JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/4zc29n28

Original Article

Frequency of Myocardial Infarction with Non-Obstructive Coronary Arteries in Patients With ST-Elevation Myocardial Infarction

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"Cite this Article" **Received**: 03 November 2025; **Accepted**: 21 December 2025; **Published**: 31 December 2025

Author Contributions: Concept: HNT; Design: SAB; Data Collection: HNT and SAB; Analysis: FK; Drafting: HNT and FK. **Ethical Approval**: Bolan Medical College Quetta, Quetta, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

ABSTRACT

Background: Accelerated idioventricular rhythm is commonly regarded as a transient ventricular rhythm associated with the reperfusion phase of acute myocardial infarction and is often interpreted as a clinical marker of successful thrombolysis. In settings where fibrinolytic therapy remains widely used for ST-segment elevation myocardial infarction, locally generated evidence regarding the frequency of accelerated idioventricular rhythm is limited. Objective: To determine the frequency of accelerated idioventricular rhythm in patients receiving thrombolytic treatment for ST-segment elevation myocardial infarction and to examine its distribution across selected demographic and clinical characteristics. Methods: This descriptive observational study was conducted at the Department of Cardiology, Bolan Medical College/Hospital, Quetta, from 11 January 2025 to 12 October 2025. Using non-probability consecutive sampling, 196 patients aged 18 to 75 years with ST-segment elevation myocardial infarction treated with streptokinase were enrolled. Patients were monitored for 24 hours during and after thrombolytic infusion, and accelerated idioventricular rhythm was recorded on electrocardiographic assessment. Data were analyzed using SPSS version 23.0. Frequencies, percentages, means, and standard deviations were computed, and chi-square testing was used for exploratory subgroup comparisons. Results: The mean age was 51.05 ± 6.76 years and the mean body mass index was 25.09 ± 4.17 kg/m². Accelerated idioventricular rhythm occurred in 80 of 196 patients, giving an overall frequency of 40.8%. Statistically significant exploratory associations were observed with hypertension (p=0.05), hyperlipidemia (p=0.001), education status (p=0.02), and residence (p=0.001), whereas age, sex, body mass index, smoking status, and diabetes mellitus were not significantly associated. Conclusion: Accelerated idioventricular rhythm was a frequent early arrhythmic finding after streptokinase thrombolysis in patients with ST-segment elevation myocardial infarction. Although several subgroup differences were observed, these findings were exploratory and require confirmation in analytically robust studies. Keywords: accelerated idioventricular rhythm, thrombolysis, streptokinase, ST-segment elevation myocardial infarction, reperfusion arrhythmia.

INTRODUCTION

ST-segment elevation myocardial infarction (STEMI) remains one of the most time-sensitive and life-threatening cardiovascular emergencies, resulting from abrupt coronary artery occlusion and subsequent cessation of blood flow to the myocardium, which leads to ischemic necrosis if reperfusion is not achieved promptly (1). Clinically, patients usually present with central chest pain or pressure that may radiate to the jaw, shoulder, back, or upper limbs, often accompanied by autonomic symptoms and electrocardiographic evidence of acute transmural ischemia (2). The burden of acute myocardial

infarction continues to be substantial worldwide, with millions of cases reported annually, and STEMI accounting for a major proportion of presentations associated with early mortality and significant post-event morbidity (5). The development of STEMI is most commonly linked to atherosclerotic coronary artery disease, in which progressive endothelial dysfunction, lipid accumulation, vascular inflammation, and plaque instability culminate in plaque rupture and occlusive thrombus formation (6-8). In addition to established biological risk factors such as diabetes mellitus, hypertension, hyperlipidemia, and obesity, behavioral exposures including smoking substantially increase both the risk of infarction and the likelihood of adverse outcomes after the event (3,4).

The cornerstone of STEMI management is rapid restoration of coronary perfusion in order to limit infarct size, preserve ventricular function, and improve survival (9). In many settings, especially where immediate percutaneous coronary intervention is not universally available, fibrinolytic therapy remains an important reperfusion strategy for eligible patients presenting within the therapeutic time window. Agents such as streptokinase, alteplase, reteplase, and tenecteplase are used to dissolve intracoronary thrombi and restore blood flow to the infarct-related artery, thereby reducing myocardial damage when administered promptly and appropriately (10,11). Because the clinical benefit of reperfusion is time dependent, considerable attention has been directed toward identifying bedside indicators that may suggest successful restoration of coronary flow after thrombolysis.

