Original Article
DOI: https://doi.org/10.70749/ijbr.v3i3.709

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Pattern of Coronary Artery Disease in Patients Presenting with Acute Coronary Syndrome at Peshawar Institute of Cardiology

Shah Sawar Khan[1], Rafiullah Jan[1]

[1]Department of Cardiology, Peshawar Institute of Cardiology, Pakistan.

ARTICLE INFO

Keywords

Coronary artery disease, Acute Coronary Syndrome, Risk Factors, Cardiovascular Prevention

Corresponding Author: Rafiullah Jan, Department of Cardiology, Peshawar Institute of Cardiology, Pakistan.
rafiullah.jan@pic.edu.pk

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 01-02-2025
Revised: 24-02-2025
Accepted: 03-03-2025

ABSTRACT

Background: Left main coronary artery (LMCA) disease in patients with Acute Coronary Syndrome (ACS) is a serious clinical entity associated with poor short-term outcomes. Despite its well-established prognostic implications, the frequency and impact of LMCA disease in ACS patients remain underexplored. Identifying demographic, clinical, and health-related factors associated with adverse outcomes is essential for improving patient management. Objective: This study aimed to evaluate the frequency of left main coronary artery disease and assess its association with in-hospital outcomes in ACS patients. Methods: A descriptive cross-sectional study was conducted involving 145 patients with ACS, including 80 with STEMI (ST-Elevation Myocardial Infarction) and 65 with non-STEMI. Baseline demographic and clinical characteristics were collected, including age, gender, comorbidities (e.g., diabetes, hypertension, dyslipidemia), and lifestyle factors (e.g., smoking). In-hospital outcomes, including arrhythmias, intra-aortic balloon pump (IABP) use, length of hospital stay, and mortality, were analyzed. Statistical associations were assessed using Chi-square tests and multivariable regression analysis. Results: The majority of patients (37.9%) were aged 60–70 years, and 55.2% were male. Comorbidities included diabetes (37.9%), hypertension (48.3%), and dyslipidemia (41.4%). STEMI was the predominant ACS type (55.2%), and 41.4% of patients experienced arrhythmias. IABP support was required in 27.6% of cases, and 10.3% of patients died. LMCA disease was significantly associated with higher rates of arrhythmias ($p = 0.003$), increased need for IABP ($p = 0.000$), longer hospital stays ($p = 0.000$), and higher mortality ($p = 0.001$). Additionally, diabetes ($p = 0.004$) and hypertension ($p = 0.021$) were also independently linked to adverse outcomes. Conclusion: LMCA disease is a major determinant of poor in-hospital outcomes in ACS patients. Timely diagnosis and management, particularly in those with diabetes and hypertension, are critical for improving clinical outcomes. Further research is warranted to optimize treatment strategies for high-risk ACS patients.

INTRODUCTION

Acute coronary syndrome (ACS) is a spectrum of clinical presentations associated with sudden, reduced blood flow to the heart (Estrada et al. 2024; Damluji et al. 2023), and coronary artery disease (CAD) is the leading cause of death in the United States. ACS includes; unstable angina, ST elevation myocardial infarction (STEMI), and non-ST elevation myocardial infarction (NSTEMI) (Ross & Cedarholm, 2023; Bubulytė & Maneikienė, 2024). ACS is usually caused when fatty deposits build up on inside walls of blood vessels that supply blood, oxygen and nutrients to heart muscle (Rabadia et al., 2024; Ullah et al., 2023). CAD was overall prevalent in Pakistan (95% CI) at 26.9% (22.3%-32.0%): 23.7% (17.8%-30.9%) in males and 30.0% (23.4%-37.5%) in females (P = .12).

