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Lesion-Specific Variations in ST-Segment Elevation and Clinical Outcomes in Acute Inferior Myocardial Infarction: Insights from Bangladesh

AKS Zahid Mahmud Khan[1*], A.K.M Monwarul Islam[2], Abdul Momen[2], Atikur Rahman[3], Raian Md. Hassan[4]
[1]Assistant Professor of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh
[2]Associate Professor of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh
[3]Assistant Registrar, Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh
[4]Senior Medical Officer, Yamagata Dhaka Friendship General Hospital, Dhaka, Bangladesh

Abstract: ***Background:*** Inferior myocardial infarction (MI) often results from right coronary artery (RCA) occlusion, with lesion location affecting infarct severity and outcomes. ST-segment elevation is a key prognostic marker, but its relationship with RCA lesion sites remains underexplored, particularly in Bangladesh. This study investigates the association between ST-segment elevation magnitude and RCA lesion sites (proximal, mid, and distal) and their impact on in-hospital complications. ***Methods and Materials:*** This observational study at the National Institute of Cardiovascular Diseases (NICVD), Bangladesh, included 100 acute inferior MI patients. RCA lesions were classified via coronary angiography. Electrocardiographic parameters, in-hospital complications, and echocardiographic findings were analyzed using chi-square and ANOVA tests ($p < 0.05$). ***Results:*** Proximal RCA lesions were associated with significantly greater ST-segment elevation in leads II, III, and aVF ($p < 0.001$) and higher prevalence of right ventricular involvement ($p < 0.001$). Patients with proximal lesions had a significantly higher incidence of hypotension (75.0%, $p < 0.001$), cardiogenic shock (27.1%, $p = 0.012$), acute left ventricular failure (45.8%, $p < 0.001$), and arrhythmias (39.6%, $p = 0.005$). Echocardiographic findings showed greater regional wall motion abnormalities in proximal lesions ($p < 0.001$), while left ventricular ejection fraction differences were not statistically significant ($p = 0.060$). ***Conclusion:*** Proximal RCA lesions are associated with more extensive ST-segment elevation and worse in-hospital outcomes, highlighting their prognostic significance. These findings emphasize the importance of lesion site identification for early risk stratification and tailored management strategies in acute inferior MI.

Keywords: Inferior Myocardial Infarction (MI), Right Coronary Artery (RCA), ST-segment elevation, Hypotension, Arrhythmias.

Research Paper

***Corresponding Author:**
AKS Zahid Mahmud Khan
Assistant Professor of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh

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INTRODUCTION

Acute myocardial infarction (AMI) remains one of the leading causes of morbidity and mortality worldwide, with inferior myocardial infarction (MI) accounting for approximately 40–50% of all ST-elevation myocardial infarctions (STEMIs) [1]. Inferior MI predominantly results from occlusion of the right coronary artery (RCA) in nearly 80% of cases, while the remaining cases are attributed to the left circumflex artery (LCX) [1, 2]. The RCA supplies blood to the right ventricle, sinoatrial (SA) node, atrioventricular (AV) node, and parts of the left ventricle, making its occlusion particularly significant in terms of clinical outcomes and hemodynamic consequences. The location of RCA occlusion—whether proximal, mid, or distal—plays a crucial role in determining the severity of ischemic damage and subsequent complications [3].

Electrocardiography (ECG) is the cornerstone for early diagnosis of inferior MI, with ST-segment elevation serving as a key diagnostic and prognostic indicator [4]. The magnitude of ST-segment elevation in leads II, III, and aVF not only confirms the diagnosis but also provides insights into infarct size, culprit lesion location, and risk stratification [5]. Several studies have demonstrated that higher ST-segment elevation is associated with more extensive myocardial damage, greater infarct burden, and increased risk of complications such as hypotension, cardiogenic shock, bradyarrhythmias, and conduction abnormalities [6, 7].

However, the relationship between ST-segment elevation magnitude and the site of RCA occlusion remains an area of ongoing investigation.

The lesion site within the RCA (proximal, mid, or distal) significantly influences the clinical course and prognosis of inferior MI.

- **Proximal RCA occlusion** often results in larger infarct size, greater ST-segment elevation, and more severe complications, including right ventricular infarction, bradyarrhythmias, and hemodynamic instability [8].
- **Mid-RCA lesions** may have variable presentations, with moderate infarct sizes and risk of AV nodal dysfunction.
- **Distal RCA occlusion**, although affecting a smaller myocardial territory, may still contribute to ischemic complications, particularly if there is inadequate collateral circulation [9].

