

ORIGINAL ARTICLE

Frequency of left mainstem disease in patients with unstable angina undergoing coronary angiography.

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ABSTRACT... Objective: To determine the frequency of left main stem disease (LMS) in patients presenting with unstable angina (UA) undergoing coronary angiography (CA). **Study Design:** Cross-sectional Study. **Setting:** Department of Cardiology, Rehmatul-lil-Alameen Postgraduate Institute of Cardiology, PESSI, Lahore. **Period:** 1st August 2025 to 31st January 2026. **Methods:** A total of 199 patients were enrolled in the study based on non-Probability consecutive sampling. The study population comprised all adult patients (aged ≥ 18 years; both genders) admitted to the cardiology department with a clinical diagnosis of unstable angina who subsequently underwent coronary angiography. The data was stratified (With LMS & without LMS disease) according to age, gender, BMI, duration of disease, family history, comorbidities (diabetes, hypertension & hyperlipidemia) and smoking status. Post-stratification chi-square test was applied to identify association between stratified groups. Statistical analysis was performed using SPSS Version 27. A p-value of ≤ 0.05 was considered statistically significant. **Results:** The mean age of the study population was 58.4 ± 10.2 years (range; 36-69 years). One hundred & thirty (65.3%) male; 69 (34.7%) females. The most common cardiovascular risk factor was hypertension, present in 110(55.3%) patients, followed by diabetes mellitus; 91(45.7%) patients, current smoking; 65(32.7%) patients, positive family history; 60(30.1%), dyslipidemia; 43(21.6%) & Obesity (BMI >30); 39(19.6%) patients. Patients with LMS disease were significantly older with 86.9% having age >50 years ($p < 0.001$). Additionally, the prevalence of diabetes 69.6% vs 42.6 %; $p = 0.027$), positive family history (65.2% vs 19.8 %; $p < 0.001$), hyperlipidemia (43.8% vs 18.7%; $p = 0.015$), duration of disease >10 years (78.3% vs. 21.6%; $p < 0.001$) and concomitant multi-vessel disease (78.3% vs. 21.6%; $p < 0.001$) was significantly higher among patients with LMS disease. **Conclusion:** This study demonstrates that left main stem (LMS) disease is present in a clinically significant proportion of patients presenting with unstable angina (UA) who undergo coronary angiography. The frequency observed in this study (11.5%) underscores the importance of maintaining a high index of suspicion for LMS involvement in this high-risk patient population.

Key words: Coronary Angiography (CA), Left Main Stem Disease (LMS), Unstable Angina (UA).

Article Citation: Latif A, Qureshi AE, Najeeb Ullah, Ch FA, Shafique MU, Anum H. Frequency of left mainstem disease in patients with unstable angina undergoing coronary angiography. Professional Med J 2026; 33(10):1945-1953. <https://doi.org/10.29309/TPMJ/2026.33.10.10554>

INTRODUCTION

Coronary artery disease (CAD) remains a leading cause of mortality and morbidity worldwide, particularly rising in developing countries due to urbanization, smoking, and dietary changes.^{1,2} In Pakistan, approximately 1 in 5 middle-aged adults may have underlying CAD.³ Significant CAD is defined as more than 50% luminal narrowing of the left main coronary artery (LMCA) or more than 70% luminal narrowing of any major epicardial artery over 2 mm in diameter.^{4,5} Among patients undergoing coronary angiography, 4-6% present with significant LMCA disease, which is frequently associated with multivessel CAD and particularly prevalent among those with unstable angina. Patients with significant LMCA disease and unstable angina

have a poor prognosis with medical management alone but benefit from early intervention.^{5,6} Despite some clinical indicators such as symptoms, ECG changes, and ischia on noninvasive testing, reliable non-invasive prediction of LMCA disease remains difficult, making coronary angiography the definitive diagnostic method.^{7,8}

In a study conducted by Iqbal et al. investigating patients with acute coronary syndrome they found that the mean age of the 246 patients was 52.42 ± 9.39 years and 190 (77.2%) of the patients had had Left Main Coronary Artery Disease. Notably, 13.82% (34) of the patients were diagnosed with unstable angina and among these 34 patients, 50% (17) had left main coronary artery disease (LMCAD)

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Article received on:

09/04/2026

Accepted for publication:

18/06/2026



as confirmed by coronary angiography.⁹ According to Hussain et al., the incidence of left main coronary artery (LMCA) disease was found to be 10.5% in their study, with the average age of affected patients being 54.98 years. Their findings highlight that the prevalence of LMCA disease is significantly high, contributing to increased morbidity and mortality among patients with coronary artery disease (CAD).⁶ According to Hashmani et al., in a study involving 248 patients with a mean age of 49.39 ± 7.23 years, the majority were male (80.6%) while 19.4% were female. Notably, 37.1% of these patients were found to have left main stem disease.¹⁰