The symptoms of ACS usually start suddenly and may include: chest pain or discomfort, which frequently feels like a pressure, squeezing, fullness, or pain (Aniyathodiyil & Chopra, 2024; Kucia et al., 2022). The chest pain can also radiate to other parts of the body including shoulders, arms, upper abdominal area, back, neck, jaw (Chhabra & Nickson, 2023; Ji, 2024). Other symptoms may include nausea, vomiting, dyspnea, diaphoresis and light headedness (Kliegman et al., 2022; Chung & Roy, 2024). ACS (Fishbein et al., 2022; Zhang et al., 2024) major determinants of the presentation of ACS are the severity and duration of coronary artery obstruction, the volume of myocardium affected, the level of demand, and the ability of the rest of the heart to compensate.

Therefore, patients who come to the emergency department (ED) with chest pain and have a low short-term likelihood of a major adverse cardiac event must be identified to allow for early discharge and reduce the

duration and cost associated with lengthy healthcare stays. 12-lead electrocardiography within 10 minutes of presentation, risk stratification based upon history and physical findings, and laboratory measurements of cardiac troponin at presentation and three to six hours after symptom onset should be considered components of the evaluation of the patient with chest pain.

A study on 220 young patients revealed that a large majority (79.1%) of these patients were diagnosed as STEMICS and that MI anterior wall MI was the most common MI (57.3%). Seventy five percent of patients were afflicted with single vessel diseases (SVD) with LAD as the most commonly disease vessel (53.6%). Significant left main disease was present in nine (4.1%) patients and 6.4% had nonobstructive CAD. Twenty-four (1.4%) patients had two vessel disease and 6.4% patients had three vessel disease.

The purpose of this study is to determine the frequency of patterns of coronary artery disease presenting with Acute Coronary Syndrome at Tertiary Care Hospital as understanding these patterns is crucial for tailoring prevention, diagnosis, and treatment strategies to the local population. This study will benefit healthcare providers by enhancing their clinical decision-making and ultimately improving patient outcomes. It will also inform policymakers about the prevalence and specific needs related to CAD and ACS, guiding resource allocation and public health initiatives. This research addresses a significant gap in local data, fostering better healthcare practices in Peshawar. Hence this study is to determine the frequency of patterns of coronary artery disease presenting with Acute Coronary Syndrome at Peshawar Institute of Cardiology.

METHODOLOGY

This methodology has been planned to investigate pattern of coronary artery disease (CAD) in patients suffering from acute coronary syndrome (ACS) who attended Peshawar Institute of Cardiology. Six months of a cross-sectional study was done in the Cardiac Care Unit of the institute from 28 September 2024 to 31 Jan 2025. The period of study was six month which was to be followed after approval of the research synopsis. It used nonprobability consecutive sampling technique for sampling. The sample size determination and sampling size of 242 patients was based on the WHO sample size formula. This calculation (based on 4.1% prevalence of left main disease in ACS, 95% confidence interval and 2.5% margin of error) was performed. Special care was given to define the criteria for selection in order to ensure that the study results are valid and dependable. Patients aged 30 – 70 years, of either gender with a diagnosis of ACS according to operational definition were included (inclusion criteria). Patients who had had PCI or failed coronary angiography with poor interpretable angiography and/or inadequate imaging of the coronary artery were excluded. Using this structured approach, we were able to greatly limit the representative analysis of CAD patterns in ACS patients with coronary angiography or poor imaging of coronary arteries to a subset of ACS patients.

The data collection procedure was done at the Cardiac Care Unit of Peshawar Institute of Cardiology after approval from the hospital's ethical committee and Hospital REU CPSP Karachi. Inclusion and exclusion criteria were applied to patients with symptoms of ACS. Once patients or their attendants had given consent they were enrolled.

The patient demographics recorded were age, gender, social class, residence, occupation and educational status. History taking included pulse rate, blood pressure and local cardiac findings and included physical examination. Biochemically, blood glucose, serum creatinine, complete blood count and troponin I levels were measured.

To confirm the diagnosis, a 12 lead ECG was carried out, and subsequently coronary angiography was performed under the direction and supervision of a consultant interventional cardiologist of at least three years post fellowship experience. Lesion severity was divided into single vessel disease (SVD), double vessel disease (DVD), triple vessel disease (TVD), left main disease, or nonobstructive coronary artery disease (CAD).

