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Frequency of Severe Single Vessel Coronary Artery Disease in Patients with Unstable Angina

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ABSTRACT

Background: Unstable angina (UA) is a high-risk manifestation of coronary artery disease (CAD) requiring early risk stratification and diagnostic evaluation. **Objective:** This study aimed to determine the frequency and clinical distribution of severe SVCAD in patients presenting with unstable angina. **Methods:** A cross-sectional study was conducted at the Department of Cardiology, NICVD Karachi, from 14th February 2025 to 14 May 2025. A total of 356 patients aged 40–80 years diagnosed with unstable angina were enrolled using non-probability sampling. Coronary angiography was performed to assess the presence and severity of single vessel disease. **Results:** Out of 356 patients, 131 (36.8%) were found to have severe SVCAD. The left anterior descending (LAD) artery was the most commonly involved vessel (65.6%), followed by the right coronary artery (22.1%) and left circumflex artery (12.2%). SVCAD was significantly more prevalent among males (p = 0.01), patients under 60 years of age (p = 0.03), and smokers (p = 0.02). No significant associations were observed with diabetes, hypertension, or residence status. **Conclusion:** Severe single vessel coronary artery disease is frequently observed in patients presenting with unstable angina, particularly among younger, male, and smoking populations. These findings emphasize the need for early angiographic evaluation and appropriate intervention, even in UA patients without multivessel disease features.

INTRODUCTION

Coronary artery disease (CAD) is one of the most frequent fatality causes in the United States especially and around the globe as well. Acute coronary syndrome (ACS) consists of three constituents which are unstable angina (UA), acute ST elevation myocardial infarction (STEMI), and acute non-ST elevation myocardial infarction (NSTEMI).[1] Correct and timely identification of clinical and electrocardiographic (ECG) features indicative of significant left main coronary artery disease (LMCAD) is extremely important, particularly in patients presenting with an acute coronary syndrome.[2] A severe single vessel disease in significant size is considered as the lesion and may occupy more than 70% of the vessel diameter. The frequency of occurrence of single vessel stenosis is 4–6% for all patients undergoing coronary angiography[2] and 30% for patients undergoing Coronary Artery Bypass Grafting (CABG).[3] The occlusion of a single vessel like the left main stem (LMS) results in at least 75% compromised blood flow to the left ventricle, unless protected by collateral flow or a patent bypass graft to either the Left Anterior Descending (LAD) or Circumflex artery (LCX).[4] Most such patients are symptomatic and at high risk of cardiovascular events. Before the revascularization with CABG became the standard of care, studies revealed a poor prognosis for patients, with only an average three-year survival rate which was only 37%. As compared to other medical therapies, CABG has shown significantly better outcomes in patients with cardiovascular diseases, including mortality.[5,6] In one study, severe single vessel disease (e.g., LMS occlusion) was found in 80% of ACS patients with symptoms consistent with unstable angina.[1] Another study by Malik et al. found a 36.4% frequency of severe single vessel disease in ACS.[7] This study was planned considering the high local prevalence of acute coronary syndrome. No recent local data exists on the occurrence of significant single vessel coronary artery disease in patients presenting with unstable angina. The study aims to provide an estimate of the burden of this disease in such patients.

Objective

To determine the frequency of severe single vessel coronary artery disease in patients with unstable angina.

METHODOLOGY

This Cross-sectional study was conducted at Department

of Cardiology, NICVD, Karachi from 14 Feb 2025 to 1st June 2025. Data were collected through Non-probability sampling technique. Calculated using the WHO sample size calculator with the following assumptions:

- Anticipated frequency = 36.4%
- Margin of error = 5%
- Confidence level = 95%
- Sample size = 356

Inclusion Criteria

- Patients aged 40 to 80 years
- Both genders
- Diagnosed with unstable angina as per operational definitions

