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Original Article

Evaluation of Risk Factors Contributing to the Development of Acute Coronary Syndrome (ACS) in Patients Admitted to a Tertiary Care Hospital

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ABSTRACT

Background: Acute Coronary Syndrome (ACS) is a leading cause of morbidity and mortality globally, with a rising burden in developing countries like India. Understanding the prevalence, risk factors, and outcomes of ACS in tertiary care hospitals is crucial for improving management and prevention strategies. The objective of the present study was to assess the risk factors contributing to ACS in a tertiary care hospital. **Materials and Methods:** This prospective observational study was conducted at a tertiary care hospital, involving 200 patients admitted with ACS between December and May. Data were collected from patient records, including demographic information, risk factors, diagnosis, treatment, and in-hospital outcomes. Statistical analysis was performed to examine associations between variables. **Results:** Significant cardiovascular risk factors identified in the study included a family history of coronary artery disease (42%), hypertension (39%), smoking (24%), and diabetes (19%). In-hospital treatment strategies were largely following established guidelines, with most patients receiving aspirin (97.5%), clopidogrel (96.9%), and statins (98.5%). Percutaneous Coronary Intervention (PCI) was performed in 60.1% of the patients. A significant association was observed between smoking and hypertension with the type of ACS diagnosis, suggesting the importance of aggressive risk factor management. **Conclusion:** The study highlights the prevalence of modifiable risk factors such as smoking and hypertension in ACS patients, emphasizing the need for preventive strategies. STEMI was the predominant form of ACS, necessitating urgent interventions.

Keywords: Acute Coronary Syndrome, STEMI, NSTEMI, Unstable Angina, Risk Factors.

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INTRODUCTION

Conditions affecting the heart and blood arteries are often referred to as Cardiovascular Diseases (CVDs). Approximately one-third of fatalities worldwide are caused by these diseases, which include coronary heart disease, cerebrovascular disease, and other associated ailments.[1,2] Ischemic Heart Disease (IHD), the predominant type of CVD, is characterized by a dynamic disease process in which atherosclerotic plaque forms in the coronary arteries of the heart. The course and stability of IHD can be changed by medication, lifestyle changes, and coronary revascularization operations. Depending on whether the patient has a stable disease state or not, IHD is categorized as either Acute Coronary Syndrome (ACS) or Chronic Coronary Syndrome (CCS).[3,4]

Unstable angina, non-ST Elevation Myocardial Infarction (NSTEMI), and ST-Elevation Myocardial Infarction (STEMI) are among the cardiovascular disorders together referred to as Acute Coronary Syndrome (ACS).[5] These disorders are brought on by an abrupt decrease in cardiac blood flow, which frequently happens as a result of atherosclerotic plaques rupturing and thrombus forming in the coronary arteries. ACS continues to be a major global contributor to the burden of cardiovascular diseases and a leading cause of morbidity and death.[6] Because of its complicated pathophysiology, varied presentation, and wide range of risk factors, ACS still presents difficulties even with major improvements in medical therapy, interventional methods, and preventative measures. ACS is a significant clinical and public health issue in India. IHD is the country's largest cause of mortality and morbidity, according to the Global Burden of Disease (GBD) Study and the Million Mortality Study (India). India has one of the highest rates of IHD in the world, with 1.54 million fatalities and 36.99 million years of disability-adjusted life expectancy, according to comparative epidemiology statistics. The GBD Study estimates that 1.2 million incident cases of IHD (ACS) occurred in 2017.[7]

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ACS is influenced by multiple risk factors, both modifiable and non-modifiable. Among the leading causes, high blood cholesterol (hyperlipidemia) plays a crucial role, particularly elevated Low-Density Lipoprotein (LDL) levels, which contribute to plaque buildup in coronary arteries, increasing the risk of ACS. Smoking and alcoholism are significant modifiable risk factors that accelerate atherosclerosis and vascular damage.[8] Smoking not only increases the risk of ACS but also raises mortality rates. Quitting smoking can significantly reduce cardiovascular risks, irrespective of age or gender. Similarly, excessive alcohol consumption leads to hypertension, cardiomyopathy, and arrhythmias, all of which heighten ACS susceptibility. A sedentary lifestyle further exacerbates risk by promoting obesity, metabolic disturbances, and hypertension. An unhealthy diet, rich in saturated and trans fats, also plays a role by encouraging atherosclerosis and increasing LDL levels.[9] Diabetes mellitus significantly heightens the risk of ACS due to its adverse effects on endothelial and smooth muscle function, increasing platelet adhesion and atherosclerotic burden.[10] Studies suggest that diabetic individuals have a 2-4 times higher risk of cardiovascular events compared to non-diabetics. Obesity is another contributing factor linked to insulin resistance, inflammation, and vascular dysfunction, increasing the likelihood of coronary artery disease. A family history of premature coronary artery disease further predisposes individuals to ACS, with studies indicating a 1.5-1.7 times higher risk among those with a genetic predisposition.[11] Additional risk factors such as atrial fibrillation, heart failure, and previous strokes further compound the risk. Given these multiple contributors, lifestyle modifications, including a healthy diet, regular physical activity, smoking and alcohol cessation, and proper diabetes management, are crucial in reducing ACS-related complications and improving cardiovascular health.[12-15]