Despite advances in acute coronary syndrome (ACS) management, identifying high-risk patients based on RCA lesion location and ST-segment elevation characteristics remains a clinical challenge. Understanding these associations is crucial for guiding early risk stratification, optimizing therapeutic strategies, and improving patient outcomes.

Although several international studies have explored the impact of RCA lesion site on the severity and prognosis of inferior MI, limited data exist regarding this association in the Bangladeshi population. Given the regional variations in cardiovascular disease epidemiology, healthcare infrastructure, and treatment accessibility, it is essential to evaluate these relationships in a local context. Bangladesh has a rising burden of ischemic heart disease, yet research focusing on RCA lesion-specific outcomes remains scarce.

Furthermore, most previous studies have focused on RCA occlusion in general, without detailed analysis of ST-segment elevation magnitude in relation to different RCA lesion sites. By investigating these associations, this study aims to fill an important knowledge gap and provide evidence-based insights that could potentially improve risk stratification and clinical decision-making for inferior MI patients in Bangladesh.

Given the potential prognostic implications, assessing the correlation between ST-segment elevation magnitude and RCA lesion location may help refine existing risk assessment models and guide patient management strategies. Early identification of high-risk patients may facilitate more aggressive therapeutic interventions, closer hemodynamic monitoring, and targeted pharmacological or revascularization strategies to mitigate adverse outcomes.

This study aims to evaluate the relationship between ST-segment elevation magnitude and right coronary artery (RCA) lesion sites (proximal, mid, and distal) in patients with acute inferior myocardial infarction (MI) in Bangladesh. Specifically, it seeks to analyze variations in ST-segment elevation across different RCA lesion sites and determine the association between lesion location and in-hospital complications, including hemodynamic instability, arrhythmias, cardiogenic shock, and left ventricular dysfunction. By addressing these objectives, the study aims to enhance the understanding of ST-segment elevation as a prognostic marker in inferior MI and contribute to more personalized and targeted management strategies in clinical practice.

MATERIAL AND METHODS

Study Design and Setting

This observational study was conducted at National Institute of Cardiovascular Diseases (NICVD), Bangladesh, a tertiary care center specializing in cardiovascular diseases. The study was carried out over a one-year period, from January to December 2022, and included patients diagnosed with acute inferior myocardial infarction (MI) with right coronary artery (RCA) involvement.

Study Population

Patients were included if they presented with acute inferior myocardial infarction (MI), confirmed by electrocardiographic (ECG) findings and coronary angiography demonstrating right coronary artery (RCA) involvement. Diagnosis was based on the presence of ST-segment elevation in leads II, III, and aVF, along with clinical symptoms suggestive of MI. Additionally, only patients who were admitted to the Coronary Care Unit (CCU) at NICVD within 12 hours of chest pain onset and underwent coronary angiography within four weeks of acute myocardial infarction (AMI) were included in the study.

Patients with the following conditions were excluded from the study to maintain a more homogenous cohort:

- History of prior myocardial infarction (MI): To eliminate the influence of previous ischemic events.
- Multi-vessel coronary artery disease: Defined as significant stenosis in more than one major coronary artery.
- Left main coronary artery disease: Due to its distinct prognostic and clinical implications.

- Non-dominant RCA or culprit lesion at the left circumflex artery (LCX): As these cases do not primarily reflect RCA-associated inferior MI.
- Prior revascularization procedures: Including coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI).
- Intraventricular conduction defects, ventricular ectopics, and paced rhythm: Which could alter ECG interpretations.
- Left ventricular hypertrophy and cardiomyopathies: As these conditions independently impact cardiac function.
- Valvular or congenital heart disease: Which may contribute to secondary myocardial changes.
- Acute pericarditis and acute myocarditis: To exclude cases where ST-segment changes are due to non-ischemic causes.
- Severe renal or hepatic impairment: Given their potential influence on clinical management and outcomes.

Variables and Data Collection

A structured data collection form was used to systematically record clinical, demographic, and procedural details. Demographic and clinical characteristics included age, sex, occupation, socioeconomic status, chest pain duration, hemodynamic parameters (heart rate, blood pressure), and Killip classification at admission. Cardiovascular risk factors such as hypertension, diabetes, dyslipidemia, smoking, and family history of coronary artery disease was documented.

Electrocardiographic analysis assessed ST-segment elevation magnitude in leads II, III, and aVF, with the sum of ST elevation indicating infarct severity. Reciprocal changes in opposing leads (I, aVL) and conduction abnormalities (atrioventricular blocks) were noted.

