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Angiographic Findings in Patients Presented with Inferior Wall Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention

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ABSTRACT

Background: Inferior wall myocardial infarction is a prevalent subtype of acute myocardial infarction, often associated with variable coronary artery involvement. Angiographic evaluation remains a critical tool for identifying the culprit vessel and guiding revascularization strategies. **Objective:** To determine the frequency of angiographic findings in patients presented with inferior wall myocardial infarction. **Study Design:** Cross-sectional study. **Duration and Place of Study:** The study was conducted from January to May 2025 at the Department of Cardiology, Lady Reading Hospital, Peshawar. **Methodology:** A total of 131 patients aged 18–75 years presenting with inferior wall myocardial infarction and undergoing coronary angiography within 24 hours were enrolled. Patients with advanced comorbidities, cardiogenic shock, or contraindications to angiography were excluded. Demographic and clinical data including age, gender, body mass index, socioeconomic status, and residential background were recorded. Coronary arteries were classified as diseased when 50% or greater luminal narrowing was observed. **Results:** The mean age was 53.01±9.03 years, and most patients were male (77.1%). Left anterior descending artery involvement was observed in 53.4%, left circumflex artery in 24.4%, and right coronary artery in 46.6% of cases. Significant associations were found between left anterior descending artery disease and both age (p=0.003) and socioeconomic status (p<0.001). Left circumflex artery involvement was significantly associated with age (p=0.018). **Conclusion:** Coronary angiography in inferior wall myocardial infarction revealed notable variability in arterial involvement, with age and socioeconomic status influencing disease distribution.

INTRODUCTION

Inferior wall myocardial infarction is a clinically important entity of the acute coronary syndromes and the most frequent one involving occlusion of the right coronary artery.[1] Patients will usually have retrosternal pain and diaphoresis, and frequently hemodynamic impairment due to right ventricular involvement.[2] Bradyarrhythmias and conduction blocks have commonly been observed owing to sinoatrial or atrioventricular nodal artery ischemia, both of which normally arise from the right coronary artery.[3] Although inferior infarctions usually have a smaller area of myocardial involvement than anterior ones, the latter can be equally lethal owing to the peril of causing cardiogenic shock, mechanical complications, and severe arrhythmias.[4] Frontline percutaneous coronary intervention established in the appropriate environment has the optimum chance of early reperfusion, myocardial salvage, and prevention of complications, and early angiographic evaluation thus forms the cornerstone of therapy.[5]

Angiographic features of inferior wall myocardial infarction typically demonstrate the right coronary artery as the infarct vessel.[6] The lesions often occur at the level of the proximal/mid segments and frequently have a high association with massive thrombus formation, occlusion, or high-grade stenosis causing substantially diminished TIMI flow.[7] Multifocal coronary disease of the arteries is also observed, which emphasizes the assessment of the entire coronary circuit beyond the lesion believed to be the culprit.[8] Plaque morphology of the right coronary artery can vary from eccentric atheromatous disease to diffuse calcification disease of the vessel, complicating the ease of the guiding wire to cross the lesion and stent placement.[9] In addition, occlusion of a more proximal right coronary artery can spread to cover the branches that supply the right ventricle, causing right ventricular infarction and propagating the hemodynamic instability further distally.[10] Recognition of these angiographic features is helpful to lead the interventionist's plan of action and predict the procedural challenges of no-reflow phenomenon or distal embolization.

In a minority but recognizable percentage of cases, the left circumflex has been implicated by angiographic assessment as the culprit vessel when it is a co-dominant or dominant of the inferior wall supply, respectively.[11] Infarction may also on rare occasions result due to the left anterior descending vessel, particularly if a wrap-around vessel follows the inferior/apical contour of the myocardium.[12] In these very rare situations, the angiographic appearance is more variable and multivessel disease may result with necessary differentiation of culprit versus non-culprit lesion of necessity.[13] Evaluation of left circumflex/wrap-around left anterior descending lesion usually demonstrates tight stenosis/occlusion with high thrombus burden and precise planning of intervention of necessity.[14] Evaluation of coronary dominance, plaque composition, and evaluation of collateral supply by the time of angiography provide important information not just for the purpose of acute revascularization, but long-term prognostic evaluation and planning of secondary prevention.[15]