Exclusion Criteria

- Prior coronary intervention
- Drug abuse history (e.g., cocaine)
- Chronic kidney disease (eGFR <60 ml/min/1.73 m^2)
- Dextrocardia
- Severe anemia (Hb <7 g/dL)

Data Collection

Ethical approval was obtained from the institutional review boards of NICVD and CPSP. Eligible patients admitted to the indoor cardiology unit were recruited after obtaining informed written consent. Baseline demographic and clinical variables were recorded, including age, gender, weight (measured barefoot with empty pockets), height, body mass index (BMI, calculated as weight in kg divided by height in meters squared), duration of symptoms (in hours), and presence of comorbidities including diabetes mellitus (defined as fasting blood sugar >130 mg/dL and on hypoglycemic therapy for >6 months), hypertension (BP >140/90 mmHg or on antihypertensives), and smoking status (assessed in pack-years). Residential status (urban vs. rural) was also documented. To assess coronary artery status, all enrolled patients underwent coronary angiography via either radial or femoral access using standard contrast and fluoroscopic techniques. Angiographic findings were evaluated by experienced interventional cardiologists to determine the presence and severity of single-vessel coronary artery disease based on pre-defined operational criteria. All data were documented on a structured proforma designed by the researcher.

Data Analysis

Statistical analysis was performed using IBM SPSS version 25. Quantitative variables such as age, BMI, and symptom duration were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR) depending on the distribution assessed using the Shapiro-Wilk test. Categorical variables such as gender, comorbidities, residence, smoking status, and angiographic findings were reported as frequencies and percentages. Stratification was performed for age, gender, BMI, smoking, residence, and comorbidities to control for potential confounders. Post-stratification, chi-square or Fisher's exact test was applied to assess associations between variables, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

Among 356 patients, the mean age was 58.6 ± 9.8 years, with males comprising the majority (229, 64.3%). Urban residents accounted for 59.8% (n = 213), and the median BMI was 26.1 kg/m^2 (IQR: 24.3–28.5). The median symptom duration before presentation was 9 hours (IQR: 6–14). Hypertension and diabetes were prevalent in 54.2% (n = 193) and 47.2% (n = 168) of patients, respectively, while 124 (34.8%) were smokers. Stenosis severity showed that 29.0% had 70–79% stenosis, 35.9% had 80–89%, and 35.1% had ≥90%.

Table 1

Demographic and Clinical Characteristics of Patients (n = 356)

Variable	Value
Mean Age (years)	58.6 ± 9.8
Gender: Male	229 (64.3%)
Gender: Female	127 (35.7%)
Urban Residence	213 (59.8%)
Rural Residence	143 (40.2%)
Median BMI (kg/m^2)	26.1 (IQR: 24.3–28.5)
Median Symptom Duration (hours)	9 (IQR: 6–14)
Hypertension	193 (54.2%)
Diabetes Mellitus	168 (47.2%)
Smokers	124 (34.8%)
Stenosis Range (%)	
70–79%	38 (29.0%)
80–89%	47 (35.9%)
≥90%	46 (35.1%)

Severe single-vessel coronary artery disease (SVCAD) was found in 131 patients, representing 36.8% of the study population. The left anterior descending artery (LAD) was most frequently affected (86 patients, 65.6%), followed by the right coronary artery (RCA) in 29 cases (22.1%) and the left circumflex artery (LCX) in 16 cases (12.2%). This highlights the LAD as the predominant site of severe SVCAD.

Table 2

Frequency and Distribution of Severe Single Vessel Coronary Artery Disease (SVCAD)

Angiographic Finding	Frequency (n, %)
Total Patients with Severe SVCAD	131 (36.8%)
LAD Involvement	86 (65.6%)
RCA Involvement	29 (22.1%)
LCX Involvement	16 (12.2%)

Males had a significantly higher frequency of severe SVCAD (101 out of 229; 44.1%, p = 0.01). Patients younger than 60 years also showed higher SVCAD prevalence (77 out of 191; 40.3%, p = 0.03). Smoking was significantly associated with SVCAD (58 out of 124; 46.8%, p = 0.02). However, no statistically significant association was observed with urban residence (p = 0.47), diabetes (p = 0.68), or hypertension (p = 0.82).