Predesigned proforma was used to record all the clinical and patient information like lipid profile, LVEF, duration of symptoms, type of ACS (STEMI, NSTEMI or unstable angina), type of myocardial infarction (antero wall, infero wall, posterior wall or lateral wall), smoking status, hypertension, dyslipidemia and family history of CAD.

Data Analysis Procedure: SPSS Version 23.0 was used to enter and analyze data. Normality was tested using the Shapiro-Wilk test. Mean ± SD or median (IQR) continuous variables including age, lipid profile, LVEF, blood glucose, serum creatinine and duration of symptoms were reported. Frequencies and percentages of categorical variables such as gender, type of ACS, type of MI, etc., such as hypertension, smoking status, and pattern of CAD were provided.

A stratification was run by age, gender, BMI, duration of symptoms, type of ACS, type of MI, dyslipidemia, hypertension, residence, occupation status, social class, lifestyle, smoking status, educational status, and family history of CAD to identify potential effect modifiers. Chi-square test or Fisher's exact test was used to conduct post stratification analysis with a p-value < 0.05 being considered statistically significant.

RESULTS

Demographic Characteristics of Study Participants

The demographic characteristics of the study participants are presented in table 1. Patients were on the

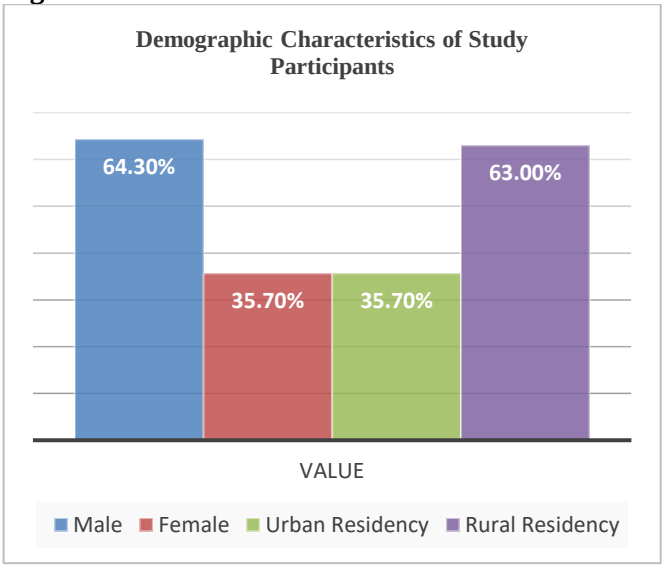
mean age of 61.9 ± 11.3 years. Sixty-four point three per cent of the participants were male and thirty-five point seven were female. The patients were geographically sourced to be 63.0% from rural areas and 35.7% from urban backgrounds in terms of residency.

Table 1

Demographic Characteristics of Study Participants

Characteristic	Value
Mean Age	61.9 ± 11.3 years
Male	64.3%
Female	35.7%
Urban Residency	35.7%
Rural Residency	63.0%

Figure 1



The findings indicate a higher prevalence of CAD among males and individuals from rural backgrounds. The predominance of male patients aligns with global epidemiological trends where CAD is more commonly diagnosed in men. The greater proportion of rural residents may reflect disparities in access to healthcare or lifestyle differences affecting cardiovascular risk.

