Original Article
DOI: https://doi.org/10.70749/ijbr.v3i7.1904

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Frequency of Non-Obstructive Coronary Artery Disease in Patients with Non-ST-Segment Myocardial Infarction Taken for Early Invasive Angiography

Muhammad Shakil[1], Fawad Farooq[1], Muhammad Junaid[1], Jamil Ur Rahman[1], Muhammad Idrees[1], Shakir Zada[2]

[1]Adult Cardiology, National Institute of Cardiovascular Diseases, Karachi, Pakistan
[2]Interventional Cardiology, National Institute of Cardiovascular Diseases, Karachi, Pakistan

ARTICLE INFO

Keywords: Non-obstructive CAD, NSTEMI, Early angiography, Coronary artery disease

Correspondence to: Muhammad Shakil,
Postgraduate Resident,
Adult Cardiology, National Institute of Cardiovascular Diseases, Karachi, Pakistan
Email: shakilicp@gmail.com

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 15-06-2025 Revised: 26-06-2025
Accepted: 11-07-2025 Published: 17-07-2025

ABSTRACT

Background: Non-ST-segment elevation myocardial infarction (NSTEMI) is a common presentation of acute coronary syndrome, typically managed with early invasive coronary angiography. **Objective:** To determine the frequency of non-obstructive coronary artery disease in patients with non-ST-segment elevation myocardial infarction undergoing early invasive coronary angiography. **Methods:** This cross-sectional study was conducted at the Department of Cardiology, NICVD, Karachi, from 14 March 2025 to 14 June 2025. A total of 156 patients aged 40–80 years, diagnosed with NSTEMI, and undergoing early coronary angiography were enrolled through non-probability consecutive sampling. Patients with prior coronary intervention or vasoactive medication use were excluded. **Results:** Among 156 patients, the mean age was 61.2 ± 9.4 years, and 66.7% were male. Non-obstructive coronary artery disease was observed in 29.5% of patients. NO-CAD was significantly more frequent in females (42.3% vs. 23.1%; p = 0.012). No significant associations were found between NO-CAD and age, BMI, diabetes mellitus, or hypertension. Typical chest pain was more prevalent in patients with obstructive CAD (p = 0.041), while smoking history was also significantly associated with obstructive CAD (p = 0.025). **Conclusion:** Non-obstructive coronary artery disease is a common finding in NSTEMI patients undergoing early invasive angiography, particularly among females. These results emphasize the need for individualized patient assessment to avoid unnecessary interventions and optimize management strategies. Further large-scale studies are recommended to confirm these findings.

INTRODUCTION

Cardiovascular disease is the leading cause of death globally, with 85% of cardiovascular deaths attributed to acute coronary syndrome (ACS) and stroke [1]. The development of coronary atherosclerosis and subsequent plaque disruption, predominantly from plaque rupture or erosion, is responsible for the majority of ACS presentations. Persistent occlusion of the coronary artery due to thrombus, leading to MI, classically presents with symptoms of chest pain and evidence of ECG changes [2,3]. Approximately 90% of patients with MI have angiographic evidence of obstructive coronary artery disease (CAD), based on registry studies published more than 30 years ago [4]. The realization that obstructive CAD was causative in the majority of patients with non-ST-elevation MI (NSTEMI) led to the development of current management strategies, including primary percutaneous coronary intervention [5]. In addition to revascularization, targeted pharmacotherapy, including high-dose statins, aspirin, P2Y12 inhibitors, beta-blockers, and angiotensin-converting enzyme inhibitors, has been shown to improve outcomes in patients with NSTEMI in large randomized controlled trials. However, most patients in these trials had obstructive CAD [6]. Around 10% of patients presenting with classical signs and symptoms of ACS do not have evidence of obstructive CAD to account for their presentation, namely those with MI with non-obstructive coronary artery (MINOCA) [7]. This phenomenon has been historically overlooked and largely understudied about prognosis and treatment. MINOCA was previously thought to carry a good prognosis; however, there is growing interest in this group of patients, as increasing data are showing that this syndrome is not as benign as previously thought [8]. In a study by Fazal et al., non-obstructive CAD on angiography was found in 35 (23.2%) patients presenting with acute myocardial infarction [9]. In another study, the frequency of non-obstructive CAD in MI patients was 27.3% [10]. Understanding of various angiographic findings in NSTEMI patients is vital for cardiologists in planning optimum treatment for their patients. While

much is known about occlusive CAD in MI patients, the burden of non-occlusive CAD is still not fully understood as evident from thorough literature search particularly when it comes to NSTEMI. Hence the study has been planned. Results of the study will benefit cardiologists in better understanding of clinical and angiographic presentations of NSTEMI patients.

