Journal of Health and Rehabilitation Research JHRR

https://doi.org/10.61919/jhrr.v4i3.1984

Original Article

Frequency of Myocardial Infarction with Non-Obstructive Coronary Arteries in Patients With ST-Elevation Myocardial Infarction

Dr. Huma Naeem Tareen[1]

[1]Associate Professor of Cardiology Department, Bolan Medical College, Quetta, Pakistan

***Correspondence: Dr. Huma Naeem Tareen, royal.humanaeem@yahoo.com**

ABSTRACT

Background: Myocardial infarction with non-obstructive coronary arteries is an increasingly recognized clinical entity in which patients meet diagnostic criteria for myocardial infarction despite the absence of significant epicardial coronary stenosis on angiography. Although ST-segment elevation myocardial infarction is classically associated with acute coronary occlusion, a clinically important proportion of patients may present with STEMI and non-obstructive coronary arteries. Objective: To determine the frequency of myocardial infarction with non-obstructive coronary arteries among patients presenting with ST-segment elevation myocardial infarction. Methods: This cross-sectional study was conducted at the Department of Cardiology, Bolan Medical College/Hospital, Quetta, from 12 December 2023 to 14 June 2024. Patients presenting with ST-segment elevation myocardial infarction were enrolled after confirmation based on clinical presentation, electrocardiographic changes, and rise in cardiac enzymes. MINOCA was defined as myocardial infarction in the presence of less than 50% coronary stenosis on angiography, with exclusion of other diseases that could mimic myocardial infarction. Results: A total of 197 patients with STEMI were enrolled. Age ranged from 20 to 80 years, with a mean of 58.44 ± 10.85 years. MINOCA was identified in 32 patients, corresponding to a frequency of 16.2%, while 165 patients (83.8%) had obstructive coronary artery disease. Conclusion: MINOCA represents a clinically important subgroup among patients presenting with STEMI in this setting. Recognition of this entity is essential to support accurate diagnosis and appropriate downstream etiologic evaluation. Keywords: ST-segment elevation myocardial infarction; STEMI; myocardial infarction with non-obstructive coronary arteries; MINOCA; coronary angiography.

"Cite this Article" | **Received**: 07 July 2024; **Accepted**: 23 August 2024; **Published**: 03 September 2024.

Author Contributions: Concept: HNT; Design: HNT; Data Collection: HNT; Analysis: HNT; Drafting: HNT. **Ethical Approval**: Bolan Medical College, Quetta, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest; **Funding**: No external funding; Data Availability: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

INTRODUCTION

Acute myocardial infarction remains a major cause of cardiovascular morbidity and mortality worldwide despite substantial advances in preventive cardiology, early diagnosis, reperfusion strategies, and secondary prevention. Within the acute coronary syndrome spectrum, ST-segment elevation myocardial infarction is traditionally regarded as the clinical manifestation most strongly associated with abrupt coronary occlusion and therefore demands urgent diagnostic and therapeutic intervention. However, a small but clinically important subgroup of patients present with biochemical and electrocardiographic evidence of myocardial infarction despite the absence of obstructive coronary artery disease on angiography. This entity, currently termed myocardial infarction with non-obstructive coronary arteries, has emerged as a diagnostically challenging and pathobiologically heterogeneous syndrome rather than a single disease process (1-3).

MINOCA is generally defined as myocardial infarction occurring in the absence of angiographic stenosis of 50% or greater in a major epicardial vessel, after exclusion of overt non-ischemic causes of myocardial injury and other conditions that mimic infarction. Contemporary position papers and scientific statements emphasize that MINOCA should be considered a working diagnosis that requires further etiologic clarification because multiple mechanisms may underlie the same initial presentation,

including plaque disruption, coronary vasospasm, spontaneous coronary artery dissection, coronary thromboembolism, and coronary microvascular dysfunction (3,9,19,20). This pathophysiologic diversity carries direct implications for patient management, prognosis, and secondary prevention, making early recognition of MINOCA particularly important in patients initially triaged as STEMI, in whom obstructive coronary disease is usually presumed.