The rationale of the current study is to address the need for data on the frequency of left main stem disease (LMSD) specifically in patients presenting with unstable angina, given that existing studies predominantly focus on the broader category of acute coronary syndrome. This study set out to address a gap in what we know by measuring just how often left main stem disease shows up in this high-risk group—patients who often need a more aggressive approach to get the best outcomes. Getting a clearer sense of how common LMS disease is among people with unstable angina matters. It helps us better assess risk, make smarter treatment decisions, and ultimately manage patients more effectively—with the potential to reduce the serious complications and deaths that can come with this severe form of coronary artery disease.

METHODS

This was a descriptive, cross-sectional study conducted at Department of Cardiology, Rehmatul-Lil-Alameen postgraduate institute of cardiology (RAIC), PESSI, Lahore from 1st August, 2025 to 31st January, 2026 (six months). The study aimed to determine the frequency of left main stem (LMS) disease among patients presenting with unstable angina (UA) who underwent coronary angiography.

The study population comprised all adult patients (aged ≥ 18 years) admitted to the cardiology department with a clinical diagnosis of unstable angina who subsequently underwent coronary angiography during the study period. Non-Probability consecutive sampling technique was applied.

The sample size of 199 was calculated using the WHO sample size calculator keeping a 95% confidence level, 9% absolute precision and 50% expected frequency of Left main coronary artery disease in patients with unstable angina.

DEFINITIONS

Unstable Angina (UA)

Patients with newly-onset chest pain occurring at rest or with minimal exertion, and exhibiting severity, prolonged duration, or frequent episodes were labelled as having unstable angina. The ECG in unstable angina may show hyperacute T-wave, flattening of the T- waves, inverted T-waves, and ST depression without rise in cardiac enzymes (Trop I or CK-MB).

Left Main Stem Disease (LMS)

It will be defined as the presence of more than 50% luminal narrowing in the left main coronary artery (LMCA) detected during coronary angiography (by visual assessment).^{4,5}

Diabetes Mellitus

Diagnosed as fasting plasma glucose ≥ 126 mg/dL or haemoglobin A1c (HbA1c) $\geq 6.5\%$.

Hypertension

Diagnosed as systolic blood pressure ≥ 140 mmHg and diastolic blood pressure ≥ 90 mmHg.

Body Mass Index (BMI)

Calculated by the formula: $BMI = \text{weight (in kg)} / \text{height (in meters)}^2$, categorized as underweight (< 18.5), normal (18.5 - 24.9), overweight (25 - 29.9), or obese (≥ 30).

Hyperlipidemia

Total cholesterol level of 200 mg/dL or higher, or an LDL cholesterol level of 130 mg/dL or higher or Triglycerides > 150 mg/dl.

Positive family history for CAD

First degree relative (male < 55 years; female < 65 years) with coronary artery disease.

Inclusion Criteria

Patients were included if they met the following criteria:

- Patients aged 18 to 70 years
- Both males and females.
- Presenting with unstable angina
- Undergoing their first diagnostic coronary angiography during the index hospitalization.

Exclusion Criteria

- Prior history of coronary intervention
- Valvular heart disease
- Cardiomyopathies
- Renal dysfunction
- Pregnancy and lactation

Data Analysis

After approval from the hospital Institutional review board & ethical committee-IRB&EC (RAIC PESSI/Estt/2024/506; Dated: 10-08-2024) and College of Physicians & Surgeons Pakistan-CPSP (Ref No: CPSP/REU/CRD-2023-274-3129 Dated: March 12, 2025), informed consent was taken from all the patients. Basic demographic information including name, age, gender, duration of disease, height, weight for calculating body mass index (BMI), comorbidities such as diabetes mellitus, hypertension, and other conditions, along with smoking status, were documented. All patients underwent standard 12-lead electrocardiography and routine laboratory investigations, including cardiac biomarkers (troponin I or CK-MB), on admission.

Coronary angiography was conducted for all enrolled patients following admission, during index hospitalization, performed by a senior consultant cardiologist with a minimum of five years of post-fellowship experience, using standard Judkins technique on Toshiba-Infinix-VFI angiography machine. Radial route was the priority, with 181 patients having coronary angiography done through right radial route while 18 patients underwent coronary angiography through right femoral route. All patients were assessed pre-procedure by the consultant cardiologist carrying out the procedure. Hemodynamic status was documented. Multiple projections were obtained during the procedure (keeping an eye on hemodynamic status & symptoms) to adequately visualize the coronary arteries. Non-ionic, low-osmolar contrast media were used. Angiographic data were analyzed by

two independent interventional cardiologists who were blinded to the patients' clinical details. In case of disagreement, a consensus was reached with a third senior cardiologist.

