Frequency and Clinical Implications of Non-Obstructive Epicardial Coronary Arteries in Patients Presenting with Typical Cardiac Chest Pain: A Retrospective Observational Study

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ABSTRACT

Background: Patients presenting with typical cardiac chest pain often undergo coronary angiography, but a significant proportion is found to have non-obstructive epicardial coronary arteries. This study aimed to determine the frequency of non-obstructive coronary arteries in patients with typical cardiac chest pain and explore associated risk factors and clinical outcomes.

Methods: This retrospective, observational study included patients who presented with typical cardiac chest pain and underwent coronary angiography at S.S. Narayana Heart Centre, Davanagere, Karnataka, between January 2018 and December 2022. Non-obstructive epicardial coronary arteries were defined as the absence of ≥50% luminal narrowing in any major coronary artery. Baseline characteristics, angiographic findings, and clinical outcomes were analyzed.

Results: Of the 1,257 patients included, 287 (22.8%) had non-obstructive epicardial coronary arteries. The frequency was higher in women (28.1%) compared to men (17.6%, $p < 0.001$). Logistic regression analysis identified female sex (odds ratio [OR] 1.84, 95% confidence interval [CI] 1.39-2.44, $p < 0.001$) and the absence of traditional cardiovascular risk factors (OR 1.62, 95% CI 1.22-2.16, $p = 0.001$) as significant predictors of non-obstructive coronary arteries. During a median follow-up of 24 months, patients with non-obstructive coronary arteries had a lower rate of major adverse cardiovascular events (MACE) (5.6% vs. 14.3%, $p < 0.001$), cardiovascular death (0.7% vs. 2.9%, $p = 0.032$), non-fatal myocardial infarction (2.1% vs. 5.3%, $p = 0.017$), and revascularization (2.8% vs. 6.2%, $p = 0.018$) compared to those with obstructive disease.

Conclusion: Non-obstructive epicardial coronary arteries were present in nearly one-quarter of patients with typical cardiac chest pain, with a higher frequency in women. Patients with non-obstructive coronary arteries had a more favorable prognosis but may still benefit from tailored diagnostic and management approaches.

INTRODUCTION

Chest pain is one of the most commonly encountered symptoms in emergency departments and outpatient clinics, accounting for approximately 5% of all emergency department visits in the United States.[1] Among these cases, typical cardiac chest pain, characterized by its quality (dull, heavy, or pressurelike), location (retrosternal or left precordial), radiation (to the left arm, neck, or jaw), and precipitating or relieving factors (exertion or rest, respectively), is often indicative of underlying coronary artery disease (CAD).[2] Consequently, a significant proportion of cardiac evaluations are performed to investigate the potential presence of CAD in patients presenting with these symptoms.

Despite the typical presentation, a considerable number of patients undergo invasive coronary angiography only to reveal non-obstructive epicardial coronary arteries, defined as less than 50% luminal narrowing in major coronary arteries.[3] This finding poses a diagnostic challenge, as it leaves many patients without a clear etiology for their symptoms and may lead to uncertainty in management strategies. While some patients may have underlying microvascular disease or other cardiac pathologies contributing to their symptoms, such as coronary artery spasm or myocardial bridging, others may have non-cardiac etiologies, such as gastrointestinal or musculoskeletal conditions.[4]

The prevalence of non-obstructive coronary artery disease (NOCAD) in patients with suspected CAD has been reported to range from 10% to 25%, with higher rates observed in women and younger individuals.[5,6] However, the specific frequency of non-obstructive epicardial coronary arteries in patients presenting with typical cardiac chest pain remains unclear, as most studies have focused on broader populations with suspected CAD.

Understanding the frequency and characteristics of this patient population is crucial for optimizing diagnostic and therapeutic approaches, as well as appropriate resource allocation. Identifying potential risk factors, clinical features, and outcomes associated with non-obstructive epicardial coronary arteries in patients with typical cardiac chest pain may aid in risk stratification and the development of targeted management strategies.

This study aims to determine the frequency of non-obstructive epicardial coronary arteries in patients presenting with typical cardiac chest pain at our institution. Additionally, we will explore potential risk factors, clinical features, and outcomes associated with this condition. The findings of this study may provide valuable insights into the management and care of this patient population.

MATERIAL AND METHODS

This was a retrospective, observational study conducted at the S.S. Narayana Heart Centre, Davanagere, Karnataka. The study included patients who presented with typical cardiac chest pain and underwent coronary angiography between January 2018 and December 2022.

