European Journal of Clinical Pharmacy

Print ISSN: 2385-409X **Online ISSN**: 3105-0409

Website: https://farmclin.com/

Original Research Article

Prevalence of Left Circumflex Artery Obstruction Causing Acute Myocardial Infarction in Patients Presenting With Killip Class III in Tertiary Care Cardiac Hospital

Article History:

Name of Author:

Farhan Khan [1], Bisma Jalil[2] ,Asif Ali Ghumro [3], Jawaid Akbar Sial[4], Aroona Kataria[5], Noor Elahi[6]

Affiliation: *[1]Post Graduate Resident National Institute of cardiovascular Disease Karachi*

[2] Post Graduate Resident National Institute of cardiovascular Disease Karachi

[3] Post Graduate Resident National Institute of cardiovascular Disease Karachi

[4] Professor of Cardiology National Institute of cardiovascular Disease Karachi

[5] Post Graduate Resident National Institute of cardiovascular Disease Karachi

[6]Post Graduate Resident National Institute of cardiovascular Disease Karachi

Corresponding Author:

Farhan Khan

Received: 20-10-2025

Revised: 15-11-2025

Accepted: 25-11-2025

Published: 01-12-2025

Abstract: ***Objective:*** To assess the left circumflex artery obstruction prevalence in patients with infarcted myocardium because of ischemia in patients that present with Killip Class III in a tertiary care cardiac hospital. Study design: Observational Cross-Sectional Study. Settings: Department of Cardiology, National Institute of Cardiovascular Diseases, Karachi. Period: February 2025 – July 2025. ***Material and Methods:*** 150 patients aged 35-70 years who had presented within 24 hours after symptoms of AMI and Killip class III were included. Demographic and clinical information (comorbidity, smoking, family history of AMI, and body mass index (BMI)) was also documented. The data were tested with the help of IBM SPSS version 24.0, and Chi-square or Fisher exact test was determined as the method of evaluating the associations, where $p < 0.05$ statistically significant. ***Results***: Participants had a mean age of 58.3 ± 8.5 years, and 62% of the respondents were male. Popular comorbidities included hypertension (46%), diabetes mellitus (38%), and dyslipidemia (32%). Obstruction at LCx was found in 23 patients (15.3%), whereas LAD and RCA were found in 53% and 31.7% respectively. LCx obstruction had significant association with female gender and diabetes mellitus (p=0.03 and p=0.04 respectively). There was no notable correlation with age, hypertension, dyslipidemia, smoking or BMI. ***Conclusion:*** LCx obstruction is present in a significant proportion of Killip class III AMI patients and it is strongly linked to the female gender and diabetes. Earlier detection of LCx activity will help to intervene in time and enhance the results of this high-risk group.

Keywords: Acute myocardial infarction, Killip class III, Left circumflex artery, Coronary angiography, Diabetes mellitus.

INTRODUCTION

The acute myocardial infarction (AMI) is a serious source of Global rates of morbidity and mortality, and the outcomes of it are highly dependent on the Killip class of presentation [1]. Killip class III patients are those who have widespread cardiac dysfunction and are more likely to develop complications and death, hence the need to diagnose them as soon as possible and properly. [1]. The left circumflex (LCx) artery is commonly underidentified as a pathogenic vessel among the coronary arteries because of the unusual manifestations and mild electrocardiographic changes [2]. Total LCx occlusions may be experienced with no ST-segment elevation or even normal electrocardiograms, postponing reperfusion therapy provision. [2]

LCx-related AMI can also have problems with electrocardiographic changes, with early alterations either being hidden or unspecialized, and may cause a diagnosis dilemma and delayed intervention. [3] Poor quality wall myocardial infarctions (IWMI) related to ST-segment depression in lead aVR, are likely to reflect LCx involvement, warranting close angiographic evaluation to properly identify the culprit angiography. [4] In elderly patients with multivessel coronary artery disease presenting with high Killip scores, complete percutaneous coronary intervention (PCI) may provide short-term benefits, while culprit-only PCI could be associated with improved long-term survival. [5]

