

Post Percutaneous Coronary Intervention (Post-PCI) Arrhythmias in Right Coronary Artery versus Left Circumflex-Related Inferior Wall Myocardial Infarction: A Comparative Study

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ABSTRACT

Objective: To determine the frequency of Right Coronary Artery (RCA) and Left Circumflex Artery (LCX) occlusion and to compare the incidence of post-PCI arrhythmias between patients with RCA-related and LCX-related acute inferior wall Myocardial Infarction (MI).

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Cardiology, Punjab Institute of Cardiology, Lahore Pakistan, from Oct 24 to Jan 25.

Methodology: This study included 90 patients diagnosed with acute inferior wall MI who underwent primary PCI after providing informed consent. RCA or LCX occlusion, defined as $\geq 50\%$ narrowing on angiography, was assessed in patients, and post-PCI arrhythmias occurring within 48 hours were recorded using ECG.

Results: RCA was the problematic artery in 67% of patients, whereas LCX was in 33%. Overall, arrhythmias were observed in 32.3% of the study population. Supraventricular, ventricular, and heart block arrhythmias were observed among RCA vs. LCX as 10.0% vs. 6.7%, 13.3% vs. 20.0%, and 11.7% vs. 0%, respectively; $p=0.210$.

Conclusion: LCX-related inferior wall MI. Notably, heart block was exclusively observed. The study concluded that RCA was more frequently identified as the culprit artery (67.0%) compared to LCX (33.0%) in patients with acute inferior wall MI. Post-PCI arrhythmias were observed in nearly one-third (32.3%) of cases. Supraventricular arrhythmias were slightly more common in RCA-related inferior wall MI, while ventricular arrhythmias were more frequently associated with in RCA-related cases (11.7%), with none in LCX-related cases.

Keywords: Culprit Artery, Inferior wall MI, Post-PCI Arrhythmias.

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INTRODUCTION

Acute myocardial infarction (MI) is leading cause of morbidity and mortality worldwide. Inferior wall acute MI accounts for approximately 40% of all MIs, with RCA being the most common culprit, followed by LCX.¹ Mortality rate associated with inferior wall MI is less than 10%. Various complications following inferior wall MI can increase mortality, including RV infarct, hypotension, and AV block.²

Inferior wall MI generally has a better prognosis than anterior wall MI in both short- and long-term outcomes.³ However, around 40% of inferior wall MIs are associated with right ventricular involvement. Hence, delayed treatment increases the risk of cardiogenic shock due to extensive myocardial damage. The right coronary artery supplies the sinoatrial node affected, leading to bradycardia and heart block.⁴ Post-MI arrhythmias can range from

bradyarrhythmia and atrioventricular block to supraventricular and ventricular arrhythmias, typically occurring within 48 hours of symptom onset.⁵

Conduction disturbances and arrhythmias are also common before or during primary PCI due to reperfusion injury and ongoing ischemia.⁶ Overall incidence of arrhythmias following STEMI is reported to be as high as 78% to 83%.⁷ More recently, it was reported that 53.6% post-PCI patients experienced arrhythmias within 24 hours of the procedure.⁸

Limited data is comparing inferior wall MI caused by occlusion of RCA versus LCX. Studies have often overlooked LCX-related MI because of the absence of significant ST-segment elevation on ECG.⁹ Previous research indicates no significant differences in demographic characteristics or traditional risk factors between RCA- and LCX-related inferior wall MI. However, one review found that LCX was associated with higher cardiac enzyme levels, greater decline in ejection fraction, and higher rates of cardiogenic shock. Conversely, RCA involvement was

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more frequently associated with complete heart block. However, incidence of ventricular arrhythmias was similar for both RCA and LCX occlusions.¹⁰

This study aims to determine the frequency of culprit artery and to compare post-PCI arrhythmias among them in patients presenting with acute inferior wall MI. The research is motivated by the clinical significance of understanding potential variations in arrhythmia patterns between these two patient groups. The investigation aligns with enhancing risk stratification, contributing insights for refining clinical guidelines, and tailoring post-intervention care strategies. Ultimately, study aspires to improve patient outcomes by providing insights into factors that may impact the occurrence and nature of post-PCI arrhythmias in context of acute inferior wall MI.