Coronary angiography confirmed RCA occlusion sites, classified as proximal (before the right ventricular branch), mid (between the right ventricular branch and posterior descending artery), or distal (beyond the posterior descending artery).

In-hospital complications were recorded, including hemodynamic instability (persistent hypotension requiring vasopressors), cardiogenic shock (SBP <90 mmHg with organ hypoperfusion), arrhythmias (sinus bradycardia, AV blocks, ventricular tachyarrhythmias), and acute left ventricular failure (requiring diuretics/inotropes).

Echocardiography performed within 48 hours assessed regional wall motion abnormalities (RWMA) in inferior myocardial segments, left ventricular ejection fraction (LVEF), and right ventricular dysfunction if suspected. This comprehensive data collection ensured an in-depth evaluation of the association between ST-segment elevation magnitude, RCA lesion sites, and in-hospital complications.

Sample Size Calculation

The sample size for this study was determined using a standard formula for prevalence-based estimation:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where: Z = 1.96 (95% Confidence Interval), p = 0.80 (anticipated prevalence of severe coronary lesions in the right coronary artery), d = 10% of p (allowable margin of error).

Substituting these values, we calculated a sample size of 95. To ensure a robust analysis, a total of 100 patients meeting the inclusion criteria were consecutively enrolled. This sample size provided sufficient power to assess the association between ST-segment elevation magnitude, RCA lesion sites, and in-hospital complications in patients with acute inferior myocardial infarction.

Statistical Analysis

Data were analyzed using SPSS version 17. Descriptive statistics were employed to summarize demographic characteristics, clinical presentation, cardiovascular risk factors, in-hospital complications, and echocardiographic findings among the three groups. Categorical variables, such as the presence of complications and lesion site distribution, were analyzed using the Chi-square test (χ^2) or Fisher's exact test, as appropriate. The selection of the statistical test was based on the expected frequency distribution within the contingency tables. Continuous variables, including ST-segment elevation magnitude and left ventricular ejection fraction (LVEF), were compared using one-way analysis of variance (ANOVA) for multiple group comparisons. In cases where only two groups were compared, an independent t-test was applied. The normality of data distribution was assessed using the Shapiro-Wilk test to determine the suitability of parametric methods. A p-value of <0.05 was considered statistically significant for all comparisons, ensuring the robustness of the statistical interpretations.

Ethical Consideration

Approval for the study was obtained from the Ethical Review Committee, National Institute of

Cardiovascular Diseases, Dhaka. In compliance with the 1964 Helsinki Declaration, all participants were informed about the study's purpose, procedures, and their right to withdraw at any time. Informed written consent was obtained from each participant.

RESULTS

The mean age of participants in the proximal, mid, and distal RCA lesion groups was 52.5 ± 9.3, 49.2 ± 9.2, and 50.2 ± 9.6 years, respectively, with no significant difference (p = 0.241). Males comprised 89.6% of the proximal group, 92.1% of the mid group, and 100.0% of the distal group (p = 0.450). Regarding occupation, 27.1% of participants in the proximal group were employed in the service sector, 10.4% were housewives, 4.2% were farmers, 22.9% were engaged in business, and 35.4% were in other professions. In the mid group, 29.7% worked in service, 8.1% were housewives, 5.4% were farmers, 27.0% were in business, and 29.7% were engaged in other occupations. Among the distal group, 64.3% were employed in service, with no housewives reported; 7.3% were farmers, 7.3% were in business, and 21.4% were in other professions. No significant differences were observed in occupational distribution across the groups (p = 0.347).

Table 1: Baseline Demographic Characteristics of Study Participants

Variable	Proximal (n=48)	Mid (n=38)	Distal (n=14)	p-value
Age (years)	52.5 ± 9.3	49.2 ± 9.2	50.2 ± 9.6	0.241
Sex				0.450
Male (%)	43 (89.6)	35 (92.1)	14 (100.0)	
Female (%)	5 (10.4)	3 (7.9)	0 (0.0)	
Occupation				0.347
Service (%)	13 (27.1)	11 (29.7)	9 (64.3)	
Housewife (%)	5 (10.4)	3 (8.1)	0 (0.0)	
Farmer (%)	2 (4.2)	2 (5.4)	1 (7.3)	
Business (%)	11 (22.9)	10 (27.0)	1 (7.3)	
Others (%)	17 (35.4)	11 (29.7)	3 (21.4)	