Objective

To determine the frequency of non-obstructive coronary artery disease in patients with non-ST-segment myocardial infarction who underwent early invasive angiography.

METHODOLOGY

This cross-sectional study was conducted at Department of Cardiology, NICVD, Karachi from 14 March 2025 to 14 June 2025. Data were collected through non-probability consecutive sampling technique. Sample size is calculated using WHO sample size formula taking the following assumptions:

- Anticipated frequency of non-obstructive CAD in patients with STEMI = 27.3%[10]
- Margin of error = 7%
- Confidence Level = 95%
- Sample size, n = 156

Inclusion criteria

- Patient age 40 to 80 years
- Both genders
- Patients diagnosed with NSTEMI undergoing early angiography as per operational definitions
- ASA status III or below

Exclusion criteria

- Patients with a prior history of acute coronary syndrome
- Patients with a prior history of coronary intervention
- Patients taking vasoactive medications
- Patients with a history of cocaine addiction
- Patients who have received thrombolytic medications before arrival to the hospital

Data Collection

Following approval from the hospital's research review board, patients meeting the selection criteria were enrolled from the indoor cardiology department after obtaining informed consent. Baseline demographic and clinical information was collected, including age, gender, weight (measured in kilograms using a weighing scale with patients barefoot and wearing light clothing), height (measured in centimeters using a stadiometer while standing erect and barefoot), BMI (calculated as weight in kg divided by height in meters squared), residence, education, profession, socioeconomic status, comorbidities such as diabetes mellitus (defined as fasting blood sugar >130 mg/dl) and hypertension (blood pressure >140/90 mmHg), and duration of pain. All enrolled patients underwent coronary angiography performed by a consultant cardiologist within 120 minutes of hospital admission. Vascular access was obtained via femoral or radial artery, followed by catheter insertion and contrast injection to opacify the coronary vasculature. Fluoroscopic imaging was used to obtain the angiogram. The presence or absence of non-obstructive coronary artery disease was documented according to the operational definitions provided in the study protocol. All data were recorded by the principal investigator on a pre-designed proforma.

Data Analysis

Data analysis was performed using IBM SPSS version 24. Quantitative variables such as age, BMI, and duration of pain were presented as mean ± standard deviation or median with interquartile range after assessing normality using the Shapiro-Wilk test. Qualitative variables including gender, residence, education, socioeconomic status, comorbidities, and the presence of non-obstructive coronary artery disease were summarized as frequencies and percentages. Comparison of non-obstructive CAD frequency across subgroups was performed using the chi-square test, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

A total of 156 patients diagnosed with non-ST-segment elevation myocardial infarction (NSTEMI) who underwent early coronary angiography were included in this study. The mean age was 61.2 ± 9.4 years for the total group, with 59.6 ± 9.1 years for the NO-CAD group and 61.9 ± 9.5 years for the Obstructive CAD group. There was no significant difference in age between the groups (p = 0.18). The gender distribution was significantly different, with 66.7% males in the total group, 23.1% in the NO-CAD group, and 76.9% in the Obstructive CAD group, indicating more males in the Obstructive CAD group (p = 0.012). The mean BMI was 26.5 ± 3.9 kg/m^2 for the total group, 26.3 ± 3.7 kg/m^2 for the NO-CAD group, and 26.7 ± 4.1 kg/m^2 for the Obstructive CAD group, with no significant difference (p = 0.53). Hypertension was present in 62.8% of the total group, 28.6% in the NO-CAD group, and 71.4% in the Obstructive CAD group, showing no significant difference (p = 0.64). The prevalence of Diabetes Mellitus was 54.5% in the total group, 29.4% in the NO-CAD group, and 70.6% in the Obstructive CAD group, with no significant difference (p = 0.77).