Study Population

Inclusion Criteria:

1. Patients aged 18 years and above
2. Presentation with typical cardiac chest pain, defined as retrosternal or left precordial discomfort, dull or heavy in quality, and precipitated by exertion or emotional stress

Exclusion Criteria:

1. Prior history of coronary artery disease or myocardial infarction
2. Presence of valvular heart disease, cardiomyopathy, or congenital heart disease
3. Incomplete medical records or unavailable coronary angiography reports

Data Collection: Electronic medical records of eligible patients were reviewed, and data were extracted using a standardized data collection form. The following information was collected:

1. Demographic data (age, sex, ethnicity)
2. Clinical presentation (chest pain characteristics, associated symptoms)
3. Risk factors (hypertension, diabetes, dyslipidemia, smoking, family history)
4. Diagnostic tests (electrocardiogram, cardiac biomarkers, stress testing)
5. Coronary angiography findings (degree of stenosis, involved vessels)
6. Treatment and follow-up data (revascularization procedures, medications, clinical outcomes)

Angiographic Assessment

Coronary angiography reports were reviewed by two experienced interventional cardiologists blinded to the clinical data. Non-obstructive epicardial coronary arteries were defined as the absence of ≥50% luminal narrowing in any major epicardial coronary artery (left main, left anterior descending, left circumflex, and right coronary artery).

Statistical Analysis:

Descriptive statistics were used to summarize the data. Continuous variables were presented as mean ± standard deviation or median (interquartile range), as appropriate. Categorical variables were reported as frequencies and percentages. The primary outcome was the frequency of non-obstructive epicardial coronary arteries in patients with typical cardiac chest pain. Logistic regression analysis was performed to identify potential risk factors associated with the presence of non-obstructive coronary arteries. A p-value of <0.05 was considered statistically significant.

Ethical Considerations:

The study protocol was approved by the Institutional Ethics Committee of S.S. Narayana Heart Centre. Patient confidentiality was maintained throughout the study, and data were anonymized to ensure privacy.

RESULTS

During the study period, a total of 1,257 patients who presented with typical cardiac chest pain and underwent coronary angiography were included in the analysis. The mean age of the study population was 58.4 ± 11.2 years, and 632 (50.3%) were males. The baseline characteristics of the study population are summarized in Table 1.

Table 1: Baseline Characteristics of the Study Population

Characteristics	Non-Obstructive CAD (n = 287)	Obstructive CAD (n = 970)	P value
Age (years)	56.2±11.8	59.1±10.9	**0.001**
Male sex, n (%)	111 (38.7%)	521 (53.7%)	**<0.001**
Hypertension, n (%)	145 (50.5%)	553 (57.0%)	**0.045**
Diabetes mellitus, n (%)	82 (28.6%)	330 (34.0%)	0.078
Dyslipidemia, n (%)	109 (38.0%)	408 (42.1%)	0.211
Current smoker, n (%)	54 (18.8%)	222 (22.9%)	0.139
Family history of CAD, n (%)	68 (23.7%)	251 (25.9%)	0.453

Table 2 shows that the overall frequency of non-obstructive coronary arteries was 22.8% (287 out of 1,257 patients). However, the frequency was higher in females (28.1%) compared to males (17.6%).

Table 2: Frequency of Non-Obstructive Coronary Arteries

	Total (n = 1,257)	Non-Obstructive CAD n (%)
Overall	1257	287 (22.8%)
Male	632	111 (17.6%)
Female	625	176 (28.1%)

Table 3 shows the results of a logistic regression analysis performed to identify potential predictors of non-obstructive coronary arteries. The odds ratios (ORs) and 95% confidence intervals (CIs) are presented for each variable. The analysis revealed that female sex (OR 1.84, 95% CI 1.39-2.44, p < 0.001) and the absence of traditional cardiovascular risk factors (OR 1.62, 95% CI 1.22-2.16, p = 0.001) were significant predictors of non-obstructive coronary arteries.

Table 3: Logistic Regression Analysis for Predictors of Non-Obstructive Coronary Arteries

Variable	Odds Ratio (95% CI)	P value
Female sex	1.84 (1.39-2.44)	**<0.001**
Age (per 10-year increase)	0.92 (0.81-1.05)	0.211
Hypertension	0.87 (0.66-1.15)	0.332
Diabetes mellitus	0.79 (0.58-1.07)	0.126
Dyslipidemia	0.94 (0.71-1.24)	0.661
Current smoking	0.83 (0.59-1.17)	0.283
Family history of CAD	1.12 (0.82-1.53)	0.481
Absence of traditional risk factors	1.62 (1.22-2.16)	**0.001**

Table 4 presents the clinical outcomes during the follow-up period, stratified by the presence of non-obstructive or obstructive CAD. The outcomes reported include major adverse cardiovascular events (MACE), cardiovascular death, non-fatal myocardial infarction (MI), and revascularization. The non-obstructive CAD group had a lower rate of MACE (5.6%) compared to the obstructive CAD group (14.3%), which was statistically significant (p < 0.001). Similarly, the rates of cardiovascular death (0.7% vs. 2.9%, p = 0.032), non-fatal MI (2.1% vs. 5.3%, p = 0.017), and revascularization (2.8% vs. 6.2%, p = 0.018) were lower in the non-obstructive CAD group compared to the obstructive CAD group, with statistically significant differences.