Clinical Presentation and Risk Factors Across RCA Lesion Sites

The mean duration of chest pain was 6.9 ± 2.8 hours in the proximal group, 7.5 ± 2.6 hours in the mid group, and 7.1 ± 2.5 hours in the distal group (p = 0.582). The mean pulse rate was 74.0 ± 11.0 beats per minute in the proximal group, 76.0 ± 17.0 in the mid group, and 76.0 ± 12.0 in the distal group (p = 0.263). Systolic blood pressure increased across groups, measuring 111.0 ± 12.0 mmHg in the proximal group, 120.0 ± 18.0 mmHg in the mid group, and 135.0 ± 19.0 mmHg in the distal group. Diastolic blood pressure was 71.0 ± 8.0 mmHg, 79.0 ± 13.0 mmHg, and 80.0 ± 12.0 mmHg in the proximal, mid, and distal groups, respectively, with a significant difference (p = 0.001).

Shortness of breath was reported in 68.5% of the proximal group, 42.1% of the mid group, and 35.7% of the distal group (p = 0.016). Sweating was present in 70.8% of the proximal group, 34.2% of the mid group, and 28.6% of the distal group (p = 0.001). Nausea was observed in 58.3% of the proximal group, 18.4% of the mid group, and 28.6% of the distal group (p = 0.001). Vomiting was reported in 29.2%, 13.2%, and 28.6% of participants in the proximal, mid, and distal groups, respectively (p = 0.187) (Table 2).

Table 2: Clinical Presentation and Risk Factors Across RCA Lesion Sites

Variable	Proximal (n=48)	Mid (n=38)	Distal (n=14)	p-value
Duration of Chest Pain (hours)	6.9 ± 2.8	7.5 ± 2.6	7.1 ± 2.5	0.582
Pulse (beats/min)	74.0 ± 11.0	76.0 ± 17.0	76.0 ± 12.0	0.263
Systolic BP (mm of hg)	111.0 ± 12.0	120.0 ± 18.0	135.0 ± 19.0	
Diastolic BP (mm of hg)	71.0 ± 8.0	79.0 ± 13.0	80.0 ± 12.0	0.001
Shortness of Breath (%)	33 (68.5)	16 (42.1)	5 (35.7)	0.016
Sweating (%)	34 (70.8)	13 (34.2)	4 (28.6)	0.001
Nausea (%)	28 (58.3)	7 (18.4)	4 (28.6)	0.001
Vomiting (%)	14 (29.2)	5 (13.2)	4 (28.6)	0.187

Cardiovascular Risk Factors Among the Three Groups

Smoking was reported in 70.8% of the proximal group, 60.5% of the mid group, and 28.6% of the distal group, with a significant difference (p = 0.017). Diabetes

mellitus was present in 64.6% of the proximal group, 26.3% of the mid group, and 28.6% of the distal group (p = 0.001). Hypertension was observed in 56.3% of the proximal group, 39.5% of the mid group, and 35.7% of the distal group (p = 0.199). Dyslipidemia was reported in 58.3% of the proximal group, 13.2% of the mid group, and 14.3% of the distal group, with a significant difference (p < 0.001). A family history of ischemic heart disease (IHD) was present in 22.9% of the proximal group, 10.5% of the mid group, and 14.3% of the distal group (p = 0.302) (Figure 1).