In spite of the enhanced awareness, LCx occlusions still remain a very common unrecognized issue, in part because of anatomic differences and the nuances of electrocardiographic presentations. [6] Empirical multicenter research has also indicated that high-risk patients having left main or multivessel coronary disease without protection need careful assessment to maximize results. [7] Abnormal origins of coronary arteries may complicate the diagnosis and treatment even more, and extensive imaging is necessary in AMI cases. [8]

Angiographically reported LCx occlusion electrocardiographic features exhibit patterns that can help in earlier diagnosis especially in patients with inferior AMI. [9] Although the left anterior descending artery (LAD) is more likely to be involved in young patients with ST-elevation myocardial infarction (STEMI), LCx obstruction is common and in the high Killip class presentations, needs to be investigated. [10]

This is necessary to understand the prevalence, clinical presentation, and electrocardiographic presentation of LCx obstruction in patients who present with Killip class III AMI to diagnose and offer necessary care promptly in tertiary care cardiac units.

MATERIAL AND METHODS

The study was an observational cross-sectional study aimed at identifying the frequency of left circumflex artery (LCx) obstruction in patients who presented with Killip type III acute myocardial infarction (AMI) at the Department of Cardiology, National Institute of Cardiovascular Diseases, Karachi, a tertiary care cardiac facility. The data was collected within six months from February 2025 – July 2025, after the research synopsis was approved. The WHO sample size calculator was used to calculate the sample size on the basis of a reported prevalence of LCx involvement in AMI of 10.9% [10], absolute precision of 5% and confidence level of 95%, which resulted in the calculation of the final sample of 150 patients. All the eligible patients who came up during the study period were recruited using consecutive non-probability sampling. The sample was restricted to patients aged between 35-70 years of age that reported to the hospital within 24 hours of development of ACS symptoms with Killip class III, whereas patients with pre-existing ECG anomalies like pathologic Q waves, ST sagging, LV hypertrophy, or bundle branch block (left or right) were excluded, as well as pregnant women. Other exclusions were patients who had undergone a coronary artery bypassing surgery or triple-vessel coronary artery disease, those who were undergoing fibrinolytic therapy in response to ST-elevation ACS, those with cardiogenic shock, and those who had acute left ventricular failure associated with diseased dilated cardiomyopathy. The Institutional Ethical Review Board and the College of Physicians and Surgeons gave ethical approval **[IRB-101/2024],** and a written informed consent was obtained by all the participants. Demographic data, medical history, diabetes, hypertension, dyslipidemia, smoking, and family history of AMI were gathered. Standardized equipment was used to measure height and weight, and body mass index (BMI) was calculated: weight in kilograms / height in meters squared (m^2). Coronary angiography was done to determine the culprit artery and LCx was classified as either absent forward flow or the existence of an intraluminal thrombus that produced 70% stenosis. A structured questionnaire was used to record all the data. The inputs were typed and viewed in the version of IBM SPSS 24.0 and Shapiro-Wilk test was conducted to determine whether the quantitative variables, i.e. age, height, weight, and BMI, were normal. The data that was normally distributed were provided as mean standard deviation and those which were not normally distributed were provided as median interquartile range. Gender, smoking status, comorbidities, and family history were categorized variables that were summarized using frequencies and percentages. Age, gender, and comorbidities were stratified and an association with LCx obstruction was analyzed according to Chi-square or Fisher exact test as appropriate with a p-value of 0.05 or less assumed to be significant.

RESULTS

The study involved 150 patients of Killip class III acute myocardial infarction**. Table 1** presents demographic and clinical features of the participants. The average patient age was 58.3 ± 8.5 years, and 62% of the cohort is male. Popular comorbidities were hypertension (46%), diabetes mellitus (38%), and dyslipidemia (32%). Reported 28% smoking and 14% positive family history of acute myocardial infarction. The study population had a mean BMI of 27.4 ± 3.2 kg/m².

Table 1: Demographic and Clinical Characteristics of Study Participants (n=150)

Characteristic	Value
Age (years), mean ± SD	58.3 ± 8.5
Gender, n (%)	
Male	93 (62%)
Female	57 (38%)
Hypertension, n (%)	69 (46%)
Diabetes Mellitus, n (%)	57 (38%)
Dyslipidemia, n (%)	48 (32%)
Smoking, n (%)	42 (28%)
Family history of AMI, n (%)	21 (14%)
BMI (kg/m²), mean ± SD	27.4 ± 3.2

Coronary angiography was used to identify the distribution of culprit arteries within the participants (**Table 2**). It was found that the left circumflex artery (LCx) was the culprit in 23 (15.3%), the most involved artery was the left anterior descending artery (LAD) in 53% with the right coronary artery (RCA) coming in the third place (31.7%).