Haider KH et al. reported that, among patients presenting with inferior wall myocardial infarction, the left anterior descending artery was involved in 57% of cases, the left circumflex artery in 32%, and the right coronary artery in 42.2%.[16]

Though inferior wall myocardial infarction has been studied adequately, heterogeneity of culprit vessel involvement and angiographic presentation is fairly unreported across regional populations. Establishing the prevalence and distribution of right coronary, left circumflex, and left anterior descending artery involvement provides valuable information on early recognition and individually directed interventional planning. Supplying such evidence is vital to obtain the optimum outcome, foresee procedure-related issues, and improve prognostic evaluation of primary percutaneous coronary intervention patients.

METHODOLOGY

This study was undertaken in the Department of Cardiology at Lady Reading Hospital, Peshawar, over a five-month period from January to May 2025, using a cross-sectional design. Prior to recruitment, clearance was obtained from the institutional ethics review board and from the College of Physicians and Surgeons of Pakistan. A total of 131 participants were enrolled, with the sample size determined using the World Health Organization sample size calculator. The calculation was based on a 95% confidence level, an 8% margin of error, and an expected frequency of left circumflex artery involvement of 32% among patients with inferior wall myocardial infarction.[16] Patients of both sexes between 18 and 75 years of age, who presented with inferior wall myocardial infarction according to pre-specified diagnostic criteria and who underwent coronary angiography within 24 hours of presentation as part of primary percutaneous coronary intervention, were included. Patients with cardiogenic shock, advanced renal dysfunction with an estimated glomerular filtration rate below 30 mL/min/1.73 m^2, recent coronary artery bypass grafting within six months, significant valvular heart disease such as critical aortic stenosis, coagulopathy, hemoglobin levels under 7 g/dL, ongoing gastrointestinal bleeding, uncontrolled hypertension above 180/110 mmHg, or pregnancy were not considered eligible. Informed consent was obtained from all participants prior to data collection, with confidentiality and voluntary participation assured. The diagnosis of inferior wall myocardial infarction was established when at least two of the following were present: chest pain lasting longer than 30 minutes, ST-segment elevation of at least 0.1 mV in two or more contiguous inferior leads (II, III, aVF), troponin I greater than 0.04 ng/mL or troponin T greater than 0.01 ng/mL, or creatine kinase-MB above 5 ng/mL within 24 hours of presentation.

Coronary angiography was performed using either radial or femoral access, and contrast dye was injected to delineate the coronary vessels. Findings were interpreted by cardiologists with more than three years of post-fellowship experience. The left anterior descending artery was classified as diseased if atherosclerotic narrowing of 50% or more was demonstrated in any segment, defined as proximal (origin to first diagonal branch), mid (from first diagonal branch to the midpoint between its origin and the apex), or distal (beyond the midpoint to the apex). The left circumflex artery was considered involved if the lumen was narrowed by 50% or more, with chronic lesions further characterized by the presence of collateral circulation. The right coronary artery was labeled affected when 50% or greater luminal reduction was observed in any major epicardial segment. These findings were systematically recorded on a structured proforma.

Statistical analysis was conducted using IBM SPSS version 26. Frequencies and percentages were used to present categorical data. Continuous data were expressed as mean ± standard deviation or as median with interquartile range, depending on the distribution as assessed by the Shapiro–Wilk test. Stratification of angiographic findings according to demographic and clinical variables was performed, and associations were tested using chi-square or Fisher's exact test where appropriate. A p-value of 0.05 or less was considered statistically significant.

RESULTS

The mean age was 53.01±9.03 years, and the mean BMI was 27.82±3.03 kg/m^2. The majority of patients were male (77.1%, n=101) compared to female (22.9%, n=30). Regarding socioeconomic status, 50.4% (n=66) belonged to the middle class, 36.6% (n=48) were from poor socioeconomic backgrounds, and 13.0% (n=17) were from high socioeconomic status. Most patients resided in urban areas (61.8%, n=81) while 38.2% (n=50) were from rural areas (as shown in Table-I).