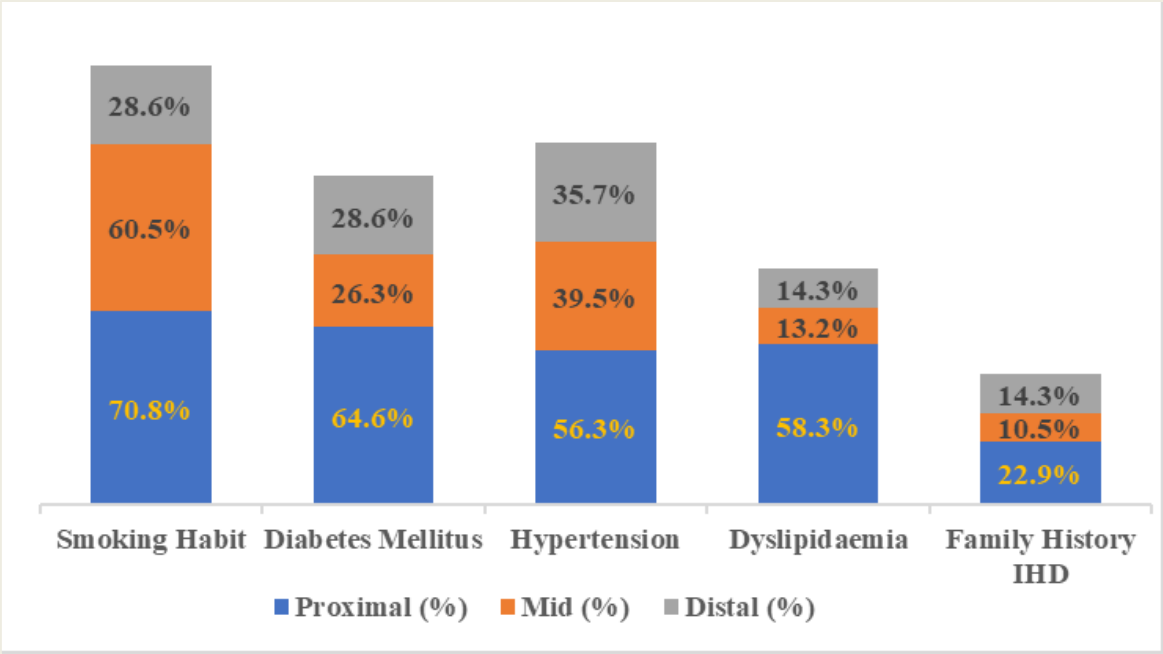

Figure 1: Cardiovascular risk factors among the three groups

In-Hospital Complications Across RCA Lesion Sites

Hypotension was observed in 75.0% of the proximal group, 15.8% of the mid group, and 21.4% of the distal group, with a significant difference (p < 0.001). Cardiogenic shock was present in 27.1% of the proximal group, 7.9% of the mid group, and none in the distal group (p = 0.012). Acute left ventricular failure (LVF) was reported in 45.8% of the proximal group, 10.5% of the mid group, and none in the distal group (p < 0.001). Arrhythmia occurred in 39.6% of the proximal group, 10.5% of the mid group, and 14.3% of the distal group (p = 0.005) (Table 3).

Table 3: In-Hospital Complications Across RCA Lesion Sites

Complication	Proximal (n=48)	Mid (n=38)	Distal (n=14)	p-value
Hypotension (%)	36 (75.0)	6 (15.8)	3 (21.4)	<0.001
Cardiogenic Shock (%)	13 (27.1)	3 (7.9)	0 (0.0)	0.012
Acute LVF (%)	22 (45.8)	4 (10.5)	0 (0.0)	<0.001
Arrhythmia (%)	19 (39.6)	4 (10.5)	2 (14.3)	

Echocardiographic Findings Across RCA Lesion Sites

Regional wall motion abnormalities (RWMA) were present in 70.8% of the proximal group, 52.6% of the mid group, and 7.1% of the distal group, with a significant difference (p < 0.001). The mean left ventricular ejection fraction (LVEF) was 48.5 ± 12.7% in the proximal group, 51.5 ± 10.7% in the mid group, and 56.7 ± 7.3% in the distal group, with no statistically significant difference (p = 0.060) (Table 4).

Table 4: Echocardiographic Findings Across RCA Lesion Sites

Echocardiographic Parameter	Proximal (n=48)	Mid (n=38)	Distal (n=14)	p-value
RWMA (%)	34 (70.8)	20 (52.6)	1 (7.1)	<0.001
LVEF (%)	48.5 ± 12.7	51.5 ± 10.7	56.7 ± 7.3	0.060
RWMA denotes regional wall motion abnormalities, LVEF denotes left ventricular ejection fraction				

ST-Segment Elevation Magnitude Across RCA Lesion Sites

Right ventricular involvement (RVI) was observed in 52.1% of the proximal group, 7.9% of the mid group, and none in the distal group ($p < 0.001$). The mean ST-segment elevation in lead II was 3.4 ± 0.5 mm in the proximal group, 2.0 ± 0.5 mm in the mid group, and 1.5 ± 0.5 mm in the distal group ($p < 0.001$). In lead III, the elevation was 4.7 ± 0.4 mm, 3.4 ± 0.5 mm, and 2.6 ± 0.5 mm, respectively ($p < 0.001$). In lead aVF, the elevation was 4.2 ± 0.8 mm in the proximal group, 2.6 ± 0.5 mm in the mid group, and 2.0 ± 0.3 mm in the distal group ($p < 0.001$). The sum of ST-segment elevation was highest in the proximal group (12.1 ± 0.6 mm), followed by the mid (8.0 ± 0.1 mm) and distal (6.1 ± 0.2 mm) groups ($p < 0.001$) (Table 5).