Diagnosis of left main stem disease was established based on the presence of more than 50% luminal narrowing in the left main coronary artery (LMCA). All data was recorded using a predefined data collection form. Patient confidentiality was maintained throughout the data collection and analysis process.

Statistical Analysis

The collected data was entered and analyzed using SPSS version 27.0. Numerical variables, such as age, height, weight, BMI, and duration of disease, were presented as mean and standard deviation. Categorical variables, including gender, comorbidities, smoking status, and presence of left main stem disease, were presented as frequency and percentages. The data was stratified according to age, gender, BMI, duration of disease, comorbidities and smoking status. Post-stratification chi-square test was applied to identify an association of stratified groups with the presence of left main stem disease. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 199 patients with a diagnosis of unstable angina were enrolled in the study during the period from 1st August, 2025 to 31st January, 2026. All patients met the inclusion criteria, and none were excluded due to incomplete data.

The mean age of the study population was 58.4 ± 10.2 years, ranging from 36-69 years. Of the total patients, 130 (65.3%) were male, and 69 (34.7%) were female.

The baseline demographic and clinical characteristics of the study population are summarized in Table-I. The most common cardiovascular risk factor was hypertension, present in 110(55.3%) patients, followed by diabetes mellitus 91(45.7%) patients, current smoking 65(32.7%) patients, positive family history 60(30.1%), dyslipidemia 43(21.6%) & Obesity (BMI>30) 39(19.6%) patients.

Coronary angiography was successfully performed in all patients. The primary outcome of this study was the frequency of left main stem (LMS) disease, defined as $\geq 50\%$ luminal stenosis. LMS disease was identified in 23(11.5%) patients among patients with LMS disease, the pattern of involvement was as follows: isolated LMS disease (without other vessel involvement) was observed in 01(4.3%) patients, LMS disease (with single vessel involvement) was observed in 04(17.4%) patients while LMS disease in combination with multi-vessel disease was observed in the remaining 18(78.3%) patients. Regarding the location of LMS lesions, ostial lesions accounted for 07(30.4%) mid-shaft lesions accounted for 03(13.04%) and distal bifurcation lesions accounted for 13(56.5%) of cases.

A comparative analysis of baseline characteristics between patients with and without LMS disease was performed (Table-II). Patients with LMS disease were significantly older with 20 out of 23 patients having age greater than 50 years ($p < 0.001$). Additionally, the prevalence of diabetes 69.6% vs 42.6 %; $p = 0.027$), positive family history (65.2% vs 19.8 %; $p < 0.001$), hyperlipidemia (43.8% vs 18.7%; $p = 0.015$), duration of disease > 10 years (78.3% vs. 21.6%; $p < 0.001$) and concomitant multi-vessel disease (78.3% vs. 21.6%; $p < 0.001$) was significantly higher among patients with LMS disease compared to those without LMS.

In summary, the frequency of left main stem disease in patients with unstable angina undergoing coronary angiography was 11.5%. Patients with LMS disease were more likely to be older, diabetic, hyperlipidemia, with positive family history, long duration of coronary artery disease and having multi-vessel coronary artery disease compared to those without LMS involvement.

TABLE-I

Baseline characteristics of study population

Characteristic	Frequency (n)	Percentage (%)
Age		
Age > 50 years	79	39.7
Age > 50 years	120	60.3
Gender		
Male	130	65.3
Female	69	34.7
Risk Factors		
Diabetes	91	45.7
Hypertension	110	55.3
Smoker	65	32.7
Positive Family history	60	30.1
Dyslipidemia	43	21.6
Obesity-BMI > 30	39	19.6
Duration of Disease > 10 years	54	27.1

TABLE-II

Comparison between patients with and without LMS disease

	Total Number (199)	With LMS Disease (23)	Without LMS Disease (176)	P-Value
Age > 50 years	79	20 (86.9%)	59 (33.5%)	<0.001
Male	130	18 (78.2%)	112 (63.6%)	0.249
Female	69	07 (30.4%)	62 (35.2%)	0.249
Diabetic	91	16 (69.6%)	75 (42.6%)	0.027
Hypertensive	110	14 (60.9%)	96 (54.5%)	0.726
Smoker	65	11 (47.8%)	54 (30.7%)	0.158
Positive Family History	60	15 (65.2%)	35 (19.8%)	<0.001
Hyperlipidemia	43	10 (43.8 %)	33 (18.7%)	0.015
Obese BMI > 30	39	07 (30.4%)	32 (18.1%)	0.266
Duration of disease > 10 years	54	14 (60.9%)	40 (22.7%)	<0.001
Concomitant Multi Vessel Disease	56	18 (78.3%)	38 (21.6%)	<0.001