The objective of the present prospective observational study was to evaluate the various risk factors contributing to the development of Acute Coronary Syndrome (ACS) in patients admitted to a tertiary care hospital. Additionally, it also aimed to assess the distribution of different ACS subtypes, including ST-Elevation Myocardial Infarction (STEMI), Non-ST-Elevation Myocardial Infarction (NSTEMI), and Unstable Angina (UA), among the patient population.

MATERIALS AND METHODS

Study design, population, and setting

This prospective observational study was conducted at a tertiary care hospital (Bangalore Baptist Hospital Bellary Road, Hebbal, Bangalore 560064) involving 200 patients admitted with ACS between December and May (6 months). Data were obtained from patient records, covering demographic details, risk factors, diagnosis, treatment, and in-hospital outcomes. Statistical analysis was performed to assess associations between various clinical and demographic variables.

Inclusion and Exclusion criteria

Inclusion criteria

In this study individuals diagnosed with ACS, including unstable angina, NSTEMI, and STEMI, regardless of specific heart wave changes were included. Patients admitted to a tertiary care hospital were selected to ensure the study represents the hospital's typical patient population. The study included only adults, aligning with the common age group affected by ACS in the hospital setting. To ensure a comprehensive understanding of ACS across different populations, individuals from diverse backgrounds, including varying genders, races, and socioeconomic statuses, were included.

Exclusion criteria

Individuals with a history of heart surgery or recent major cardiac interventions, such as stent placement, were excluded to focus on newly diagnosed ACS cases. Patients with pre-existing chronic heart conditions that differ from ACS were also not included to maintain the study's relevance to new-onset heart problems. Additionally, individuals who had undergone recent non-cardiac surgeries were also excluded, as these procedures may not directly impact ACS. Patients with severe, life-threatening illnesses or limited life expectancy were not considered, ensuring the study focuses on those who can provide meaningful long-term data. Pregnant women were also excluded, as pregnancy-induced physiological changes can significantly alter cardiovascular function, which falls outside the scope of this study.

Data collection

This study utilized a combination of medical record reviews, patient interviews, and clinical examinations for data collection. Medical records were analyzed to extract demographic details, medical history, diagnostic procedures, treatments, and patient outcomes, providing a retrospective dataset for identifying patterns and associations. Structured interviews and questionnaires were used to gather additional information on lifestyle factors, family history, and psychosocial aspects contributing to ACS risk. Clinical examinations, including physical assessments and laboratory tests such as blood pressure and cholesterol measurements, were also done. Follow-up assessments were conducted to monitor long-term outcomes and recurrence of ACS, offering insights into the persistence of risk factors over time.

Study procedure

The study on risk factors associated with ACS in a tertiary care hospital followed a structured methodology to ensure reliable and valid findings. The study started with the development of a detailed research protocol outlining objectives, study design, and inclusion/exclusion criteria. Patients diagnosed with ACS were

screened, and informed consent was obtained before collecting demographic, medical, and clinical information.

Data collection involved both retrospective and prospective methods. Retrospective data was extracted from medical records, including patient history, diagnostic tests, treatments, and outcomes. Prospective was gathered through structured interviews and standardized questionnaires assessing lifestyle factors, psychosocial aspects, and family history. Clinical assessments, such as blood pressure measurement, anthropometric evaluations, and laboratory tests for lipid profiles and glucose levels, were conducted to provide a comprehensive cardiovascular health evaluation.