Accelerated idioventricular rhythm (AIVR) is a ventricular rhythm typically characterized by three or more consecutive ventricular beats with a rate faster than the intrinsic ventricular escape rhythm but slower than sustained ventricular tachycardia, and it is generally regarded as a transient and relatively benign arrhythmia in the setting of acute myocardial infarction (12,13). AIVR is frequently observed during the reperfusion phase and has historically been considered a noninvasive marker suggestive of successful reperfusion, although its diagnostic value is not absolute when used in isolation (14). Despite its recognized occurrence after reperfusion therapy, the reported frequency of AIVR varies across populations and treatment contexts, and local data from thrombolysed STEMI patients remain limited. In resource-constrained clinical environments where thrombolysis continues to play a central therapeutic role, understanding the frequency of AIVR may improve interpretation of post-thrombolysis rhythm changes and support context-specific clinical decision-making. Therefore, this study was conducted to determine the frequency of accelerated idioventricular rhythm in patients receiving thrombolytic therapy for STEMI at a tertiary care cardiology center in Quetta and to examine its distribution across selected demographic and clinical characteristics.

MATERIALS AND METHODS

This hospital-based descriptive observational study was conducted in the Department of Cardiology, Bolan Medical College/Hospital, Quetta, from 11 January 2025 to 12 October 2025. The study was designed to determine the frequency of accelerated idioventricular rhythm among patients with ST-segment elevation myocardial infarction receiving thrombolytic therapy and to examine the distribution of this rhythm disturbance across selected patient characteristics. A non-probability consecutive sampling technique was used, and all eligible patients presenting during the study period were considered for inclusion.

Adult patients of either sex aged 18 to 75 years with acute ST-segment elevation myocardial infarction who received thrombolytic treatment with streptokinase in the cardiology department were enrolled after informed written consent. A detailed clinical history and physical examination were performed at the time of admission. Patients were evaluated in the in-hospital setting, and baseline demographic and clinical characteristics were recorded, including age, sex, body mass index, smoking history, history of diabetes mellitus, hypertension, hyperlipidemia, educational status, and place of residence. Body mass index was calculated in kilograms per square meter using measured height and weight. Smoking history

was recorded as present or absent. Diabetes mellitus, hypertension, and hyperlipidemia were recorded according to previously established clinical history at the time of evaluation.

The primary study outcome was the occurrence of accelerated idioventricular rhythm during the first 24 hours during and after streptokinase infusion. Patients were monitored for 24 hours in the cardiology unit, and rhythm assessment was performed using electrocardiographic monitoring. A 12-lead electrocardiogram was recorded using the Fukuda Me C110 device at a standard paper speed of 25 mm per second and standard voltage calibration. The presence of idioventricular rhythm was identified on electrocardiographic assessment and recorded as present or absent for analysis. For analytical purposes, age was categorized into 18 to 40 years and 41 to 75 years, while body mass index was categorized as less than 25 kg/m² and greater than 25 kg/m².

Data were entered and analyzed using SPSS version 23.0. Continuous variables, including age and body mass index, were summarized as mean and standard deviation. Categorical variables were presented as frequencies and percentages. The frequency of accelerated idioventricular rhythm was calculated for the overall sample and then stratified according to age category, sex, body mass index category, smoking history, diabetes mellitus, hypertension, hyperlipidemia, educational status, and residence in order to explore variation across subgroups. After stratification, the chi-square test was applied to assess differences in the distribution of accelerated idioventricular rhythm across categories, and a p-value of less than 0.05 was considered statistically significant. The findings were presented in tables to ensure clarity of reporting and facilitate comparison across clinical and demographic variables.

The study was conducted after approval from the institutional ethical committee of the hospital. Written informed consent was obtained from all participants prior to enrollment, and patient information was handled confidentially throughout the study process. Data were recorded in a structured manner and analyzed using predefined variables to maintain consistency and support the integrity of the final dataset.

RESULTS

A total of 196 patients with ST-segment elevation myocardial infarction who received streptokinase thrombolysis were included in the analysis. The mean age of the participants was 51.05 ± 6.76 years, and the mean body mass index was 25.09 ± 4.17 kg/m². Of the total sample, 110 patients (56.1%) were male and 86 (43.9%) were female. Smoking history was present in 133 patients (67.9%), diabetes mellitus in 99 (50.5%), hypertension in 149 (76.0%), and hyperlipidemia in 116 (59.2%). With respect to socioeconomic variables, 108 patients (55.1%) were illiterate and 118 (60.2%) resided in rural areas. Accelerated idioventricular rhythm was observed in 80 of 196 patients, giving an overall frequency of 40.8%.