DISCUSSION

This cross-sectional study was conducted to determine the frequency of left main stem (LMS) disease in patients presenting with unstable angina (UA). The key finding of this study is that LMS disease, defined as $\geq 50\%$ luminal stenosis, was present in 11.5 % of the study population. This finding highlights just how critical it is to recognize left main stem involvement in patients with unstable angina. For these individuals, LMS disease signals a high-risk anatomical situation that demands quick risk assessment and often drives the decision around revascularization.

The 11.5% rate observed in this study aligns well with what previous research has shown in similar groups. Earlier angiographic studies have put the prevalence of significant LMS disease somewhere between 3% and 8% in stable angina patients, and between 10% and 15% in those with acute coronary syndromes. One large registry of over 20,000 patients, for instance, reported rates of about 5.5% in stable angina and 8.9% in acute coronary syndromes.¹¹ Another study focusing on unstable angina found a frequency of 7.2%, with even higher rates among patients who had multi-vessel disease.¹² These differences from one study to the next aren't surprising—they likely stem from variations in how patients were selected, how significant stenosis was defined (some use $\geq 50\%$, others $\geq 70\%$), regional differences in the burden of coronary artery disease, and differences in risk factor profiles across populations.

The fact that a meaningful number of unstable angina patients turn out to have LMS disease carries real clinical weight. The left main artery supplies about 75% of the heart muscle in people with left-dominant circulation, so a significant narrowing here puts patients at serious risk for major adverse events—heart attack, cardiogenic shock, even sudden cardiac death.¹³ The presence of LMS disease in the setting of unstable angina further amplifies this risk due to the underlying plaque instability and dynamic nature of the stenosis.¹⁴

In this study, patients with LMS disease were significantly older and more likely to be diabetic, hyperlipidemic and with positive family history

compared to those without LMS involvement. This observation aligns partially with well-established epidemiological data indicating that advanced age and male sex are independent predictors of left main and multi-vessel coronary artery disease.¹⁵ In our study, there was no significant difference regarding gender. The higher prevalence of diabetes mellitus and hyperlipidemia among patients with LMS disease in this cohort is also consistent with previous reports, as these risk factors are known to accelerate the progression of atherosclerosis and are frequently associated with more diffuse and complex coronary artery disease patterns.^{16,17}

The strong association between LMS disease and multi-vessel coronary artery disease observed in this study (78.3%) is noteworthy. This finding fits with what we know about left main disease—it rarely shows up on its own.¹⁸ Instead, it's usually a sign of advanced, widespread atherosclerosis throughout the coronary arteries. That pattern of diffuse disease matters when it comes to treatment. These patients often need more complete revascularization, which typically means coronary artery bypass surgery rather than stenting, to achieve the best possible outcomes.¹⁹

The demographic characteristics of patients with LMS disease in this study partially mirror those reported in major revascularization trials. In the SYNTAX (Synergy Between PCI with Taxus and Cardiac Surgery) trial, which compared PCI versus CABG in patients with left main or three-vessel disease, the mean age of participants was approximately 65 years, with a predominance of males (76%) and a high prevalence of hypertension (76%) and diabetes (31%).²⁰ Similarly, the EXCEL (Evaluation of XIENCE versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization) trial, which specifically examined patients with left main disease, reported comparable risk factor profiles, with a mean age of 66 years, 77% male, 74% hypertension, and 29% diabetes.²¹ These findings reinforce the lack of complete consistency of these demographic characteristics across different populations and geographic regions.

The frequency of LMS disease observed in this study is also comparable to data from Asian populations.

A study by Park et al. from Korea reported a LMS disease prevalence of 6.8% in patients with acute coronary syndromes undergoing angiography.²² A study from Pakistan by Khan and colleagues reported similar numbers, finding left main stenosis in 5.9% of patients who presented with unstable angina.²³ What this suggests is that the rate of left main involvement in South Asian and East Asian populations aligns closely with what's been seen in Western studies—underscoring that LMS disease is a global public health concern, not limited to any one region.