Collected data was analyzed using statistical methods, including descriptive and inferential statistics, to identify associations between risk factors and ACS incidence. Multivariate analysis was used to control for confounding variables. Ethical considerations were strictly followed, with institutional review board approval ensuring compliance with ethical standards, confidentiality, and participant privacy.

RESULTS

Among 200 ACS patients, the most common risk factors were a family history of CAD (42%) and hypertension (39%), with hypertension being more prevalent in males (25%) than females (14%). Diabetes and hyperlipidemia were present in 19% of patients, smoking in 24%, and alcoholism in 16%. Additionally, obesity was noted as an independent risk factor, with 33% of patients being overweight and 3% obese. All 200 patients had elevated cardiac troponin T levels (>1.0 ng/mL), indicating a high likelihood of ACS. The mean age was 64 ± 12 years, and patients were grouped based on discharge heart rates into <78 bpm, 78-89 bpm, and ≥90 bpm. Hemoglobin levels were lower in 18 female patients and 10 male patients, further linking anemia to worse ACS outcomes. The comparative risk factors for ACS are presented in Figure 1.

Aspirin (97.5%) and Clopidogrel (96.9%) are almost universally prescribed, given their critical role in dual antiplatelet therapy to prevent thrombus formation and recurrent ischemic events. Statins (98.5%) show the highest usage, emphasizing the importance of lipid-lowering therapy to stabilize atherosclerotic plaques and reduce cardiovascular risk. Beta-blockers (79.9%) are commonly used to decrease myocardial oxygen demand, reducing the likelihood of recurrent events and arrhythmias. Nitrates (66.7%) are moderately used for symptomatic relief by improving coronary blood flow, particularly in patients with unstable angina. Figure 2 shows the IN-hospital medications usage-wise distribution of ACS patients.

The Chi-Square test was used to assess the association between categorical variables and the type of ACS (Table 1). The analysis revealed that sex was not significantly associated with the type of ACS ($\chi^2 = 3.54$, $p = 0.17$), suggesting that the distribution of ACS subtypes does not differ significantly between males and females. Similarly, alcohol use showed no significant relationship with ACS type ($\chi^2 = 4.10$, $p = 0.13$), indicating that alcohol consumption may not be a major differentiating factor in ACS subtypes. However, smoking status exhibited a significant association with ACS type ($\chi^2 = 7.62$, $p = 0.02$), implying that smoking plays a crucial role in determining the type of ACS patients develop. Likewise, hypertension demonstrated a strong statistical significance ($\chi^2 = 9.32$, $p = 0.01$), indicating that hypertensive individuals are more likely to develop specific ACS subtypes. These findings highlight the importance of modifiable risk factors, such as smoking and hypertension, in ACS pathogenesis and suggest targeted prevention strategies for at-risk populations.

Hypertension and smoking are significant risk factors for ACS, with smoking having the strongest association. Table 2 shows

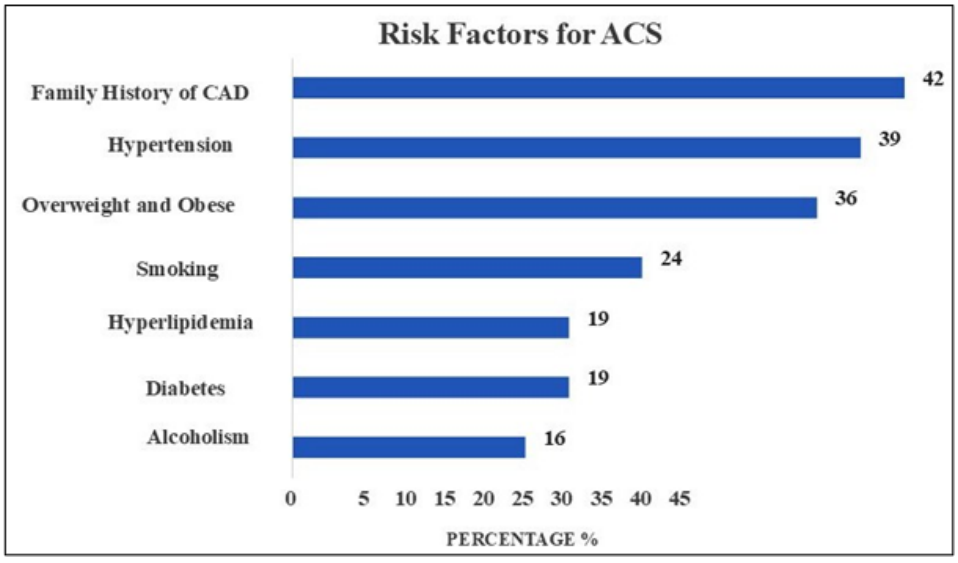

Figure 1: Risk factors wise distribution of ACS patients.

the logistic regression analysis of risk factors for ACS. The study identified hypertension (39%), family history of coronary artery disease (42%), smoking (24%), and diabetes (19%) as the most common risk factors.