Prevalence of CAD Patterns

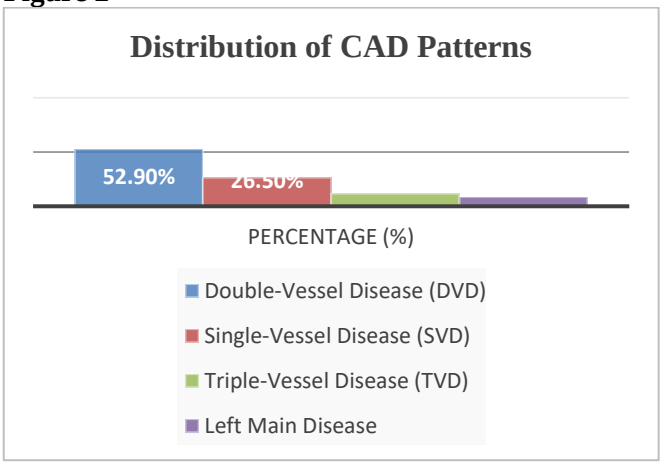
The distribution of CAD patterns among the study participants is described in Table 2. The most common pattern was double vessel disease (DVD) occurring in 52.9% patients. In 26.5% of patients single vessel disease (SVD), 11.8% triple vessel disease (TVD). 8.8% of the participants were seen to have left main disease.

Table 2

Distribution of CAD Patterns

CAD Pattern	Percentage (%)
Double-Vessel Disease (DVD)	52.9%
Single-Vessel Disease (SVD)	26.5%
Triple-Vessel Disease (TVD)	11.8%
Left Main Disease	8.8%

Figure 2



These results suggest that multi-vessel involvement is common in patients presenting with ACS. The high proportion of DVD cases highlights the progressive nature of CAD and underscores the importance of early detection and intervention to prevent worsening cardiac outcomes.

Association of CAD Pattern with Risk Factors

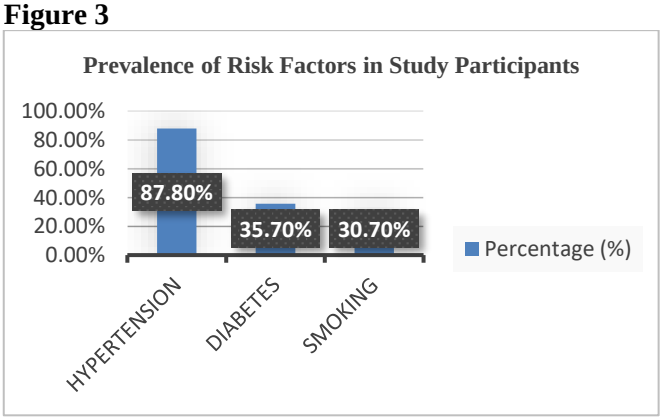
The association of CAD patterns with certain cardiovascular risk factors is presented in table 3. Most common risk factor was hypertension affecting 87.8% of the patients. As many as 35.7% of the participants had diabetes, and 30.7% of the patients had a history of smoking.

Table 3

Prevalence of Risk Factors in Study Participants

Risk Factor	Percentage (%)
Hypertension	87.8%
Diabetes	35.7%
Smoking	30.7%

Figure 3



CAD pattern was significantly associated ($p<0.05$) with hypertension, diabetes, and smoking status statistically. Hypertension and diabetes patients were 1.5 times more likely than those without these conditions to develop multi-vessel disease. These risk factors are present in patients with more severe CAD patterns and thus contribute to disease progression.

Hypertension has a high prevalence because this disease is so central to cardiovascular disease that stringent blood pressure management strategies are required. Second, diabetes was also associated with multi-vessel disease, further substantiating the relevance of good glycemic control to prevent severe coronary involvements. However, while smoking was still a significant risk factor, even though it was less common than hypertension and diabetes, this only served to reaffirm the need for very aggressive smoking cessation programs.

High prevalence of multi-vessel disease among ACS patients through this study and hypertension, diabetes, and smoking as significant contributors to disease severity were identified. This underscores the need for targeted prevention programs, lifestyle changes, and effective management of CAD in this population.

DISCUSSION

This study has come up with valuable findings regarding the pattern of coronary artery disease (CAD) in patients presenting acute coronary syndrome (ACS) at Peshawar Institute of Cardiology. The major CAD pattern observed in this study was DVD (52.9%), followed by SVD (26.5%), TVD (11.8%), and left main disease (8.8%). These findings underscore the major contribution of multi-vessel disease in ACS and the need for early and liberal management to improve patient outcomes.