Exploratory subgroup analysis showed no statistically significant difference in the frequency of accelerated idioventricular rhythm across age categories, sex, body mass index category, smoking status, or diabetes mellitus status. Patients aged 41–75 years had a numerically higher odds of accelerated idioventricular rhythm than those aged 18–40 years, but the association was imprecise and not statistically significant (odds ratio [OR] 1.41, 95% CI 0.41–4.84; p=0.41). Male sex was likewise not significantly associated with accelerated idioventricular rhythm (OR 1.10, 95% CI 0.62–1.95; p=0.43). Body mass index greater than 25 kg/m² (OR 0.94, 95% CI 0.53–1.67; p=0.88), smoking history (OR 0.66, 95% CI 0.36–1.22; p=0.12), and diabetes mellitus (OR 0.89, 95% CI 0.50–1.57; p=0.39) also did not show statistically significant associations.

In contrast, several variables demonstrated significant or borderline significant associations with accelerated idioventricular rhythm. Hypertension was associated with higher odds of accelerated idioventricular rhythm, although the estimate was borderline in statistical significance (OR 1.87, 95% CI 0.93–3.79; p=0.05). Hyperlipidemia showed a stronger relationship, with affected patients

demonstrating more than threefold higher odds of accelerated idioventricular rhythm compared with those without hyperlipidemia (OR 3.56, 95% CI 1.89–6.69; p=0.001). Illiterate patients also had significantly higher odds than literate patients (OR 1.99, 95% CI 1.11–3.58; p=0.02). The largest observed difference was seen for residence, where urban participants had markedly higher odds of accelerated idioventricular rhythm than rural participants (OR 74.57, 95% CI 29.38–189.29; p=0.001). Because of the extreme magnitude of this estimate, this comparison should be interpreted cautiously and verified against the source dataset before final submission.

Table 1. Baseline Continuous Characteristics of the Study Population

Variable	Mean	Standard Deviation
Age (years)	51.05	6.76
Body mass index (kg/m²)	25.09	4.17

Table 2. Baseline Categorical Characteristics and Overall Frequency of Accelerated Idioventricular Rhythm

Characteristic	Category	n	%
Sex	Male	110	56.1
	Female	86	43.9
Smoking history	Present	133	67.9
	Absent	63	32.1
Diabetes mellitus	Present	99	50.5
	Absent	97	49.5
Hypertension	Yes	149	76.0
	No	47	24.0
Hyperlipidemia	Present	116	59.2
	Absent	80	40.8
Education status	Literate	88	44.9
	Illiterate	108	55.1
Residence	Urban	78	39.8
	Rural	118	60.2
Accelerated idioventricular rhythm	Present	80	40.8
	Absent	116	59.2

Table 3. Exploratory Association Between Patient Characteristics and Accelerated Idioventricular Rhythm

Variable	Category	AIVR Present n/N (%)	AIVR Absent n/N (%)	Unadjusted OR (95% CI)	p-value
Age	18–40 years	4/12 (33.3)	8/12 (66.7)	Reference	
	41–75 years	76/184 (41.3)	108/184 (58.7)	1.41 (0.41–4.84)	0.41
Sex	Female	34/86 (39.5)	52/86 (60.5)	Reference	
	Male	46/110 (41.8)	64/110 (58.2)	1.10 (0.62–1.95)	0.43
Body mass index	<25 kg/m²	35/84 (41.7)	49/84 (58.3)	Reference	
	>25 kg/m²	45/112 (40.2)	67/112 (59.8)	0.94 (0.53–1.67)	0.88
Smoking history	Absent	30/63 (47.6)	33/63 (52.4)	Reference	
	Present	50/133 (37.6)	83/133 (62.4)	0.66 (0.36–1.22)	0.12
Diabetes mellitus	Absent	41/97 (42.3)	56/97 (57.7)	Reference	
	Present	39/99 (39.4)	60/99 (60.6)	0.89 (0.50–1.57)	0.39
Hypertension	No	14/47 (29.8)	33/47 (70.2)	Reference	
	Yes	66/149 (44.3)	83/149 (55.7)	1.87 (0.93–3.79)	0.05
Hyperlipidemia	Absent	19/80 (23.8)	61/80 (76.2)	Reference	
	Present	61/116 (52.6)	55/116 (47.4)	3.56 (1.89–6.69)	0.001
Education status	Literate	28/88 (31.8)	60/88 (68.2)	Reference	
	Illiterate	52/108 (48.1)	56/108 (51.9)	1.99 (1.11–3.58)	0.02
Residence*	Rural	11/118 (9.3)	107/118 (90.7)	Reference	
	Urban	69/78 (88.5)	9/78 (11.5)	74.57 (29.38–189.29)	0.001