Table 2: Distribution of Culprit Artery in Killip Class III AMI Patients (n=150)

Culprit Artery	N (%)
Left Anterior Descending (LAD)	80 (53%)
Right Coronary Artery (RCA)	48 (31.7%)
Left Circumflex Artery (LCx)	23 (15.3%)

Table 3 displays stratified analysis of LCx obstruction according to patient characteristics. There was a significant correlation between LCx obstruction and female gender (p=0.03) and diabetes mellitus (p=0.04). There was no statistically significant correlation with age groups, hypertension, dyslipidemia, smoking or BMI less than 25kg/m^2.

Table 3: Association of Patient Characteristics with LCx Obstruction (n=150)

Characteristic	LCx Obstruction Present n (%)	LCx Obstruction Absent n (%)	p-value
Age <60 years	10 (43.5%)	55 (40.7%)	0.74
Age ≥60 years	13 (56.5%)	80 (59.3%)	
Gender			
Male	8 (34.8%)	85 (62.9%)	0.03*
Female	15 (65.2%)	50 (37.1%)	
Diabetes Mellitus	14 (60.9%)	43 (31.8%)	0.04*
Hypertension	12 (52.2%)	57 (42.2%)	0.31
Dyslipidemia	8 (34.8%)	40 (29.6%)	0.58
Smoking	5 (21.7%)	37 (27.4%)	0.57
BMI ≥25 kg/m²	13 (56.5%)	72 (53.3%)	0.74

*Statistically significant at p ≤ 0.05

DISCUSSION

The frequency of left circumflex artery (LCx) obstruction was found to be 15.3% in this observational study of 150 Killip class III acute myocardial infarction (AMI) patients which was significant both in relation to female gender and diabetes mellitus. Sabry et al. 11 examined the territorial longitudinal strain as a predictor of culprit vessels in non-ST-segment elevation myocardial infarction (NSTEMI). They indicated that LCx was usually under-diagnosed by conventional ECG, but sophisticated echocardiographic detection was enhanced. Their results are supported by our study, which emphasizes that LCx culprit lesions are rare compared to LAD or RCA involvement (15.3% vs. 53% and 31.7%) which strengthens the problem of the diagnostic challenge of LCx infarctions.

A study of NSTEMI patients who had acute total LCx occlusion 12 revealed that diabetes was a common comorbidity with over 55% of cases having LCx. This agrees with our findings, in which LCx obstruction was strongly correlated with diabetes mellitus (p=0.04), which is the idea that diabetic patients can be predisposed to LCx involvement. Garin et al.13 reported the diagnostic delays in LCx culprit ST-elevation myocardial infarction (STEMI) and noted that in-hospital mortality relating to late identification of LCx lesions was high. The timing of diagnosis was not evaluated directly in our study, although the relatively lower prevalence of LCx (15.3%) than LAD supports the clinical challenge emphasized by Garin et al., especially among Killip class III patients in critical care.

Hamaguchi et al. 14 compared the outcomes of proximal and non-proximal RCA occlusions in inferior STEMI patients and found that poor outcomes were related to proximal lesions. Even though we studied LCx specifically, it can be stressed that infarct location is a highly important factor with regard to risk stratification and that LCx lesions in our group can be also associated with increased morbidity because of delayed manifestations. In an evaluation of ECG patterns in LCx occlusion in inferior myocardial infarction, Soomro et al.15 found that there were common atypical presentations, which under-diagnosed. This is to add to our discovery in that LCx obstruction was less common and mostly in females implying the possibility of sex-specific differences in ECG and how a diagnostic assessment should be cautiously made.