Table 5: RVI and ST-Segment Elevation Magnitude Across RCA Lesion Sites

Variable	Proximal (n=48)	Mid (n=38)	Distal (n=14)	p-value
RVI (%)	25 (52.1)	3 (7.9)	0 (0.0)	<0.001
ST-Segment Elevation (mm)				
Lead II	3.4 ± 0.5	2.0 ± 0.5	1.5 ± 0.5	<0.001
Lead III	4.7 ± 0.4	3.4 ± 0.5	2.6 ± 0.5	<0.001
aVF	4.2 ± 0.8	2.6 ± 0.5	2.0 ± 0.3	<0.001
Sum of ST Elevation	12.1 ± 0.6	8.0 ± 0.1	6.1 ± 0.2	<0.001
RVI denotes respiratory viral infection, aVF denotes arteriovenous fistula, ST Elevation denotes ST Elevation Myocardial Infarction				

DISCUSSION

The anatomical location of an RCA lesion plays a crucial role in determining the clinical presentation, hemodynamic status, and complications in patients with coronary artery disease. This study provides valuable insights into how lesion site influences symptom severity, cardiovascular risk factors, and in-hospital outcomes, contributing to a more comprehensive understanding of RCA-related infarctions.

The mean age of participants across the proximal, mid, and distal RCA lesion groups showed no significant differences, aligning with previous studies that report similar age distributions in coronary artery disease (CAD) patients [10, 11]. Males constituted the majority in all groups, consistent with the higher prevalence of CAD among men due to hormonal and lifestyle factors [10, 11]. Occupational distribution varied among study groups, with service sector employees making up the largest proportion in the distal group (64.3%), compared to the proximal (27.1%) and mid (29.7%) groups. Housewives were only present in the proximal (10.4%) and mid (8.1%) groups, and the proportion of farmers was low across all groups (proximal: 4.2%, mid: 5.4%, distal: 7.3%). Even though differences were observed, they were not statistically significant ($p = 0.347$). Previous studies indicate that high-stress occupations, sedentary lifestyles, and limited healthcare access may increase CAD risk [12, 13].

The duration of chest pain and pulse rates were comparable across groups ($p = 0.582$ and $p = 0.263$, respectively). However, systolic and diastolic blood pressures were significantly elevated in distal lesions ($p = 0.001$), as indicated by the previous study [14]. The significant increase in blood pressure across lesion sites may be attributed to compensatory mechanisms in response to varying degrees of ischemia, as previously reported.

Shortness of breath ($p = 0.016$), sweating ($p = 0.001$), and nausea ($p = 0.001$) were significantly more frequent in proximal lesions, suggesting greater myocardial involvement, in agreement with earlier findings on infarct size and symptom severity [15]. These symptoms are likely due to extensive myocardial ischemia and autonomic nervous system activation, which are more pronounced in proximal RCA occlusions.

Among cardiovascular risk factors, smoking and diabetes were significantly more prevalent in the proximal group ($p = 0.017$ and $p = 0.000$, respectively), reinforcing the established connection between these factors and severe atherosclerosis [16]. Dyslipidaemia was also more common in the proximal group ($p <0.001$), consistent with studies emphasising its role in a substantial coronary plaque burden [17]. However, diabetes mellitus and family history of ischaemic heart disease were found to be insignificant.

Hypotension was most prevalent in patients with proximal RCA occlusions (75.0%), significantly higher than in mid (15.8%) and distal (21.4%) lesions ($p < 0.001$). This can be attributed to the extensive myocardial territory supplied by the proximal RCA, including the right ventricle (RV), sinoatrial (SA), and atrioventricular (AV) nodes. Ischemia in these regions can impair RV contractility and cardiac output, leading to hemodynamic instability [18, 19]. Similarly, cardiogenic shock occurred significantly more in proximal lesions (27.1%) compared to mid (7.9%), with

no cases reported in the distal group ($p = 0.012$). This finding aligns with prior studies indicating that proximal RCA involvement frequently compromises both RV and inferior left ventricular (LV) function, resulting in severe pump failure [20].

Acute LVF and Arrhythmias was also significantly more common in proximal RCA occlusions compared to mid and distal lesions ($p < 0.001$ and 0.005, respectively). This is likely due to the role of the proximal RCA in supplying the posterior and inferior LV walls via the posterior descending artery (PDA). Proximal occlusions can, therefore, lead to extensive LV dysfunction and pulmonary congestion, whereas mid and distal lesions typically affect smaller myocardial territories, mitigating the risk of LVF [21, 22].

Echocardiographic findings showed a significantly higher prevalence of regional wall motion abnormalities (RWMA) in proximal lesions in relation to mid and distal lesions ($p <0.001$), correlating with greater myocardial damage. In contrast, left ventricular ejection fraction (LVEF) was lower in the proximal group, though the difference was not statistically significant, mirroring trends observed in studies linking lesion location with cardiac function [23].