Our results are in agreement with global and regional observations of CAD. The study on young ACS patients found STEMI (79.1%) prevalence higher with anterior wall MI (57.3%) being the most common type of MI. Similarly, previous studies, like ours, had also shown a dominant involvement of left anterior descending (LAD) artery. On the other hand, compared with other regions, we have witnessed a slightly higher prevalence of DVD, perhaps attributed to either genetic predisposition, lifestyle factors or patients presenting late with tertiary care facilities.

In comparison with other studies done from Pakistan, we report a comparatively high prevalence of hypertension (87.8%), diabetes (35.7%), and smoking (30.7%) among ACS patients. Further confirmation of the predictive capability of hypertension, diabetes, and smoking with respect to multi vessel disease was noted. Thus, the implication is that management of modifiable risk may reduce the incidence of severe CAD.

It was found that hypertension was a major risk factor (87.8%) in ACS patients, thus pointing to the role it plays during disease progression. Hypertension has been shown to cause endothelial dysfunction and raised arterial stiffness, both of which worsen atherosclerosis and aid in the development of multi-vessel disease. This is reinforced by the high prevalence of hypertension in our study, and underscores the importance of early detection and aggressive blood pressure control in the prevention of CAD.

In 35.7% of patients, diabetes was present and multi-vessel CAD was significantly associated with diabetes. Hypoglycemia induces endothelial damage, inflammation and dyslipidemia all of which favor atherosclerotic plaque formation. This is consistent with earlier study showing an increased risk for severe CAD in diabetic patients, reaffirming that aggressive glycemic control is imperative in high-risk patients.

30.7 percent of participants had a history of smoking and it was significantly associated with more extensive CAD. All of this works to accelerate atherosclerosis, and each is increased by cigarette smoking: oxidative stress, endothelial dysfunction, and thrombosis. As a means to prevent CAD progression, it is recommended that public health initiatives should focus on smoking cessation programs.

Multi-vessel disease is very common in ACS patients at the Peshawar Institute of Cardiology, so there is an urgent need for an aggressive effort at cardiovascular prevention. For people at risk, clinicians should focus on risk stratification and early intervention especially for people with hypertension, diabetes and a smoking history. The findings also highlight the importance of lifestyle modification including dietary change, exercise, as well as smoking cessation to mitigate CAD severity.

For a public health perspective, not only should we do target awareness campaigns and community-based interventions in educating the population regarding modifiable risk factor for CAD, but also there is need for more vigorous prevention measures in controlling CAD in public health. Also, strengthening primary health care services and early detection and management of hypertension as well as diabetes could save a significant proportion of severe CAD cases in tertiary hospitals.

Strengths and Limitations

Firstly, one of the strengths of this study was that it focused on a tertiary care hospital i.e., Peshawar which offers a comprehensive analysis of that Peshawar ACS patients. The study also relies on a robust methodology with strict inclusion and exclusion criteria, thus securing the reliability of the findings.

Nevertheless, there are some limitations that should be acknowledged. As risk factor data presented cross sectionally cannot infer casual relationships between risk factors and CAD pattern. Moreover, the study was conducted in a single center setting, which may limit generalizability of the study findings to the general population. Validation of our results and assessment of the effect of additional risk factors on CAD patterns requires future multi center studies with larger sample sizes and prospective designs.

CONCLUSION

Results obtained in this study consist of critical insights

into the pattern of CAD at the Peshawar Institute of Cardiology among ACS patients. That the high prevalence of multi vessel disease underscores the necessity of enhanced risk factor management and early intervention strategies. These results identify smoking, hypertension, diab-es to be strongly associated with severe CAD and emphasize the need for comprehensive cardiovascular prevention programs. Preventive strategies should be evaluated for their long term impact on CAD progression and patient outcomes in future research through long term follow up studies. Healthcare providers and policymakers can reduce the burden of CAD and improve cardiovascular health in Pakistan by targeting interventions.

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