Table 4: Clinical Outcomes

Outcome	Non-Obstructive CAD (n = 287)	Obstructive CAD (n = 970)	p-value
MACE	16 (5.6%)	139 (14.3%)	**<0.001**
Cardiovascular death	2 (0.7%)	139 (14.3%)	**0.032**
Non-fatal MI	6 (2.1%)	51 (5.3%)	**0.017**
Revascularization	8 (2.8%)	60 (6.2%)	**0.018**

DISCUSSION

In this study, we found that 22.8% of patients presenting with typical cardiac chest pain had non-obstructive epicardial coronary arteries on coronary angiography. This frequency is consistent with previous reports in the literature, which have estimated the prevalence of non-obstructive coronary artery disease (NOCAD) in patients with suspected CAD to range from 10% to 25%.[3,6]

Our study also revealed a higher frequency of non-obstructive coronary arteries in women (28.1%) compared to men (17.6%), which is in line with prior research. The Women's Ischemia Syndrome Evaluation (WISE) study, a landmark investigation in this field, reported that approximately 60% of women undergoing coronary angiography for suspected ischemic heart disease had no obstructive coronary lesions.[7] Similarly, the Prospective Multicenter Imaging Study for Evaluation of Chest Pain (PROMISE) trial found that women had a higher prevalence of NOCAD compared to men (36% vs. 20%).[8]

The observed higher frequency of non-obstructive coronary arteries in women has been attributed to potential differences in the underlying pathophysiology of ischemic heart disease, such as a higher prevalence of microvascular dysfunction and coronary artery spasm in women.[9,10]

Consistent with previous studies, our logistic regression analysis identified female sex and the absence of traditional cardiovascular risk factors as significant predictors of non-obstructive coronary arteries.[5] These findings highlight the importance of considering alternative etiologies for chest pain in women and individuals without established risk factors, such as microvascular disease, coronary artery spasm, or non-cardiac causes.

Interestingly, our study found that patients with non-obstructive coronary arteries had a lower rate of major adverse cardiovascular events (MACE), cardiovascular death, non-fatal myocardial infarction, and revascularization compared to those with obstructive CAD. This observation is consistent with previous studies that have reported a better prognosis and

lower risk of adverse events in patients with NOCAD compared to those with obstructive CAD.[6,11]

However, it is important to note that NOCAD is not a benign condition, and some patients may experience persistent symptoms, reduced quality of life, and a higher risk of adverse events compared to the general population.[12,13] Identifying the underlying etiology and implementing appropriate management strategies are crucial in this patient population.

The strengths of our study include a large sample size and the evaluation of patients presenting with typical cardiac chest pain, which is a common clinical scenario in practice. However, there are some limitations to consider. First, our study was retrospective in nature, which may introduce potential biases. Second, we did not have detailed information on the presence of microvascular disease or coronary artery spasm, which could provide insights into the underlying mechanisms in patients with non-obstructive coronary arteries. Additionally, our follow-up duration was relatively short, and longer-term outcomes need to be explored.

In conclusion, our study adds to the growing body of evidence on the frequency and clinical implications of non-obstructive coronary arteries in patients with typical cardiac chest pain. Our findings highlight the importance of considering alternative etiologies, particularly in women and individuals without traditional risk factors, and emphasize the need for tailored diagnostic and management approaches in this patient population.

CONCLUSION

This study found that 22.8% of patients presenting with typical cardiac chest pain had non-obstructive epicardial coronary arteries on coronary angiography, with a higher frequency observed in women. Female sex and the absence of traditional cardiovascular risk factors were identified as predictors of non-obstructive coronary arteries. Patients with non-obstructive coronary arteries had a lower rate of adverse cardiovascular events compared to those with obstructive disease. These findings highlight the need for a comprehensive diagnostic approach and tailored management strategies in this patient population. Future research should focus on identifying underlying etiologies and developing evidence-based treatments to improve outcomes.

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