RVI was observed in 52.1% of patients with proximal RCA lesions, compared to 7.9% in mid lesions and none in distal lesions ($p < 0.001$). This pattern is consistent with the anatomical distribution of the right ventricular branches, which typically originate from the proximal RCA [24]. Proximal occlusions, therefore, disrupt RV perfusion, leading to ischemia and subsequent ST-segment elevation in right precordial leads [25].

The degree of ST-segment elevation in inferior leads (II, III, and aVF) was also significantly greater in proximal RCA lesions the mid and distal groups ($p < 0.001$ for all). The sum of ST-segment elevation was also highest in the proximal group (12.1 ± 0.6 mm), compared to the mid (8.0 ± 0.1 mm) and distal (6.1 ± 0.2 mm) groups ($p < 0.001$). These findings align with prior studies that highlight proximal RCA lesions as a key predictor of extensive ST-segment elevation [25].

The progressive decline in ST-segment elevation from proximal to distal lesions can be explained by the decreasing amount of myocardium at risk. Proximal RCA occlusions jeopardize a larger myocardial territory, including the inferior LV wall, the RV, and conduction centers, resulting in more pronounced electrocardiographic changes (4). Mid-RCA lesions still impact the inferior LV but to a lesser extent, leading to moderate ST-segment elevations, whereas distal lesions, which primarily involve smaller branches, produce the least ST-segment deviation (5). Prior studies have established that greater ST-segment elevation correlates with more extensive myocardial injury and worse clinical outcomes, underscoring the importance of lesion site identification for risk stratification and management [26].

CONCLUSION

The study highlights the significant impact of RCA lesion location on clinical presentation, hemodynamic parameters, in-hospital complications, and electrocardiographic findings. Proximal lesions were associated with more severe symptoms, higher prevalence of cardiovascular risk factors, and greater hemodynamic instability, including hypotension, cardiogenic shock, and arrhythmias. ST-segment elevation and right ventricular involvement were most pronounced in proximal lesions, reinforcing their critical role in determining infarct severity. These findings emphasize the need for early identification and tailored management strategies based on lesion site to improve clinical outcomes in RCA-related infarctions.

REFERENCE

1. Warner MJ, Tivakaran VS. Inferior Myocardial Infarction. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Mar 6]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK470572/
2. Pratistha FSM, Wulandari NLES. Inferior STEMI as the challenge of predicting the right coronary artery vs. the left circumflex artery as culprit lesion using the ECG criteria: a case report. Intisari Sains Medis. 2022 Aug 30;13(2):571–4.
3. Coronary Artery Occlusion - an overview | ScienceDirect Topics [Internet]. [cited 2025 Mar 6]. Available from: https://www.sciencedirect.com/topics/nursing-and-health-professions/coronary-artery-occlusion
4. MSD Manual Professional Edition [Internet]. [cited 2025 Mar 6]. Acute Myocardial Infarction (MI) - Cardiovascular Disorders. Available from: https://www.msdmanuals.com/professional/cardiovascular-disorders/coronary-artery-disease/acute-myocardial-infarction-mi
5. Rafla S, Kamal A. Localization of the occluded vessel in acute myocardial infarction. J Cardiol Cardiovasc Med. 2020 Feb 18;5(1):029–33.
6. kbar H, Foth C, Kahloon RA, Mountfort S. Acute ST-Segment Elevation Myocardial Infarction (STEMI). In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Mar 6]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK532281/