METHODOLOGY

After taking approval from the IRB (REF: RTPGME-Research-314; dated 10-10-2024, this cross-sectional study was conducted at Cardiology department of Punjab Institute of Cardiology, Lahore, Pakistan, from Oct 24 to Jan 25. A sample size of 90 patients was calculated using WHO sample size calculator, using 95% Confidence level, 10% margin of error, and an expected percentage of LCX as culprit artery taken as 35.3%.¹¹ Patients were enrolled using non-probability consecutive sampling. This study was conducted on 90 patients meeting the selection criteria

Inclusion Criteria: Patients of either gender, 20-65 years of age, diagnosed with acute inferior wall MI (ST elevation in ECG leads II, III, and aVF with history of chest pain not exceeding 12 hours) undergoing primary PCI.

Exclusion Criteria: Patients were excluded from the study if they met any of the following criteria: arrhythmias before PCI, ventricular septal rupture identified on echocardiography, discharge within 48 hours post-PCI, hyperthyroidism, abnormal serum electrolyte levels (calcium, magnesium, or potassium), serum creatinine levels exceeding 1.6 mg/dL, pregnancy, cardiogenic shock at presentation (Killip class IV), or history of CABG or pre-existing arrhythmias.

Data was collected using a pre-designed form. The following demographic data of all patients were taken, including name, age, gender, and time of presentation following symptoms onset. All patients had 12-lead ECG, transthoracic echocardiography, and routine investigations, including levels. Patients were

assessed for co-morbidities, including diabetes (known diabetics of fasting BSL >126mg/dl), hypertension (known hypertensive or BP >130/90mmHg), active smoking, and heart failure (shortness of breath/raised JVP/fine crepitations on chest auscultation). All patients were treated on the basis of acute MI guidelines and had primary PCI. All procedures were done by a consultant cardiologist with a minimum of 3 years of experience following post-graduation. Culprit artery occlusion was recorded as defined as ≥50% narrowing of RCA or LCX as observed on angiography. All patients were observed for the occurrence of post PCI arrhythmias occurring up to 48 hours after PCI, including supraventricular arrhythmias (Atrial fibrillation & SVT), ventricular arrhythmias (Ventricular tachycardia or fibrillation), heart blocks (1st degree, 2nd degree, complete heart block), documented using 12-lead ECG, and timing of arrhythmias was also recorded.

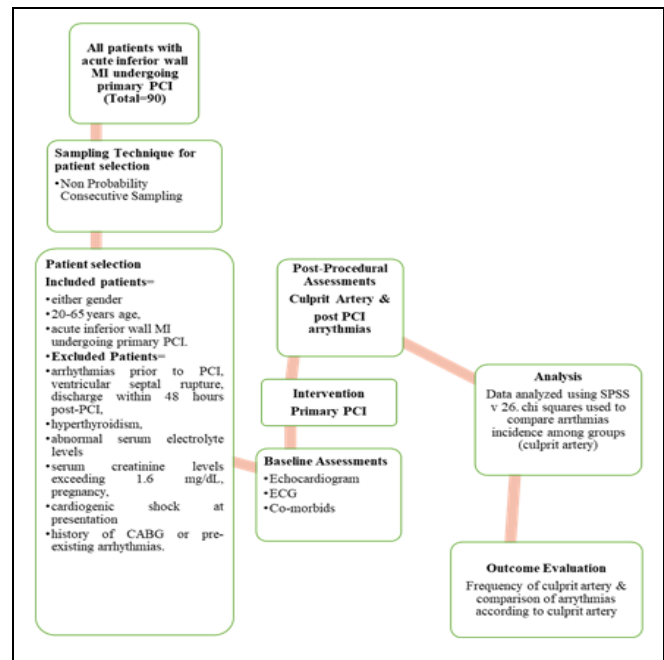


Figure-I: Patient Flow Diagram

Data was entered and analyzed in statistical Package for the Social Sciences version 26. Quantitative variables like age, ejection fraction, serum creatinine, CKMB were presented as mean and standard deviation. Qualitative variables like culprit artery and occurrence of arrhythmias are presented as percentages and frequencies. Chi-square test/Fisher's test was used for association, at $p \leq 0.05$ as statistically significant.