Table I

Patient Demographics

Demographics	Mean ± SD
Age (years)	53.01±9.03
BMI (kg/m^2)	27.82±3.03
Gender	
Male n (%)	101 (77.1%)
Female n (%)	30 (22.9%)
Socioeconomic Status	
Poor n (%)	48 (36.6%)
Middle n (%)	66 (50.4%)
High n (%)	17 (13.0%)
Residential Status	
Rural n (%)	50 (38.2%)
Urban n (%)	81 (61.8%)

Angiographic findings revealed that Left Anterior Descending artery involvement was present in 53.4% (n=70) of patients, Left Circumflex artery involvement was found in 24.4% (n=32), and Right Coronary Artery involvement was observed in 46.6% (n=61) of cases (as shown in Table-II).

Table II

Frequency of Angiographic Findings in Patients with Inferior Wall Myocardial Infarction

Angiographic Findings	Frequency	% age
Left Anterior Descending Artery		
Yes	70	53.40%
No	61	46.60%
Total	131	100%
Left Circumflex Artery		
Yes	32	24.40%
No	99	75.60%
Total	131	100%
Right Coronary Artery		
Yes	61	46.60%
No	70	53.40%
Total	131	100%

The association analysis demonstrated that LAD involvement was significantly associated with age groups, with younger patients (≤50 years) showing higher involvement (69.2%, n=36) compared to older patients (>50 years) at 43.0% (n=34) (p=0.003). Socioeconomic status also showed a significant association with LAD involvement, with poor patients having the highest involvement (66.7%, n=32), followed by middle-class patients (54.5%, n=36), and high socioeconomic status patients showing the lowest involvement (11.8%, n=2) (p<0.001). Gender, BMI, and residential status did not show significant associations with LAD involvement (p=0.093, p=0.197, and p=0.919, respectively) (as shown in Table-III).

Table III

Association of Left Anterior Descending Artery Involvement with Demographic Factors

Demographic Factors		Left Anterior Descending Artery		p-value
		Yes n(%)	No n(%)	
Age (years)	≤50	36 (69.2%)	16 (30.8%)	0.003*
	>50	34 (43.0%)	45 (57.0%)	
Gender	Male	58 (57.4%)	43 (42.6%)	0.093
	Female	12 (40.0%)	18 (60.0%)	
BMI (Kg/m²)	≤25	9 (40.9%)	13 (59.1%)	0.197
	>25	61 (56.0%)	48 (44.0%)	
Residential Status	Rural	27 (54.0%)	23 (46.0%)	0.919
	Urban	43 (53.1%)	38 (46.9%)	
Socioeconomic Status	Poor	32 (66.7%)	16 (33.3%)	<0.001*
	Middle	36 (54.5%)	30 (45.5%)	
	High	2 (11.8%)	15 (88.2%)	

*Fischer Exact Test

For LCX involvement, only age showed a significant association, with older patients (>50 years) having higher involvement (31.6%, n=25) compared to younger patients (13.5%, n=7) (p=0.018). Gender, BMI, residential status, and socioeconomic status did not demonstrate significant associations with LCX involvement (p=0.196, p=0.733, p=0.742, and p=0.719, respectively) (as shown in Table-IV).

Table IV

Association of Left Circumflex Artery Involvement with Demographic Factors

Demographic Factors		Left Circumflex Artery		p-value
		Yes n(%)	No n(%)	
Age (years)	≤50	7 (13.5%)	45 (86.5%)	0.018
	>50	25 (31.6%)	54 (68.4%)	
Gender	Male	22 (21.8%)	79 (78.2%)	0.196
	Female	10 (33.3%)	20 (66.7%)	
BMI (Kg/m²)	≤25	6 (27.3%)	16 (72.7%)	0.733
	>25	26 (23.9%)	83 (76.1%)	
Residential Status	Rural	13 (26.0%)	37 (74.0%)	0.742
	Urban	19 (23.5%)	62 (76.5%)	
Socioeconomic Status	Poor	10 (20.8%)	38 (79.2%)	0.719*
	Middle	18 (27.3%)	48 (72.7%)	
	High	4 (23.5%)	13 (76.5%)	

*Fischer Exact Test

RCA involvement did not show any significant associations with demographic factors, with p-values of 0.131 for age, 0.098 for gender, 0.128 for BMI, 0.644 for residential status, and 0.289 for socioeconomic status (as shown in Table-V).