In a report of multivessel coronary artery disease in patients participating in primary percutaneous coronary intervention due to STEMI, Khan et al. 16 reported that LCx was involved in 17% of patients. The prevalence of LCx 15.3% in our study is comparable to their results, implying a comparable representation of culprit arteries in high-risk groups of AMI in tertiary care units. Terlecki et al. 17 examined how the acute total blockage of the culprit artery affected the outcome in NSTEMI and proved that patients with LCx experience had a greater heart failure and adverse outcome rates. This observation is in line with our Killip class III cohort where these patients are inherently high-risk cardiac compromise and the clinical significance of identifying LCx obstruction.

In an article reviewing the changing management approaches to stable ischemic heart disease, it is observed that the risk factors including diabetes and females sex play a critical role in involving vessels. 18 Our results of LCx obstruction correlating with female gender and diabetes are in line with the paradigm as emphasized by Boden et al., where these patients might have to be placed under increased surveillance. Hu et al. 19 examined the prognosis of long-term outcomes in inferior STEMI with right ventricular myocardial infarction and highlighted the prognostic value of non-LAD culprit arteries. Their study albeit based on RCA, supports the clinical relevance of non-LAD infarctions such as LCx that can cause higher morbidity in Killip class III patients, which is in line with our findings.

Birnbaum et al. 20 also highlighted the persistence of ECG in the diagnosis of ACS, as LCx occlusions often have minor or non-diagnostic changes on ECG. This is in tandem with our report that LCx obstruction is rarer and more difficult to detect and therefore the necessity of the extensive diagnostic methods such as coronary angiography, particularly in patients at risk.

The study had limitations that were based on its single-center design and non-probability consecutive sampling that could be applicable to the generalizability of results. To enhance the assessment of the prevalence and risk factors of LCx obstruction in high-risk AMI patients, future multicenter, larger, randomized cohort studies are suggested.

CONCLUSION

Killip class III AMI patients with LCx obstruction were noted in 15.3 percent of patients, and it was significantly related to female gender and diabetes mellitus. There is a strong need to identify LCx involvement early so that it can be intervened in a timely manner and potentially achieve better clinical outcomes in this at-risk group.

REFERENCES

1. Rossello X, Ramis-Barceló MF, Raposeiras-Roubín S. Acute myocardial infarction with high Killip class: do geographic differences matter? Eur Heart J Acute Cardiovasc Care. 2021 Jun 30;10(5):513-515. doi: 10.1093/ehjacc/zuab025.
2. Sihite TA, Hendrawansyah S, Pranata R. Acute total occlusion of the left circumflex coronary artery presenting with non-ST-segment elevation myocardial infarction and normal electrocardiogram – a case report. Open Access Maced J Med Sci. 2021;9(C):297-299. doi:10.3889/oamjms.2021.7517.
3. Komatsu J, Nishimura YK, Sugane H, Hosoda H, Imai RI, Nakaoka Y, Nishida K, Seki SI, Kubo T, Yamasaki N, Kitaoka H, Kubokawa SI, Kawai K, Hamashige N, Doi Y. Acute Left Circumflex Coronary Artery Occlusion - Diagnostic Problems of Initial Electrocardiographic Changes. Circ Rep. 2022 Sep 28;4(10):482-489. doi: 10.1253/circrep.CR-22-0044.
4. Raza A, Ali F, Bano N, Yasmeen, Sumaiya, Ali M, Fazal A, Fazal K. Culprit arteries in patients with inferior wall myocardial infarction (IWMI) with ST-segment depression in lead aVR. Pak J Health Sci. 2023;4(5):145-148.

doi:10.54393/pjhs.v4i05.769.