RESULTS

Mean age of study participants (n=90) was calculated to be 52.4±9.2 years. Among them, 65% were male, and 35% were female. The most commonly involved culprit artery found was Right Coronary Artery (RCA), observed in 67% of cases, followed by Left Circumflex Artery (LCX) 33% as shown in figure-2.

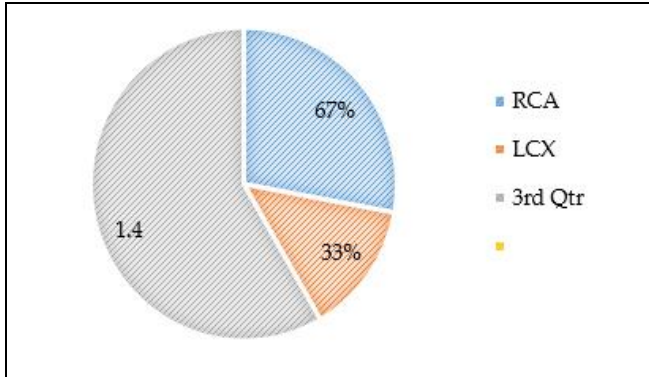


Figure-2: Culprit Artery (RCA and LCX)

As shown in table-I, in patients under 50 years of age, 64% had RCA involvement compared to 36% with LCX. Among those aged 50 years or older, 71% had RCA as culprit artery, while 29% had LCX ($p=0.530$). Regarding gender, 66% of males had RCA involvement versus 63% in LCX-Group; females comprised 34% of RCA-Group and 37% of LCX-Group ($p=0.870$). Among diabetic patients, 70% were in RCA-Group and 30% in LCX-Group. Non-diabetics showed a similar trend, with 64% in RCA and 36% in LCX ($p=0.551$). In hypertensive patients, 71% had RCA involvement, while 29% had LCX. Among non-hypertensives, 64% were in RCA-Group compared to 36% in LCX ($p=0.539$). Active smokers also showed a higher proportion of RCA involvement (70%) compared to LCX (30%), whereas among non-smokers, RCA and LCX were seen in 65% and 35%, respectively ($p=0.635$). Cardiac failure was more common in RCA-Group (75%) than LCX (25%), and among those without cardiac failure, 64% had RCA involvement and 36% had LCX ($p=0.370$). Arrhythmia patterns were also analyzed in relation to culprit artery, as shown in table-II. Supraventricular arrhythmias were observed in 10.0% of patients with RCA involvement and 6.7% with LCX. Ventricular arrhythmias occurred in 13.3% of RCA cases and 20.0% of LCX cases. Heart blocks were found in 11.7% of the RCA-Group, while no heart blocks were observed in the LCX-Group. However, differences in frequency and types of arrhythmias between the RCA

and LCX-Groups were not statistically significant ($p=0.210$).

Table-I: Association of patient-related characteristics according to the culprit artery (n=90)

Stratified Variables	Culprit Artery		p-value	
	RCA (n=60)	LCX (n=30)		
Age	<50years	38(64%)	21(36%)	0.530
	≥50 years	22(71%)	9(29%)	
Gender	Male	37(66%)	19(34%)	0.87
	Female	23(68%)	11(32%)	
DM	Yes	32(70%)	14(30)	0.551
	No	28(64%)	16(36%)	
HTN	Yes	24(71%)	10(29%)	0.539
	No	36(64%)	20(36%)	
Active smokers	Yes	21 (70%)	9(30%)	0.635
	No	39(65%)	21(35%)	
Cardiac failure	Yes	15(75%)	5(25%)	0.370
	No	45(64%)	25(36%)	

*RCA = Right Coronary Artery, LCA = Left Circumflex Artery, DM = Diabetes Mellitus, HTN = Hypertension