Table V

Association of Right Coronary Artery Involvement with Demographic Factors

Demographic Factors		Right Coronary Artery		p-value
		Yes n(%)	No n(%)	
Age (years)	≤50	20 (38.5%)	32 (61.5%)	0.131
	>50	41 (51.9%)	38 (48.1%)	
Gender	Male	51 (50.5%)	50 (49.5%)	0.098
	Female	10 (33.3%)	20 (66.7%)	
BMI (Kg/m²)	≤25	7 (31.8%)	15 (68.2%)	0.128
	>25	54 (49.5%)	55 (50.5%)	
Residential Status	Rural	22 (44.0%)	28 (56.0%)	0.644
	Urban	39 (48.1%)	42 (51.9%)	
Socioeconomic Status	Poor	25 (52.1%)	23 (47.9%)	0.289*
	Middle	31 (47.0%)	35 (53.0%)	
	High	5 (29.4%)	12 (70.6%)	

*Fischer Exact Test

DISCUSSION

The results demonstrated that Left Anterior Descending artery involvement was the most prevalent (53.4%), followed by Right Coronary Artery (46.6%) and Left Circumflex artery (24.4%) involvement. The predominance of LAD involvement in inferior wall MI, traditionally associated with RCA occlusion, can be explained by the presence of multi-vessel disease and collateral circulation patterns that often develop in patients with coronary artery disease. The significantly higher LAD involvement in younger patients (≤50 years) compared to older patients may be attributed to the acute thrombotic nature of coronary events in younger individuals, often involving the LAD due to its larger caliber and higher flow rates, making it more susceptible to sudden occlusion. The strong association between socioeconomic status and LAD involvement, with poor patients showing the highest prevalence, reflects the impact of lifestyle factors, delayed medical care, and higher prevalence of cardiovascular risk factors among economically disadvantaged populations. The increased LCX involvement in older patients can be explained by the gradual progression of atherosclerotic disease with age, where chronic inflammatory processes and calcification tend to affect smaller vessels like the circumflex artery more prominently in elderly patients. The lack of significant associations between RCA involvement and demographic factors suggests that RCA-related inferior wall MI occurs uniformly across different population subgroups, indicating that anatomical and hemodynamic factors rather than demographic characteristics primarily determine RCA involvement in inferior wall myocardial infarction.

The current study's findings regarding the predominance of LAD involvement (53.4%) in inferior wall myocardial infarction contrast with several previous investigations that have traditionally associated inferior MI with RCA occlusion. Haque et al. [16] reported RCA as the culprit vessel in 70% of inferior MI cases, while our study demonstrated higher LAD involvement, suggesting either anatomical variations in the study population or the presence of multivessel disease with LAD as a significant contributor rather than the primary culprit vessel.[17] This discrepancy may be explained by the difference in study methodology, where our analysis focused on angiographic involvement rather than culprit vessel identification. The RCA involvement rate of 46.6% in our study aligns more closely with Haider et al. [6] who found RCA involvement in 42% of young MI patients, though their study population was limited to patients ≤45 years.

The demographic profile of our study population, with a mean age of 53.01±9.03 years and male predominance (77.1%), is consistent with multiple studies. Ramzan et al. [18] reported a similar mean age of 57.54±6.86 years with 84.6% male patients, while Ghosh et al. [19] found 84% male predominance with a mean age of 54 years. However, our findings contrast with Khan et al.[20] who reported younger STEMI patients with a mean age of 50.82±11.65 years, and Haque et al.[16] who found a notably younger population with a mean age of 48.45±13.79 years. These age variations may reflect differences in regional cardiovascular risk factor prevalence and healthcare-seeking behaviors.