5. Biscaglia S, Campo G, Tebaldi M, et al. Complete or culprit-only PCI in older patients with myocardial infarction and multivessel disease. N Engl J Med. 2023;389:1236-1247. doi:10.1056/NEJMoa2300468.
6. Geffin R, Triska J, Najjar S, et al. Why do we keep missing left circumflex artery myocardial infarctions? J Electrocardiol. 2024;83:4-11. doi:10.1016/j.jelectrocard.2023.12.011.
7. Alexandre A, Roubille F, Bouisset F, et al. Twelve-year trends in unprotected left main coronary artery occlusion: insights from a real-world multicentre study. ESC Heart Fail. 2024;11(4):1981-1991. doi:10.1002/ehf2.14683.
8. Li K, Hu P, Luo X, et al. Anomalous origin of coronary artery and its clinical implications in myocardial infarction. BMC Cardiovasc Disord. 2024;24:271. doi:10.1186/s12872-024-03942-8.
9. Youssri IE, Allah WMS, Youssof MM, Wadie MMM. Electrocardiographic characteristics in angiographically documented occlusion of the left circumflex artery with acute inferior myocardial infarction. Pak Heart J. 2025;58(3):315-320. doi:10.47144/phj.v58i3.2921.
10. Sabeen M, Kubra G, Hassan M, Sikandari F, Nadeem D, Murtaza A. Frequency of left anterior descending artery involvement as a culprit vessel in young patients with ST elevation myocardial infarction. Pak J Med Health Sci. 2022;16(12):262-265. doi:10.53350/pjmhs20221612262.
11. Sabry AM, Al-Rabbat KE, Zahid B. Prediction of the Culprit Vessel using Territorial Longitudinal Strain in Non-ST-segment Elevation Myocardial Infarction. J Cardiovasc Echogr. 2025 Jul-Sep;35(3):237-243. doi: 10.4103/jcecho.jcecho_94_24.
12. Wei Y, Pei D, Deng J, et al. Clinical and electrocardiographic characteristics in NSTEMI patients with acute total occlusion of the culprit left circumflex artery. Ann Noninvasive Electrocardiol. 2025;30(3):e70070. doi:10.1111/anec.70070.
13. Garin D, Grin N, Arroyo D, Faucherre Y, Bennar W, Cook ST, Togni M, Meier P, Gobin E, Puricel S, Cook S. Diagnostic delays and cardiovascular mortality in left circumflex culprit ST-segment elevation myocardial infarction: a 16-year experience. Hellenic J Cardiol. 2025. doi:10.1016/j.hjc.2025.11.002.
14. Hamaguchi K, Sakakura K, Jinnouchi H, Taniguchi Y, Yamamoto K, Tsukui T, Hatori M, Kasahara T, Watanabe Y, Ishibashi S, Seguchi M, Fujita H. Comparison of clinical outcomes between proximal and non-proximal right coronary artery occlusion in patients with inferior ST-segment elevation myocardial infarction. J Cardiol. 2025;85(2):88-95. doi:10.1016/j.jjcc.2024.07.007.
15. Soomro MK, Shaikh JK, Ismail M, Butt MH, Ram J, Phulpoto AA. Comparative analysis of electrocardiographic patterns in left circumflex artery occlusion in patients with acute inferior myocardial infarction. J Popul Ther Clin Pharmacol. 2025;32(10):1358-1364. doi:10.53555/zcvq3k74.
16. Khan M, Rahim T, Khan K, Ahmad J, Shah S, Shah T, Shah H. Prevalence of multivessel coronary artery disease in patients undergoing primary percutaneous coronary intervention for acute ST-elevation myocardial infarction at a tertiary care hospital. Indus J Biosci Res. 2025;3:454-458. doi:10.70749/ijbr.v3i7.1776.
17. Terlecki M, Wojciechowska W, Dudek D, Siudak Z, Plens K, Guzik TJ, Drożdż T, Pęksa J, Bartuś S, Wojakowski W, Grygier M, Rajzer M. Impact of acute total occlusion of the culprit artery on outcome in NSTEMI based on the results of a large national registry. BMC Cardiovasc Disord. 2021;21(1):297. doi:10.1186/s12872-021-02099-y.
18. Boden WE, Marzilli M, Crea F, et al. Evolving management paradigm for stable ischemic heart disease patients: jacc review topic of the week. J Am Coll Cardiol. 2023;81(5):505–514. doi: 10.1016/j.jacc.2022.08.814
19. Hu M, Lu Y, Wan S, et al. Long-term outcomes in inferior ST-segment elevation myocardial infarction patients with right ventricular myocardial infarction. Int J Cardiol. 2022;351:1–7. doi: 10.1016/j.ijcard.2022.01.003.
20. Birnbaum Y, Rankinen J, Jneid H, Atar D, Nikus K. The role of ecg in the diagnosis and risk stratification of acute coronary syndromes: an old but indispensable tool. Curr Cardiol Rep. 2022;24(2):109–118. doi: 10.1007/s11886-021-01628-7