The identification of LMS disease in patients with unstable angina has profound clinical implications. Current clinical practice guidelines from the American College of Cardiology/American Heart Association (ACC/AHA) and the European Society of Cardiology (ESC) recommend that patients with significant LMS disease and unstable angina or non-ST-elevation acute coronary syndrome undergo urgent revascularization.^{24,25} CABG has traditionally been the standard of care for left main disease, offering survival benefits particularly in patients with concomitant multi-vessel disease, diabetes, or complex coronary anatomy.²⁶ However, with advancements in stent technology and interventional techniques, PCI has emerged as a viable alternative in selected patients with less complex left main anatomy (low SYNTAX scores) and those at high surgical risk.²⁷

The findings of this study underscore the importance of maintaining a high index of suspicion for LMS disease in patients presenting with unstable angina, particularly those with multiple risk factors, advanced age, long duration of disease and evidence of multi-vessel disease on non-invasive testing. Early identification through timely coronary angiography allows for appropriate risk stratification, informed decision-making regarding revascularization strategy, and optimization of medical therapy, all of which contribute to improved patient outcomes.²⁸

It's worth considering what's actually happening biologically in patients with left main stem disease and unstable angina. Unstable angina usually stems from a plaque that ruptures, erodes, or develops a clot on top of existing atherosclerosis.²⁹ When that

process unfolds in the left main artery, the stakes are especially high—this vessel supplies a large portion of the heart muscle, so any disruption can have serious consequences.

Imaging studies using intravascular ultrasound (IVUS) have shown that left main lesions in people with acute coronary syndromes often have telltale signs of instability: positive remodeling, a heavy plaque burden, and the kind of thin, fragile cap that's prone to rupture.³⁰ In these patients, significant LMS narrowing likely reflects either a long-standing plaque that has recently become unstable, or—less often—an acute disruption happening within the left main artery itself.³¹

The fact that multi-vessel disease was common in this study points to an important pattern: when LMS disease shows up in patients with unstable angina, it's usually part of widespread atherosclerosis rather than an isolated problem.

LIMITATIONS

It's important to be upfront about the study's limitations. For starters, this was a single-center study, so the findings may not apply more broadly to populations with different backgrounds or clinical approaches. The assessment of left main stem narrowing relied mostly on visual estimates by interventional cardiologists. While that's how things are done in everyday practice, it can vary from one doctor to the next and isn't always as precise as quantitative measurements (QCA) or intravascular imaging like intravascular ultrasound (IVUS) — especially in left main lesions, where tricky spots like the ostium or bifurcation can make accurate judgment difficult.^{32,33}

The study also didn't track clinical outcomes—things like in-hospital deaths, major cardiovascular events, or how patients fared after revascularization—so it can't speak to the long-term significance of LMS disease in this group. Similarly, there was no data on whether patients underwent bypass surgery or stenting, or how those procedures turned out, which would have added valuable context. The sample size was relatively small, and the study didn't make use of angiographic scoring systems like the SYNTAX score, which could have helped capture the overall

complexity of the coronary disease and made it easier to compare findings with major trials.³⁴

That said, the study does have real strengths. It focused on a clearly defined group of patients with unstable angina, using widely accepted diagnostic criteria, which strengthens the validity of the findings.³⁵ Including consecutive patients who underwent angiography during the study period helped reduce selection bias. Having two experienced interventional cardiologists independently review the angiograms and agree on the findings added a layer of reliability to the assessments. Importantly, the study offers contemporary data on left main stem disease in a region where such information has been scarce—adding something meaningful to the existing literature and offering practical insights for local clinical practice.

CONCLUSION

This study found that a significant number of people with unstable angina who undergo angiography have left main stem disease—about 11.5% in this case. That's a high enough rate to remind clinicians to always keep LMS disease on their radar in this vulnerable group.

Because significant LMS narrowing often calls for quick action—usually bypass surgery or, in some cases, high-risk stenting—catching it early on an angiogram is crucial. It helps doctors assess the level of risk and move forward with potentially lifesaving treatment without delay.

Looking ahead, more research is needed. Large, multicenter, prospective studies would help give a clearer picture of how common LMS disease is among unstable angina patients and what factors predict it, especially across different populations. Using advanced imaging could also allow for a better understanding of how severe the blockages are, what the plaque looks like, and whether there are high-risk features like rupture-prone plaques.³⁵ Long-term follow-up studies are essential to understand how LMS disease affects outcomes over time. Finally, comparing outcomes between CABG and stenting—taking into account both the complexity of the anatomy and patients' overall health—would offer valuable guidance for treatment

decisions.³⁶

ACKNOWLEDGEMENT

This study does not involve any personal, financial, or other conflicts of interest.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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