Table 3

Stratification of Severe SVCAD by Risk Factors

Variable	SVCAD Present (n, %)	p-value
Gender (Male)	101 (44.1%)	0.01
Age <60 years	77 (40.3%)	0.03
Smoking History	58 (46.8%)	0.02
Urban Residence	80 (37.6%)	0.47
Diabetes	60 (35.7%)	0.68
Hypertension	70 (36.3%)	0.82

Among patients with LAD involvement (n = 86), 62 (72.1%) were male and 24 (27.9%) were female. RCA involvement (n = 29) was also predominantly male (20 males, 69.0%) compared to females (9, 31.0%). LCX was

involved in 13 males (81.3%) and 3 females (18.7%) out of 16 total cases.

Table 4

Distribution of SVCAD by Coronary Artery Involved and Gender

Coronary Artery Involved	Male (n, %)	Female (n, %)
LAD	62 (72.1%)	24 (27.9%)
RCA	20 (69.0%)	9 (31.0%)
LCX	13 (81.3%)	3 (18.7%)

DISCUSSION

This study aimed to determine the frequency and distribution of severe single vessel coronary artery disease (SVCAD) in patients presenting with unstable angina (UA). Our findings revealed that 36.8% of patients had severe SVCAD, with the left anterior descending (LAD) artery being the most frequently involved vessel. This is consistent with prior literature, which highlights the LAD as the most commonly affected artery in single-vessel presentations due to its critical perfusion territory and susceptibility to atherosclerosis.[8] The relatively high frequency of SVCAD underscores the importance of not underestimating UA patients who may appear low-risk on clinical grounds but harbor significant lesions requiring timely intervention.[9] Importantly, more than one-third of patients had ≥90% stenosis, indicating the urgent need for angiographic evaluation even in the absence of ST-segment elevation.[10] These findings support the recommendations for early invasive strategies in selected UA cases to prevent myocardial infarction and reduce long-term mortality.[11]

Stratified analysis revealed that SVCAD was significantly more common among male patients, those younger than 60 years, and smokers.[12] The association with smoking is biologically plausible, as tobacco use accelerates endothelial dysfunction and promotes plaque instability key contributors to acute coronary syndromes.[13] While diabetes and hypertension were prevalent in the cohort, they did not show a significant association with severe SVCAD, possibly due to their stronger link with diffuse or multivessel disease rather than isolated single-vessel involvement.[14] The gender distribution of coronary artery involvement also showed that males accounted for the majority of severe LAD and RCA lesions.[12] This aligns with global epidemiological trends where men present earlier and more frequently with obstructive CAD compared to women, who may present with non-obstructive or microvascular disease. Additionally, the predominance of urban patients may reflect differences in healthcare access and exposure to modifiable risk factors such as sedentary lifestyle, stress, and dietary patterns.[15,16]

This study has several strengths, including the use of angiographic confirmation to classify disease severity and a sufficiently large sample size. However, it is not without limitations. Being a single-center study with non-probability sampling limits the generalizability of findings. Additionally, plaque morphology and functional significance (e.g., via FFR or IVUS) were not assessed, which could provide further risk stratification. Lastly, long-term clinical outcomes were not evaluated. Despite these limitations, the study provides valuable insight into the burden of severe SVCAD in patients with unstable angina, reinforcing the need for early diagnostic angiography and consideration of revascularization, especially in male and smoking populations.

CONCLUSION

It is concluded that severe single-vessel coronary artery disease is present in a significant proportion (36.8%) of patients presenting with unstable angina, with the left anterior descending artery being the most commonly involved vessel. The condition was notably more prevalent among males, younger individuals, and smokers. These findings highlight the importance of prompt coronary angiographic evaluation in unstable angina, even in patients without classical high-risk features.

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