The significant association between younger age and higher LAD involvement (69.2% in ≤50 years vs. 43.0% in >50 years, p=0.003) in our study contradicts the general expectation that younger patients typically present with single-vessel disease. This finding differs from Haider et al. [6] who found LAD involvement in 57% of young adults (≤45 years) but did not compare this with older populations. The higher LAD involvement in younger patients in our study may reflect the acute thrombotic nature of coronary events in this age group, where larger vessels like the LAD are more susceptible to sudden occlusion due to plaque rupture.

Our study's multivessel involvement patterns, inferred from the high rates of LAD (53.4%), RCA (46.6%), and LCX (24.4%) involvement, align with Kazazi et al. [(21)] who reported higher multivessel disease in inferior MI patients (72% vs. 59.3% in anterior MI). Similarly, Haque et al. [16] found multivessel disease in 63% of inferior MI patients, supporting the concept that inferior wall MI often involves complex coronary anatomy. The relatively lower LCX involvement (24.4%) in our study is consistent with Khan et al. [20] and other studies, reflecting the anatomical distribution and flow characteristics of the circumflex system.

The strong association between socioeconomic status and LAD involvement (p<0.001) in our study, with poor patients showing the highest involvement (66.7%), represents a novel finding not extensively reported in the reviewed literature. This association likely reflects the cumulative impact of lifestyle factors, delayed medical care, and higher prevalence of traditional cardiovascular risk factors among economically disadvantaged populations, leading to more extensive coronary disease. The lack of gender association with vessel involvement in our study contrasts with some expectations based on Acuña-Román et al. [22] who reported different clinical presentations and outcomes in women with AMI, though their focus was on clinical outcomes rather than angiographic patterns.

The age-related increase in LCX involvement (31.6% in >50 years vs. 13.5% in ≤50 years, p=0.018) observed in our study may reflect the progressive nature of atherosclerotic disease, where smaller vessels like the circumflex artery become increasingly affected with age due to chronic inflammatory processes and calcification. This finding supports the pathophysiological understanding that coronary artery disease complexity increases with age, though specific comparative data from the reviewed studies is limited. The absence of significant associations between RCA involvement and demographic factors suggests that RCA-related pathology in inferior MI occurs uniformly across population subgroups, which may explain why traditional studies have consistently identified RCA as the primary culprit vessel in inferior wall MI, as demonstrated by Ramzan et al. [18] and others.

The unexpected predominance of LAD involvement and its strong association with socioeconomic status underscore the complexity of coronary artery disease presentation in developing countries, where delayed healthcare access and higher burden of cardiovascular risk

factors may lead to more extensive multivessel involvement at presentation. These observations have important clinical implications for risk stratification and treatment planning in patients presenting with inferior wall MI, suggesting that a more comprehensive angiographic evaluation may be warranted regardless of the traditional ECG localization. The age-related differences in vessel involvement patterns further emphasize the need for individualized approaches to coronary intervention strategies, particularly in younger patients who may present with atypical angiographic findings despite classic inferior wall ECG changes.

This study has several limitations that should be acknowledged. First, being a single-center study, the findings may not be generalizable to other populations or healthcare settings with different demographic characteristics and risk factor profiles. The cross-sectional design limits the ability to establish temporal relationships and may introduce selection bias, as only patients who underwent coronary angiography were included, potentially excluding those with contraindications or those who presented late. The study did not differentiate between culprit vessel occlusion and significant stenosis in non-culprit vessels, which may have overestimated the involvement of certain coronary arteries. Additionally, the lack of follow-up data prevents assessment of clinical outcomes and long-term prognosis associated with different vessel involvement patterns. The study population's socioeconomic status classification was based on subjective assessment rather than standardized economic indicators, which may introduce classification bias.

CONCLUSION

Our study has concluded that angiographic findings in patients with inferior wall myocardial infarction demonstrate a complex pattern of coronary artery involvement that extends beyond the traditional understanding of RCA-predominant disease. Left anterior descending artery involvement was found to be the most prevalent, followed by right coronary artery and left circumflex artery involvement.

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