Regarding in-hospital management, aspirin, clopidogrel, and statins were the most commonly used medications, administered to over 90% of patients. This high usage reflects adherence to established ACS management guidelines, similar to the findings of Dilip *et al.*, where aspirin was used in 100% of patients.[16]

DISCUSSION

ACS is considerably more likely to occur in families with a history of Coronary Artery Disease (CAD), as hereditary susceptibility can lead to metabolic problems, hypertension, and dyslipidemia. Excess body weight is associated with insulin resistance, inflammation, and elevated cholesterol levels-all of which contribute to atherosclerosis-obesity is another significant risk factor.[13] Smoking accelerates the course of CAD and raises the risk of ACS by harming endothelial cells, causing oxidative stress, and raising the propensity for blood clot formation. Due to endothelial dysfunction, increased platelet adhesion, and a general pro-inflammatory state, diabetes increases the risk of cardiovascular disease and raises the burden of atherosclerosis. Drinking too much alcohol can aggravate lipid imbalances, increase blood pressure, and cause irregular heartbeats, all of which increase a person's risk of developing ACS.[8] The risk of ACS is increased by hyperlipidemia, which is defined by high levels of triglycerides and LDL cholesterol. This condition also encourages plaque accumulation in arteries, which narrows them and limits blood flow to the heart. Identification and control of these risk factors are crucial for cardiovascular health because they together affect vascular function, increase inflammation, and promote plaque instability, all of which contribute to the pathophysiology of ACS.[14] These risk factors might be inherited or lifestyle-related. The association between smoking status and the type of ACS is statistically significant, indicating that smoking may be a stronger predictor for certain types of ACS. Similarly, hypertension is also significantly associated with the type of ACS. Table 1 shows the Chi-Square Test for Association Between Categorical Variables.

The findings of this study are similar to those reported by El-Sayed *et al.*, where hypertension and diabetes were among the leading risk factors in women with ACS.[15] Similarly, Dilip et al. found that hypertension (63%) and diabetes (51%) were prevalent in their study population.[16]

Smoking was significantly associated with ACS type, particularly STEMI, which is consistent with findings from Ralapanawa *et al.*, where smoking was more prevalent among STEMI patients.[17] This highlights the critical role of smoking cessation in reducing ACS incidence. The findings of this study underscore the importance of addressing modifiable risk factors like smoking, hypertension, and diabetes to reduce ACS incidence. The predominance of STEMI and the widespread use of guideline-based therapies indicate significant strides in ACS management. However, the burden of risk factors like smoking and hypertension remains a challenge, emphasizing the need for enhanced preventive strategies. Future research should focus on long-term outcomes, particularly in high-risk groups, and explore the impact of socioeconomic factors on ACS management and outcomes. Expanding research to multiple centers will also help in obtaining