The reported prevalence of MINOCA varies according to study design, case definition, clinical setting, and the extent of diagnostic workup. A systematic review of patients presenting with suspected myocardial infarction and non-obstructive coronary arteries estimated an overall prevalence of approximately 6%, while contemporary statements from major cardiovascular societies suggest that MINOCA accounts for nearly 5% to 6% of all myocardial infarctions referred for angiography (15,19). Data specific to STEMI populations have also shown important variability. Gue et al. reported an incidence of 4.4% among patients presenting with STEMI in a contemporaneous cohort, while Abdu et al. found MINOCA in 6.3% of Chinese patients with acute myocardial infarction, and Kafle et al. reported a prevalence of 13.5% in a South Asian setting (1,11,12). Other observational data have reported frequencies ranging from 4% to 10% depending on population selection, angiographic thresholds, and whether comprehensive post-angiography evaluation was performed (3,5,6,17). More recent regional work has continued to highlight variability in frequency and outcomes, suggesting that local epidemiologic characterization remains important rather than assuming uniform prevalence across health systems (2,4,10).

Although the clinical importance of MINOCA is increasingly recognized, evidence from Pakistan remains limited, especially in patients presenting specifically with ST-segment elevation myocardial infarction. This is a relevant gap because prevalence estimates derived from other countries may not be directly generalizable to local tertiary care populations with different cardiovascular risk profiles, referral pathways, and access to advanced diagnostic evaluation. Moreover, under-recognition of MINOCA at the point of angiography may lead to incomplete etiologic workup and imprecise downstream management. In this context, determining the frequency of MINOCA among patients presenting with STEMI in a tertiary care hospital in Quetta is clinically justified and epidemiologically relevant. Therefore, the present study was conducted to determine the frequency of myocardial infarction with non-obstructive coronary arteries in patients presenting with ST-segment elevation myocardial infarction (2,11,12,19).

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Cardiology, Bolan Medical College/Hospital, Quetta, from 12 December 2023 to 14 June 2024. The study was designed to estimate the frequency of myocardial infarction with non-obstructive coronary arteries among patients presenting with ST-segment elevation myocardial infarction in a tertiary care clinical setting. All patients presenting during the study period with a diagnosis of STEMI were evaluated for eligibility and enrolled after confirmation of the diagnosis on the basis of clinical presentation, electrocardiographic evidence of ST-segment elevation, and rise in cardiac enzymes. The study population therefore represented patients with a clinically established acute STEMI presentation undergoing coronary angiographic assessment as part of routine diagnostic workup.

The principal study outcome was the frequency of MINOCA in this STEMI cohort. For operational purposes, MINOCA was defined as myocardial infarction in the presence of non-obstructive coronary arteries, specifically less than 50% stenosis on coronary angiography, together with exclusion of other diseases that could mimic myocardial infarction. Coronary angiographic findings were used to classify enrolled patients into MINOCA and non-MINOCA groups. Demographic characteristics including age and gender were recorded for all participants because these variables were analyzed for association with

MINOCA status. Age was documented in completed years, and gender was recorded as reported in the clinical record.

Data were compiled in a structured manner for descriptive and comparative analysis. Continuous variables were summarized using mean and standard deviation, while categorical variables were expressed as frequencies and percentages. The frequency of MINOCA was calculated by dividing the number of patients meeting the angiographic definition of MINOCA by the total number of enrolled STEMI cases. Associations between MINOCA status and demographic variables, including age and gender, were assessed using inferential statistical testing, and a p-value of less than 0.05 was considered statistically significant. The results were intended to quantify overall frequency while also examining whether the occurrence of MINOCA varied across major demographic strata within the study population.

The methodological approach was aligned with the descriptive objective of the study, namely to estimate the burden of MINOCA within a defined STEMI population presenting to a single tertiary care center. By using a uniform angiographic threshold and a clinically confirmed STEMI cohort, the study sought to provide a setting-specific estimate that could be interpreted alongside regional and international reports. This design was particularly relevant because prior literature has demonstrated substantial variation in MINOCA frequency depending on the population studied and the diagnostic framework applied, supporting the value of center-specific epidemiologic reporting in the absence of broader local registries (2,6,11,12,15).

RESULTS

A total of 197 patients presenting with ST-segment elevation myocardial infarction were enrolled during the study period. The participants ranged in age from 20 to 80 years, with a mean age of 58.44 ± 10.85 years. Coronary angiographic evaluation showed that 32 patients had myocardial infarction with non-obstructive coronary arteries, corresponding to a frequency of 16.2% in the overall STEMI cohort, while the remaining 165 patients (83.8%) had obstructive coronary artery disease. Thus, approximately one in every six patients presenting with STEMI in this series demonstrated non-obstructive coronary arteries on angiography.