Table-II: Association of Arrhythmias frequency and types according to culprit artery (n=90)

Arrhythmias	Culprit Artery		p-value
	RCA (n=60)	LCX (n=30)	
Supraventricular	6(10.0%)	2(6.7%)	0.210
Ventricular	8(13.3%)	6(20.0%)	
Heart Blocks	7(11.7%)	0(0.0%)	
No Arrhythmias	39(65.0%)	22(73.3%)	

*RCA = Right Coronary Artery, LCA = Left Circumflex Artery

DISCUSSION

In current study, RCA was found as culprit artery in 67% patients, and LCX in 33% patients. Similar to current observation, in study by Kumar *et al.*, 77.6% found to have RCA as culprit compared to LCX 22.4%.¹² In contrast, in a study by Raza *et al.*, LCX was identified as culprit more commonly, 58%, while RCA was identified in 42% patients suffering from inferior wall MI.¹³ In another study, overall frequency of RCA was found to be higher among patients suffering from STEMI, irrespective of anterior, inferior, lateral, or septal involvement.¹⁴ Current study has observed post PCI arrhythmias in 32.3%, with majority of arrhythmias occurring within the first 12 hours post-PCI. Supraventricular, ventricular, and heart block arrhythmias were observed among RCA vs. LCX as 10.0% vs. 6.7%, 13.3% vs. 20.0%, and 11.7% vs. 0%, respectively; $p=0.210$. However, in a study by Fawwad *et al.*, the overall occurrence of arrhythmias (16.6%) observed was lower to current observation, with majority developing within 1st 24 hours following primary PCI. Ventricular arrhythmias were more prevalent than atrial arrhythmias.¹⁵ In a study by Altarejos *et al.*, AV block occurred in 17.8% of RCA

cases compared to 3.4% in LCX cases, atrial fibrillation was noted in 10.2% of RCA cases versus 11.4% in LCX cases, while ventricular fibrillation occurred in 10.4% of RCA cases and 7.4% of LCX cases. These findings varied from those observed in current study.¹⁴

In contrast with observation in the study by Ali *et al.*, ventricular arrhythmias were observed more with RCA involvement 9% vs LCX 5%, and a similar trend was seen for heart failure.¹⁶ Study by Panda *et al.*, reported incidence of arrhythmias as 3.12% with RCA as culprit.¹⁷ Alam *et al.*, among patients with inferior wall MI observed tachyarrhythmias and bradyarrhythmia in 18.36% patients and 32.6% patients, respectively.¹⁸ However, this study has not classified arrhythmias according to culprit artery involvement. Furthermore, it was also reported by Li *et al.*, and Shah *et al.*, that patients with LCX-related inferior wall MI tend to have poorer outcomes, characterized by higher rates of heart failure, opposing current findings, where more heart failure was observed in patients with RCA as the culprit.^{19,20}

Overall, findings indicate that RCA involvement is associated with a higher frequency of post-PCI arrhythmias and heart failure compared to LCX-related MI, suggesting different clinical outcomes based on the culprit artery in inferior wall MI cases.

LIMITATION OF STUDY

The study has several significant limitations, including sample size and single-center study. The follow-up period was limited to only 48 hours post-PCI, which is relatively short and may not account for late-onset complications or major adverse cardiovascular events (MACE) that could occur beyond this period. These limitations suggest that the findings may not fully represent the long-term outcomes of patients with acute inferior wall MI undergoing primary PCI.

CONCLUSION

The study concluded that RCA was more frequently identified as the culprit artery compared to LCX in patients with acute inferior wall MI. Post-PCI arrhythmias were observed in nearly one-third, while supraventricular arrhythmias were slightly more common in RCA-related inferior wall MI, ventricular arrhythmias were more frequently associated with LCX-related inferior wall MI. Notably, heart block was exclusively observed in patients with RCA involvement.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MJ & SYH: Data acquisition, data analysis, critical review, approval of the final version to be published.

MT & H: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SR & AB: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Post Percutaneous Coronary Intervention

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