI who underwent transthoracic echocardiography after receiving thrombolysis as a form of therapy. Patients who did not provide complete or accurate information about their symptoms during thrombolysis or their post-thrombolytic LV systolic function were not included in the study. Patients who underwent additional forms of therapy, such as primary PCI or coronary artery bypass grafting (CABG), as well as those with severe coexisting illnesses or LV dysfunction, were also excluded.¹⁰ The rules and guidelines governing ethical conduct were followed during this study. The relevant institutional Ethical Review Committee reviewed the study protocol and approved it (approval code/ref.No.RC-EA-2023/075). Patient privacy and confidentiality were upheld throughout the study, and all data were de-identified to guarantee anonymity. The SPSS software version 2021 was used for the data analysis.

RESULTS

The analysis revealed interesting findings regarding the relationship between symptoms at the time of thrombolysis and LV systolic function. It was observed that most patients with normal LV systolic function received thrombolysis within 3 hours. As the time of thrombolysis increased, there was a gradual increase in the proportion of patients with mildly impaired LV function and moderately impaired LV function. This suggests a potential association between delayed thrombolysis and worsening LV systolic function. Similarly, it was noted that a higher number of patients who received thrombolysis within 3 to 6 hours and 9 to 12 hours had severely impaired LV function. This provides additional evidence of the potential impact of

delayed thrombolysis on LV systolic function. Thus, the study showed a significant correlation ($p < 0.05$) between symptoms at the time of thrombolysis and LV systolic function with a chi-square value of 21.516. The paired T-test indicated a link between them with a mean difference of 0.779 and a significant difference ($p < 0.001$). A majority of patients with AWMI (Anterior Wall Myocardial Infarction) and IWMI (Inferior Wall Myocardial Infarction) had mild to moderately impaired LV function, according to the analysis. However, patients who had HLWMI (High Lateral Wall Myocardial Infarction) or PLWMI (Posterior Lateral Wall Myocardial Infarction) did not experience significantly reduced LV function. These results imply that different levels of LV systolic function may be related to different types of myocardial infarction. Analysis revealed a statistically significant relationship ($p = 0.015$) between the type of myocardial infarction and LV systolic function. The significant difference ($t = 5.950$, $p < 0.001$) with a mean difference of 0.530 points to a correlation between these variables. The analysis failed to find a significant relationship between patient gender and LV systolic function ($p = 0.149$). Similar proportions of the different types of LV impairment were present in both male and female patients. This suggests that in the context of this study, gender may not be a significant factor in determining LV systolic function. Risk factors such as hypertension, diabetes, and smoking also had insignificant values in determining the population's LV systolic function.

Table 1: The Baseline Characteristics

Characteristics	Number (n=149)	%age
Males	107	71.8
Females	42	28.2
Hypertension	83	55.7
Diabetes Mellitus	35	23.5
Smoker	43	28.9
Anterior MI	61	40.9
Inferior MI	82	55.0
High Lateral MI	05	3.4
Postrolateral wall MI	01	0.7

Table 2: Symptoms of the Time of Thrombolysis and LV Systolic Function

LV systolic function	Symptoms of Thrombolysis Time					P-Value	Chi-Square
	<3 hours	3-6 hours	6-9 hours	9-12 hours	Total		
Normal	20	02	03	03	28	0.011	21.516
Mild impaired	35	34	07	10	86		
Moderate impaired	10	09	06	01	26		
Severe Impaired	03	02	01	03	09		
Total	68	47	17	17	149		

Table 3: Type of Myocardial Infarction and LV Systolic Function

LV Systolic Function	Normal	Mild Impaired	Moderate Impaired	Severe Impaired	P-Value	Chi-Square
AWMI	10	27	18	06	0.015	20.487
IWMI	15	56	08	03		
HLWMI	02	03	0	0		
PLWMI	01	0	0	0		
Total	28	86	26	09		

Table 4: Gender of the Patient and LV Systolic Function

LV Systolic Function	Normal	Mild Impaired	Moderate Impaired	Severe Impaired	P-Value
Male	20	66	14	07	0.149
Female	08	20	12	02	

DISCUSSION

The relationship between the time of thrombolysis and LV systolic function in patients with acute myocardial infarction (AMI) is particularly interesting in cardiovascular research. The effect of prompt reperfusion therapy on LV function and its subsequent impact on patient outcomes has been the subject of numerous studies.^{11,12,13} Danchin et al. examined five-year survival rates in patients with STEMI based on various reperfusion modalities, including thrombolysis, in the FAST-MI 2005 Cohort study. This study clarifies the long-term effects connected to different reperfusion strategies. It can be assumed that timely reperfusion, including thrombolysis, is crucial in enhancing LV function and overall survival, even though specific data on LV systolic function are not discussed. This emphasizes the importance of starting thrombolysis as soon as possible to reduce myocardial damage and maintain LV function.^{14,15} Thiele et al. emphasized the value of prompt reperfusion therapy, which includes thrombolysis, in their study of the treatment of cardiogenic shock, a serious complication of AMI. While the study's primary focus is cardiogenic shock, it emphasizes the crucial part that reperfusion strategies play in maintaining LV function and lowering mortality. Early thrombolysis must be started to restore blood flow and reduce myocardial damage, which can do.¹⁶ Previous studies have examined the effect of the time to reperfusion therapy on LV systolic function. Quick restoration of blood flow to the ischemic myocardium is essential. Quick restoration of blood flow to the ischemic myocardium is essential to preserve viable myocardium and reduce the degree of irreversible damage. According to several studies, there is a greater chance of maintaining LV function when thrombolysis is started within the first few hours of the onset of symptoms.^{17,18,19} However, contradictory results have also been noted, with some studies claiming there may

be no connection between LV systolic function and time to thrombolysis. These differences show that additional research is necessary to clarify the true nature of this relationship.⁷ Numerous studies have found similar results that have looked into the effect of time to reperfusion on LV systolic function. Boersma et al.'s meta-analysis of over 58,000 STEMI patients revealed that longer treatment delays were linked to higher mortality rates and a higher risk of heart failure. To achieve early reperfusion, the study emphasized the significance of cutting down on waiting times and improving care delivery systems.^{20,21,22} Another study by Widimsky et al. examined the association between LV function and the length of time between the onset of symptoms and reperfusion in patients undergoing primary PCI or fibrinolysis. The results showed that compared to delayed reperfusion, early reperfusion within 2 hours of the onset of symptoms was associated with better LV function and decreased mortality.^{23,24}

LIMITATIONS

A total of 149 patients made up the study sample, which may not entirely represent the general population. This study was limited to a single Cardiology Department, so the results may not be applied to populations or healthcare settings with different demographics or healthcare delivery systems (generalizability). Future studies might consider a larger and more varied sample, thorough data collection, and multivariate analyses to account for potential confounders to overcome these limitations.

CONCLUSIONS

This study significantly correlates STEMI patient symptoms during thrombolysis and LV systolic function. Early thrombolysis administration within the first few hours of the onset of symptoms is linked to a higher chance of maintaining normal or mildly impaired LV function. An increased risk of moderate to severely impaired LV function results from delaying the start of treatment.

CONFLICT OF INTEREST: None

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