*The very large urban–rural contrast should be checked against the source dataset before final submission.

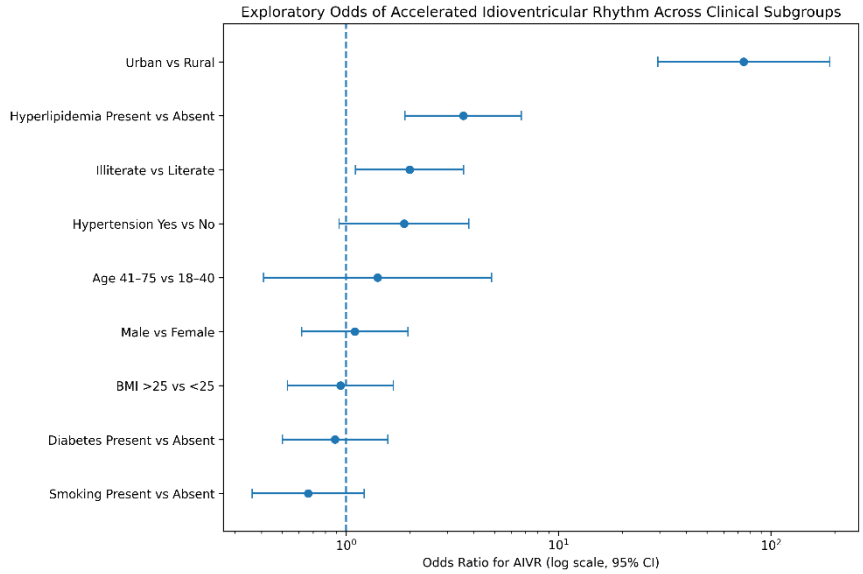

Figure 1 Exploratory odds of accelerated idioventricular rhythm across clinical subgroups

The exploratory effect-size analysis showed that hyperlipidemia, illiteracy, and hypertension were associated with higher odds of accelerated idioventricular rhythm, whereas age, sex, body mass index, smoking history, and diabetes mellitus were not associated with clear between-group differences. Hyperlipidemia demonstrated a clinically important elevation in risk, with an odds ratio of 3.56 (95% CI 1.89–6.69), while illiterate participants had nearly twofold greater odds than literate participants (OR 1.99, 95% CI 1.11–3.58). Hypertension showed a weaker but directionally similar pattern (OR 1.87, 95% CI 0.93–3.79). The urban–rural comparison produced an extremely large odds ratio of 74.57 (95% CI 29.38–189.29), indicating a marked distributional imbalance that is statistically strong but should be interpreted with caution until the underlying coding and source table are rechecked.

DISCUSSION

Accelerated idioventricular rhythm was observed in 80 of 196 patients, corresponding to an overall frequency of 40.8% in this streptokinase-treated ST-segment elevation myocardial infarction population. This finding suggests that AIVR is a common early post-thrombolysis rhythm disturbance in routine cardiology practice and supports its continued relevance as a recognizable reperfusion-associated phenomenon in settings where fibrinolytic therapy remains widely used. The observed frequency is consistent with prior work reporting AIVR in approximately two-fifths of patients after reperfusion therapy, including the studies by Khan et al. and Wehrens et al., which documented comparable frequencies of 41% and 42%, respectively (15,16). In contrast, Tatli et al. reported a much higher occurrence after revascularization, indicating that the apparent burden of AIVR may vary according to study setting, reperfusion strategy, monitoring approach, and patient selection (17). These differences highlight the need to interpret the frequency of AIVR within the clinical and institutional context in which it is measured.