Table 1

Baseline Demographic and Clinical Characteristics of Study Participants

Characteristic	Total (n = 156)	NO-CAD (n = 46)	Obstructive CAD (n = 110)	p-value
Age (years), mean ± SD	61.2 ± 9.4	59.6 ± 9.1	61.9 ± 9.5	0.18
Gender, n (%)				0.012*
Male	104 (66.7%)	24 (23.1%)	80 (76.9%)	
Female	52 (33.3%)	22 (42.3%)	30 (57.7%)	
BMI (kg/m^2), mean ± SD	26.5 ± 3.9	26.3 ± 3.7	26.7 ± 4.1	0.53
Hypertension, n (%)	98 (62.8%)	28 (28.6%)	70 (71.4%)	0.64
Diabetes Mellitus, n (%)	85 (54.5%)	25 (29.4%)	60 (70.6%)	0.77

*p ≤ 0.05 considered statistically significant.

In the age group of 40–59 years, 34.7% of the NO-CAD group and 65.3% of the Obstructive CAD group were

represented, with no significant difference (p = 0.18). In the 60–80 years group, 25.4% of the NO-CAD group and 74.6% of the Obstructive CAD group were represented. Gender distribution showed a significant difference, with 23.1% males in the NO-CAD group and 76.9% in the Obstructive CAD group for males, and 42.3% females in the NO-CAD group and 57.7% in the Obstructive CAD group, with a p-value of 0.012, indicating more males in the Obstructive CAD group.

Table 2
Stratification of Non-Obstructive CAD by Age and Gender

Variable	Subgroup	NO-CAD (n = 46)	Obstructive CAD (n = 110)	p-value
Age Group (years)	40–59	25 (34.7%)	47 (65.3%)	0.18
	60–80	21 (25.4%)	63 (74.6%)	
Gender	Male	24 (23.1%)	80 (76.9%)	0.012*
	Female	22 (42.3%)	30 (57.7%)	

The median chest pain duration was 4 hours (IQR 2–8) for the total group, 3 hours (IQR 2–7) for the NO-CAD group, and 5 hours (IQR 2–9) for the Obstructive CAD group, with no significant difference (p = 0.27). Typical chest pain was reported in 71.8% of the total group, 25.0% of the NO-CAD group, and 75.0% of the Obstructive CAD group, with a p-value of 0.041, indicating a significant difference, with more typical chest pain in the Obstructive CAD group. Atypical chest pain was more common in the NO-CAD group (40.9%) compared to the Obstructive CAD group (59.1%). Associated dyspnea was observed in 24.4% of the total group, 36.8% in the NO-CAD group, and 63.2% in the Obstructive CAD group, with no significant difference (p = 0.09). Palpitations were reported by 14.1% of the total group, 40.9% of the NO-CAD group, and 59.1% of the Obstructive CAD group, with no significant difference (p = 0.16).

Table 3
Clinical Presentation and Pain Duration

Characteristic	Total (n = 156)	NO-CAD (n = 46)	Obstructive CAD (n = 110)	p-value
Chest Pain Duration (hours), median (IQR)	4 (2–8)	3 (2–7)	5 (2–9)	0.27
Typical Chest Pain, n (%)	112 (71.8%)	28 (25.0%)	84 (75.0%)	0.041*
Atypical Chest Pain, n (%)	44 (28.2%)	18 (40.9%)	26 (59.1%)	
Associated Dyspnea, n (%)	38 (24.4%)	14 (36.8%)	24 (63.2%)	0.09
Palpitations, n (%)	22 (14.1%)	9 (40.9%)	13 (59.1%)	0.16

*p ≤ 0.05 considered statistically significant.

Socioeconomic status was distributed as 40.4% low, 47.4% middle, and 12.2% high for the total group, with no significant difference (p = 0.36). Smoking history was more common in the Obstructive CAD group (78.6%) compared to the NO-CAD group (21.4%), with a significant difference (p = 0.025). Physical inactivity was present in 57.1% of the total group, 28.1% in the NO-CAD group, and 71.9% in the Obstructive CAD group, with no significant difference (p = 0.74).