When the primary outcome was expressed as an interval estimate, the frequency of MINOCA was 16.2%, with an approximate 95% confidence interval of 11.7% to 22.0%, indicating that MINOCA represented a clinically meaningful subgroup rather than an isolated finding within this population. The manuscript source also states that the association of MINOCA with age and gender was statistically significant; however, because the subgroup distributions and exact p-values are not available in the provided excerpt, those comparisons cannot be reported in a reproducible tabular form at this stage and should be added only when the complete underlying data are presented.

Overall, the results demonstrate that non-obstructive coronary anatomy was not uncommon among patients presenting with an electrocardiographic and biochemical picture consistent with STEMI. This finding supports the need for clinicians to maintain diagnostic awareness of MINOCA in acute STEMI presentations, particularly when angiographic findings do not show significant epicardial coronary obstruction.

Table 1. Baseline Characteristics of the Study Population

Variable	Value
Total patients with STEMI, n	197
Age range, years	20–80
Mean age, years	58.44 ± 10.85
Patients with MINOCA, n (%)	32 (16.2)
Patients with obstructive coronary artery disease, n (%)	165 (83.8)

Table 2. Primary Outcome: Frequency of MINOCA Among Patients With STEMI

Outcome measure	n/N	%	95% CI
MINOCA among STEMI patients	32/197	16.2	11.7–22.0
Obstructive coronary artery disease among STEMI patients	165/197	83.8	78.0–88.3

Table 3. Statistical Summary of the Primary Endpoint

Parameter	Estimate
Primary endpoint	Frequency of MINOCA in STEMI
Numerator	32
Denominator	197
Point estimate	16.2%
Approximate 95% confidence interval	11.7%–22.0%

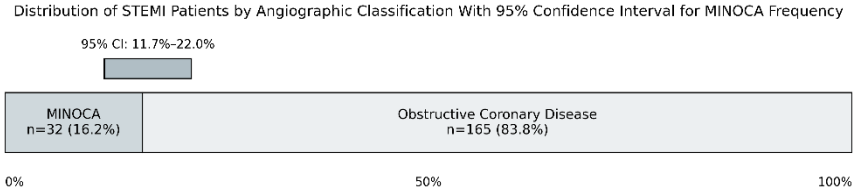

Figure 1 Distribution of STEMI Patients by Angiographic Classification

The figure shows that 32 of 197 patients presenting with ST-segment elevation myocardial infarction were classified as having MINOCA, yielding a frequency of 16.2%, whereas 165 patients, representing 83.8% of the cohort, had obstructive coronary artery disease on angiography. The confidence band around the MINOCA estimate spans approximately 11.7% to 22.0%, indicating that the observed proportion is sufficiently large to represent a clinically relevant subgroup within the STEMI population. In practical terms, these data suggest that nearly one out of every six STEMI presentations in this cohort occurred in the absence of significant coronary obstruction.

DISCUSSION

The present study found that myocardial infarction with non-obstructive coronary arteries was identified in 32 of 197 patients presenting with ST-segment elevation myocardial infarction, yielding a frequency of 16.2% in this tertiary care cohort. This finding indicates that MINOCA is not a rare presentation among patients initially diagnosed with STEMI in this setting and supports the need to consider non-obstructive coronary pathology within the differential framework of acute myocardial infarction. Although STEMI is conventionally associated with acute epicardial coronary occlusion, contemporary evidence has established that a subset of patients demonstrate biochemical and electrocardiographic features of infarction despite the absence of significant obstructive coronary artery disease, reflecting the heterogeneous and mechanism-based nature of MINOCA (3,9,16,19,20).