The present study did not identify statistically significant differences in AIVR frequency across age category, sex, body mass index, smoking status, or diabetes mellitus status. These findings suggest that, in this cohort, the development of AIVR after thrombolysis was not strongly patterned by several common demographic and metabolic characteristics. Although older age showed numerically higher odds of AIVR than younger age, the estimate was imprecise and based on a very small number of younger participants, limiting the strength of inference. Similarly, the absence of significant differences by smoking status and diabetes mellitus may reflect either a true lack of association or the limited discriminatory power of simple subgroup comparisons in a modestly sized descriptive sample. For this reason, these null findings should be interpreted cautiously rather than as definitive evidence of no relationship.

Several exploratory subgroup comparisons did show notable differences. Patients with hypertension had higher odds of AIVR than those without hypertension, and although this association was borderline in statistical significance, the direction of effect may indicate greater electrical instability in patients with a higher underlying cardiovascular risk burden. Hyperlipidemia demonstrated a stronger relationship, with more than threefold higher unadjusted odds of AIVR among affected patients. Illiterate participants also showed a higher frequency of AIVR than literate participants, which may reflect broader differences in health status, disease awareness, delayed presentation, or other unmeasured social and clinical determinants rather than a direct biologic effect. These observations are clinically interesting, but because the analysis was limited to unadjusted chi-square comparisons and crude odds ratios, they should be regarded as exploratory rather than independent predictors.

The most striking finding in the subgroup analysis was the very large urban–rural difference, with AIVR reported far more frequently among urban than rural participants. Although this comparison was statistically strong, the magnitude of the observed effect was unusually large and exceeds what would ordinarily be expected from residence status alone. This raises the possibility of residual confounding, differential case mix, data entry issues, or subgroup misclassification. Accordingly, this result should be interpreted with considerable caution and should ideally be verified against the original dataset before being used to support any clinical or public health inference. In the absence of multivariable modeling and formal data validation, residence should not be presented as an established determinant of AIVR based on the current analysis.

From a pathophysiological perspective, AIVR has long been recognized as a transient ventricular rhythm commonly encountered during the reperfusion phase of acute myocardial infarction and is generally regarded as hemodynamically benign in most patients (12,13). Earlier literature has described its usefulness as a bedside sign suggestive of coronary reperfusion, although its specificity as a sole marker remains limited and it should be interpreted in conjunction with other clinical and electrocardiographic indicators, including symptom relief and ST-segment resolution (14,18). The present findings add local evidence supporting the frequent occurrence of AIVR after thrombolytic therapy, but they do not establish whether its presence in this cohort corresponded to angiographic reperfusion success, myocardial salvage, or improved short-term outcomes, as such endpoints were not evaluated in the study design.

This study has several limitations that should be acknowledged. It was conducted at a single center using non-probability consecutive sampling, which limits generalizability. The study was primarily descriptive, yet multiple subgroup comparisons were performed without adjustment for confounding or multiplicity, increasing the risk of chance findings. The manuscript also classified AIVR as a binary outcome within the first 24 hours after thrombolysis without reporting detailed rhythm burden, timing of onset, duration, associated symptoms, or correlation with serial ST-segment changes. In addition, no multivariable analysis was undertaken to assess whether the observed subgroup differences remained significant after accounting for other covariates. These limitations reduce the strength of causal and prognostic interpretation. Nevertheless, the study provides clinically relevant baseline data from a setting where thrombolytic therapy remains important and where locally generated evidence on reperfusion-associated arrhythmias is limited.

Taken together, the results suggest that accelerated idioventricular rhythm is frequently encountered after streptokinase thrombolysis in patients with ST-segment elevation myocardial infarction and that its occurrence may vary across selected patient subgroups. However, the subgroup findings should be interpreted as hypothesis-generating rather than confirmatory. Future multicenter studies with standardized rhythm monitoring, validated subgroup coding, and multivariable analytical models are needed to clarify the clinical correlates and prognostic implications of AIVR in thrombolysed STEMI populations.

CONCLUSION

Accelerated idioventricular rhythm occurred in 40.8% of patients receiving streptokinase thrombolysis for ST-segment elevation myocardial infarction, indicating that it is a frequent early rhythm finding in this clinical setting. Exploratory subgroup analysis suggested higher frequencies among patients with hypertension, hyperlipidemia, illiteracy, and urban residence, but these associations were based on unadjusted analyses and should be interpreted cautiously. Overall, the findings support the relevance of AIVR as a common post-thrombolysis arrhythmic event in routine practice, while also underscoring the need for analytically robust studies to clarify its determinants and clinical significance.

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