Table 4
Socioeconomic Status and Lifestyle Factors

Characteristic	Total (n = 156)	NO-CAD (n = 46)	Obstructive CAD (n = 110)	p-value
Socioeconomic Status, n (%)				0.36
Low	63 (40.4%)	18 (28.6%)	45 (71.4%)	
Middle	74 (47.4%)	20 (27.0%)	54 (73.0%)	
High	19 (12.2%)	8 (42.1%)	11 (57.9%)	
Smoking History, n (%)	56 (35.9%)	12 (21.4%)	44 (78.6%)	0.025*
Physical Inactivity, n (%)	89 (57.1%)	25 (28.1%)	64 (71.9%)	0.74

*p ≤ 0.05 considered statistically significant.

DISCUSSION

This study aimed to determine the frequency of non-obstructive coronary artery disease (NO-CAD) in patients with non-ST-segment elevation myocardial infarction (NSTEMI) undergoing early invasive angiography. In our sample of 156 patients, NO-CAD was observed in 29.5% of cases, which is comparable to previously reported frequencies ranging from 20% to 30% in similar populations. These finding underscores that nearly one-third of NSTEMI patients may not exhibit significant coronary obstruction upon early angiographic evaluation, a fact that holds important implications for clinical management. Our results demonstrated a significantly higher frequency of NO-CAD in female patients compared to males (42.3% vs. 23.1%, p = 0.012) [11]. This aligns with previous research suggesting that female gender is associated with a higher prevalence of myocardial infarction with non-obstructive coronary arteries (MINOCA), likely due to factors such as microvascular dysfunction, endothelial abnormalities, and plaque erosion rather than rupture [12]. The observation emphasizes the need for gender-specific diagnostic and therapeutic approaches in ACS patients. Although patients aged below 60 years showed a higher frequency of NO-CAD compared to those aged 60 years and above, the difference was not statistically significant [13]. This trend mirrors earlier findings indicating that younger NSTEMI patients may present with NO-CAD more frequently, potentially linked to non-atherosclerotic causes such as coronary vasospasm, thromboembolism, or myocarditis [14]. Interestingly, smoking history showed a significant association with obstructive CAD (p = 0.025), reinforcing its established role as a major modifiable risk factor in the pathogenesis of atherosclerotic coronary disease [15]. Socioeconomic status and BMI did not demonstrate a significant relationship with NO-CAD in our cohort, which is consistent with prior studies reporting similar observations. Another key point highlighted was the difference in clinical presentation [16]. Typical chest pain was significantly more prevalent in obstructive CAD patients, whereas atypical pain patterns and palpitations were observed more frequently among NO-CAD patients [17]. This distinction suggests that clinical symptomatology may aid in risk stratification but cannot reliably replace angiographic assessment. The study

findings are consistent with international literature emphasizing the heterogeneity of NSTEMI presentations and outcomes [18]. The relatively high prevalence of NO-CAD underscores the need for precise diagnosis to avoid overtreatment, particularly unnecessary dual antiplatelet therapy or revascularization procedures in patients who might not benefit from them. This study was limited by its single-center design and relatively small sample size, which may affect the generalizability of findings. Additionally, microvascular or functional coronary abnormalities were not evaluated, as the study focused exclusively on anatomical obstruction. Long-term clinical outcomes of NO-CAD patients were also not assessed.

CONCLUSION

It is concluded that non-obstructive coronary artery disease (NO-CAD) is a frequent finding in patients presenting with non-ST-segment elevation myocardial infarction (NSTEMI) undergoing early invasive coronary angiography, observed in approximately 29.5% of cases in this study. Female gender and absence of typical chest pain were significantly associated with a higher likelihood of NO-CAD. These findings highlight the importance of recognizing NO-CAD as a distinct clinical entity within NSTEMI presentations, necessitating careful patient evaluation to avoid unnecessary invasive procedures and optimize management strategies.

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