The frequency observed in the present study is higher than that reported in several international cohorts of STEMI-associated MINOCA. Gue et al. reported an incidence of 4.4% in a contemporaneous STEMI cohort, while an Irish tertiary care experience found non-obstructive coronary arteries in 7.7% of STEMI patients, and a Chinese cohort documented MINOCA in 6.3% of acute myocardial infarction presentations overall (1,11,14). Registry-based and contemporary cohort data have also suggested frequencies in the range of approximately 4% to 8%, depending on case selection and diagnostic workup (5,6,17). In contrast, the frequency in the present study is closer to or slightly higher than some South Asian observations, including the 13.5% prevalence reported from Western Nepal, and lower than one recent tertiary-care report that documented a substantially higher proportion, likely reflecting broader inclusion criteria and a different denominator population (2,12). These variations are plausible and likely relate to differences in study design, local referral patterns, angiographic interpretation, clinical thresholds for angiography, population risk profile, and the extent to which mimicking conditions are actively excluded.

The clinical significance of MINOCA lies in the fact that it is not a final etiologic diagnosis but rather a working syndrome that requires further characterization. Position papers and reviews have emphasized that mechanisms underlying MINOCA include plaque disruption, coronary vasospasm, coronary embolism, spontaneous coronary artery dissection, and microvascular dysfunction, all of which may produce myocardial necrosis without severe angiographic stenosis (3,9,16,19). This distinction is important because the therapeutic strategy and long-term prognosis may differ substantially according to the underlying cause. Consequently, identifying the frequency of MINOCA in local STEMI populations is more than an epidemiologic exercise; it also informs clinical vigilance and supports the need for more structured post-angiographic assessment in patients whose coronary anatomy appears non-obstructive despite a clear infarction phenotype.

The present findings also reinforce the importance of cautious interpretation of angiographic results in acute care settings. Patients with ST-segment elevation and elevated cardiac biomarkers are often managed under the assumption of an occlusive coronary event, yet the current data indicate that nearly one in six such patients in this cohort had non-obstructive coronary arteries. This proportion is clinically meaningful and suggests that institutions managing STEMI should maintain awareness that angiographic non-obstruction does not exclude myocardial infarction. Rather, such cases warrant careful reassessment to identify the most likely ischemic mechanism and to exclude other causes of myocardial injury. The manuscript source also noted a statistically significant association of MINOCA with age and gender; however, because subgroup counts and exact p-values were not available in the shared numerical extract, those associations should be interpreted conservatively until fully displayed in the final results tables.

This study should be interpreted in light of several limitations. It was conducted at a single tertiary care center, which may limit generalizability to broader populations. The cross-sectional design appropriately estimates frequency but does not permit longitudinal evaluation of recurrence, treatment patterns, or mortality. In addition, MINOCA was defined angiographically using a threshold of less than 50% stenosis together with exclusion of conditions mimicking infarction, but the shared manuscript extract does not detail whether adjunctive tools such as intravascular imaging or cardiac magnetic resonance imaging were systematically used. As emphasized in contemporary guidance, incomplete etiologic workup may leave residual diagnostic uncertainty in some cases of suspected MINOCA (3,19). Despite these limitations, the study contributes valuable local evidence by documenting a substantial burden of MINOCA among STEMI patients in a setting where published data remain limited.

CONCLUSION

Myocardial infarction with non-obstructive coronary arteries was identified in 16.2% of patients presenting with ST-segment elevation myocardial infarction in this tertiary care cohort, indicating that it constitutes a clinically important subgroup within the STEMI population. These findings support the need for careful post-angiographic evaluation in STEMI patients without significant coronary obstruction so that underlying ischemic mechanisms can be recognized more accurately and subsequent management can be better individualized.

REFERENCES

1. Abdu FA, Liu L, Mohammed AQ, Luo Y, Xu S, Auckle R, et al. Myocardial infarction with non-obstructive coronary arteries (MINOCA) in Chinese patients: Clinical features, treatment and 1 year follow-up. Int J Cardiol. 2019.

2. Abubakar S, Ahmed F, Fatima F, Batool N, Sikandar F, Saher S. Frequency and outcome of myocardial infarction with non-obstructive coronary arteries (MINOCA) at tertiary care hospital. IJBR. 2025.

3. Agewall S, Beltrame J, Reynolds H, Niessner A, Rosano G, Caforio A, et al. ESC working group position paper on myocardial infarction with non-obstructive coronary arteries. Eur Heart J. 2016.

4. Andishmand A, Emami Meybodi M, Namayandeh SM, Mohammadi HR, Andishmand M, Zarbakhsh M, et al. Comparison between myocardial infarction with non-obstructive coronaries (MINOCA) and myocardial infarct patients with coronary artery disease (MI-CAD): a single-center retrospective cohort study. Caspian J Intern Med. 2024;15(1).