7. Salama ABM, Gebreil A, Shaker AM. Chapter 2 - ST-segment elevation myocardial infarction. In: El-Baz AS, Suri JS, editors. Cardiovascular and Coronary Artery Imaging [Internet]. Academic Press; 2023 [cited 2025 Mar 6]. p. 13–33. Available from: https://www.sciencedirect.com/science/article/pii/B9780128219836000023
8. Zeymer U, Neuhaus KL, Wegscheider K, Tebbe U, Molhoek P, Schröder R. Effects of thrombolytic therapy in acute inferior myocardial infarction with or without right ventricular involvement. J Am Coll Cardiol. 1998 Oct 1;32(4):876–81.
9. Savaş G, Yazıcı S, Terzi S. A proximal right coronary artery occlusion presenting with ST-segment depression in leads II, III, and aVF. Anatol J Cardiol. 2020 Dec;24(6):411–4.
10. (PDF) Magnitude of ST-Segment Elevation in Acute Inferior Myocardial Infarction and the Proximity of Right Coronary Artery Lesion. ResearchGate [Internet]. 2024 Nov 1 [cited 2025 Mar 8]; Available from: https://www.researchgate.net/publication/372229868_Magnitude_of_ST-Segment_Elevation_in_Acute_Inferior_Myocardial_Infarction_and_the_Proximity_of_Right_Coronary_Artery_Lesion
11. Raptopoulos VD, Boiselle PB, Michailidis N, Handwerker J, Sabir A, Edlow JA, *et al*., MDCT Angiography of Acute Chest Pain: Evaluation of ECG-Gated and Nongated Techniques. Am J Roentgenol. 2006 Jun;186(6_supplement_2):S346–56.
12. Mirmohammadi SJ, Taheri M, Mehrparvar AH, Heydari M, Saadati Kanafi A, Mostaghaci M. Occupational Stress and Cardiovascular Risk Factors in High-Ranking Government Officials and Office Workers. Iran Red Crescent Med J. 2014 Aug;16(8):e11747.
13. Higgins S, Pomeroy A, Bates LC, Paterson C, Barone Gibbs B, Pontzer H, *et al*., Sedentary behavior and cardiovascular disease risk: An evolutionary perspective. Front Physiol. 2022 Jul 27;13:962791.
14. Verhaaren BFJ, Vernooij MW, de Boer R, Hofman A, Niessen WJ, van der Lugt A, *et al.*, High blood pressure and cerebral white matter lesion progression in the general population. Hypertens Dallas Tex 1979. 2013 Jun;61(6):1354–9.
15. Cinca J, Noriega FJ, Jorge E, Alvarez-Garcia J, Amoros G, Arzamendi D. ST-segment deviation behavior during acute myocardial ischemia in opposite ventricular regions: Observations in the intact and perfused heart. Heart Rhythm. 2014 Nov;11(11):2084–91.
16. Jiang Y, Pang T, Shi R, Qian W lei, Yan W feng, Li Y, *et al*., Effect of Smoking on Coronary Artery Plaques in Type 2 Diabetes Mellitus: Evaluation With Coronary Computed Tomography Angiography. Front Endocrinol. 2021 Nov 3;12:750773.
17. Pappan N, Awosika AO, Rehman A. Dyslipidemia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Mar 8]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK560891/
18. Brookes C, Ravn H, White P, Moeldrup U, Oldershaw P, Redington A. Acute right ventricular dilatation in response to ischemia significantly impairs left ventricular systolic performance. Circulation. 1999 Aug 17;100(7):761–7.
19. Brookes C, Ravn H, White P, Moeldrup U, Oldershaw P, Redington A. Acute Right Ventricular Dilatation in Response to Ischemia Significantly Impairs Left Ventricular Systolic Performance. Circulation. 1999 Aug 17;100(7):761–7.
20. Fuernau G, Fengler K, Desch S, Eitel I, Neumann FJ, Olbrich HG, *et al*., Culprit lesion location and outcome in patients with cardiogenic shock complicating myocardial infarction: a substudy of the IABP-SHOCK II-trial. Clin Res Cardiol Off J Ger Card Soc. 2016 Dec;105(12):1030–41.
21. Arrigo M, Jessup M, Mullens W, Reza N, Shah AM, Sliwa K, *et al*., Acute heart failure. Nat Rev Dis Primer. 2020 Mar 5;6(1):16.
22. Gheeraert PJ, Henriques JPS, De Buyzere ML, Voet J, Calle P, Taeymans Y, *et al*., Out-of-hospital ventricular fibrillation in patients with acute myocardial infarction: Coronary angiographic determinants. J Am Coll Cardiol. 2000 Jan 1;35(1):144–50.
23. Gallone G, Kang J, Bruno F, Han JK, De Filippo O, Yang HM, *et al*., Impact of Left Ventricular Ejection Fraction on Procedural and Long-Term Outcomes of Bifurcation Percutaneous Coronary Intervention. Am J Cardiol. 2022 Jun 1;172:18–25.
24. Kumar A, Abdel-Aty H, Kriedemann I, Schulz-Menger J, Gross CM, Dietz R, *et al*., Contrast-Enhanced Cardiovascular Magnetic Resonance Imaging of Right Ventricular Infarction. J Am Coll Cardiol. 2006 Nov 21;48(10):1969–76.
25. Akbar H, Foth C, Kahloon RA, Mountfort S. Acute ST-Segment Elevation Myocardial Infarction (STEMI). In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Mar 8]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK532281/
26. Piérard LA. ST elevation after myocardial infarction: what does it mean? Heart. 2007 Nov;93(11):1329–30.