5. Bainey K, Welsh R, Alemayehu W, Westerhout C, Traboulsi D, Anderson T, et al. Population-level incidence and outcomes of myocardial infarction with non-obstructive coronary arteries (MINOCA): Insights from the Alberta contemporary acute coronary syndrome patients invasive treatment strategies (COAPT) study. Int J Cardiol. 2018.

6. Dees D, Rahimi F, Amann M, Nührenberg TG, Löffelhardt N, Schmitz R, et al. Prevalence and causes of myocardial infarction with non-obstructive coronary arteries in a contemporary cohort of patients with suspected myocardial infarction. J Clin Med. 2021;10(21):5188.

7. Dicusar O, Dumanschi C, Ivanov V, Ciobanu L, Popovici I, Munteanu M, et al. Clinical features in patients with non-ST-segment elevation myocardial infarction with nonobstructive coronary arteries. Bull Acad Sci Mold Med Sci. 2024.

8. Ferrari GMD, Fox K, White JA, Giugliano R, Tricoci P, Reynolds H, et al. Outcomes among non-ST-segment elevation acute coronary syndromes patients with no angiographically obstructive coronary artery disease: observations from 37,101 patients. Eur Heart J Acute Cardiovasc Care. 2014.

9. Foà A, Canton L, Bodega F, Bergamaschi L, Paolisso P, Vita AD, et al. Myocardial infarction with nonobstructive coronary arteries: from pathophysiology to therapeutic strategies. J Cardiovasc Med. 2023.

10. Gabaldón-Pérez A, Bonanad C, García-Blas S, Marcos-Garcés V, D'Gregorio JG, Fernández-Cisnal A, et al. Clinical predictors and prognosis of myocardial infarction with non-obstructive coronary arteries (MINOCA) without ST-segment elevation in older adults. J Clin Med. 2023.

11. Gue Y, Corballis N, Ryding A, Kaski J, Gorog DA. MINOCA presenting with STEMI: incidence, aetiology and outcome in a contemporaneous cohort. J Thromb Thrombolysis. 2019.

12. Kafle RC, Jha GS, Sharma D, Alurkar VM. Prevalence of myocardial infarction with non-obstructive coronary arteries in Western Nepal. Nepalese Heart J. 2020;17(2):39-42.

13. Khaniukov O, Sapozhnychenko L, Samilyk MV, Perepelytsia KD. Management of patients with myocardial infarction and nonobstructive coronary arteries: literature review and own data. Ukrainian Therapeutical Journal. 2021.

14. Kumar J, Kumar R, Armstrong R, Murphy R, Daly C. Incidence and prevalence of MINOCA (myocardial infarction with non-obstructive coronary arteries) in STEMI patients: experience from Irish tertiary care centre. Brian Maurer young investigator award finalists 2021. 2021.

15. Pasupathy S, Air T, Dreyer R, Tavella R, Beltrame J. Systematic review of patients presenting with suspected myocardial infarction and nonobstructive coronary arteries. Circulation. 2015.

16. Pasupathy S, Tavella R, Beltrame JF. Myocardial infarction with nonobstructive coronary arteries (MINOCA). Circulation. 2017;135(16):1490-3.

17. Rakowski T, De Luca G, Siudak Z, Plens K, Dziewierz A, Kleczyński P, et al. Characteristics of patients presenting with myocardial infarction with non-obstructive coronary arteries (MINOCA) in Poland: data from the ORPKI national registry. J Thromb Thrombolysis. 2018.

18. Solsi A, Gandhi DD. An unusual case of ST elevation myocardial infarction in angiographically non-obstructed coronary arteries. Cureus. 2021.

19. Tamis-Holland J, Jneid H, Reynolds H, Agewall S, Brilakis E, Brown T, et al. Contemporary diagnosis and management of patients with myocardial infarction in the absence of obstructive coronary artery disease: a scientific statement from the American Heart Association. Circulation. 2019.

20. Vidal-Pérez R, Casas CAJ, Agra-Bermejo R, Alvarez-Alvarez B, Grapsa J, Fontes-Carvalho R, et al. Myocardial infarction with non-obstructive coronary arteries: a comprehensive review and future research directions. World J Cardiol. 2019.