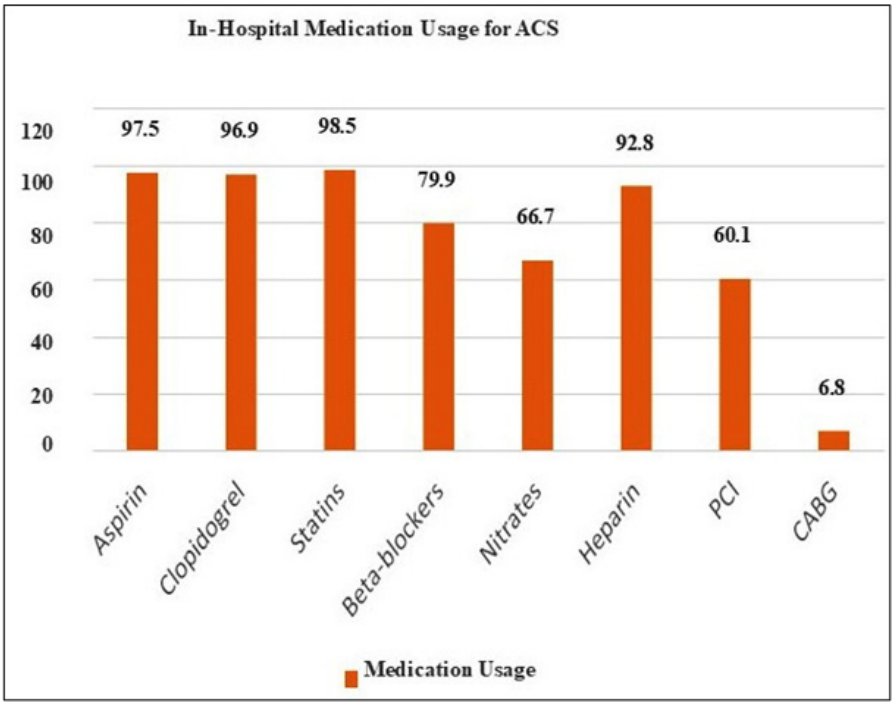

Figure 2: In hospital medication usage wise distribution of ACS patients.

Table 1: Chi-Square Test for Association Between Categorical Variables.

Variables Compared	Chi-Square Value	Degrees of Freedom (d_f)	*p*-value	Significance
Sex vs. Type of ACS	3.54	2	0.17	Not Significant
Smoking Status vs. Type of ACS	7.62	2	0.02	Significant
Alcohol Use vs. Type of ACS	4.10	2	0.13	Not Significant
Hypertension vs. Type of ACS	9.32	2	0.01	Significant

Table 2: Logistic Regression Analysis of Risk Factors for ACS.

Risk Factor	Odds Ratio (OR)	*p*-value	Significance
Hypertension	2.2	0.001	Significant
Diabetes	1.5	0.08	Not Significant
Smoking	2.8	0.002	Significant
Alcoholism	1.3	0.18	Not Significant

a more comprehensive understanding of ACS across diverse populations.

The study has several limitations that may impact its generalizability and comprehensiveness. Conducted at Bangalore Baptist Hospital with a sample size of 200 patients, its findings may not be fully applicable to larger or more diverse populations. The retrospective cross-sectional design, relying on medical records, introduces potential biases, missing data, and recall bias. Additionally, being a single-center study, it may not capture variations in ACS management across different hospitals or regions. While management practices were reported, the study lacked detailed insights into the rationale behind treatment decisions. Moreover, it provided limited information on long-term patient outcomes, such as 30-day mortality or readmission rates. Socioeconomic factors, including income, education, and healthcare access, were also not considered, potentially overlooking key determinants of ACS outcomes.

Future research on ACS at Bangalore Baptist Hospital should focus on integrating machine learning for risk prediction and personalized treatment. Longitudinal studies are needed to assess long-term outcomes, including readmission and quality of life. Expanding socioeconomic research can help identify disparities in care, while multi-center collaborations will improve the generalizability of findings. Evaluating hospital-based quality improvement interventions is essential, particularly in low-income settings. Studying the impact of public health crises like COVID-19 can enhance preparedness. Patient-centered research and implementation science should guide the adoption of evidence-based practices, ensuring effective, patient-focused ACS management in clinical settings.

CONCLUSION

The prevalence of risk factors for ACS in young patients with ACS is different from those in older patients. The prevalence of smoking and alcohol addiction was higher in the case of young patients. In general, ~ 60% population was detected with STEMI followed by unstable angina ~20% and NSTEMI ~19%. The administration of aspirin, clopidogrel, beta-blockers, ACE inhibitors/ARBs, and statins formed the cornerstone of ACS management. However, the non-use of beta-blockers, cardiogenic shock, and reduced ejection fraction emerged as independent predictors of mortality. This research provides a foundation for future studies to enhance ACS treatment protocols and patient outcomes, emphasizing the need for larger, multi-centered trials to validate these findings. There is still a need to improve cardiovascular primary prevention and health promotion in the population.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

ACS: Acute Coronary Syndrome; **PCI:** Percutaneous Coronary Intervention; **CVDs:** Cardiovascular diseases; **IHD:** Ischemic heart disease; **NSTEMI:** non-ST elevation myocardial infarction; **STEMI:** ST-elevation myocardial infarction; **GBD:** Global Burden of Disease; **LDL:** Low-density lipoprotein; **UA:** Unstable Angina; **CAD:** Coronary artery disease.

SUMMARY

This prospective observational study assessed 200 ACS patients in a tertiary care hospital and identified key modifiable risk factors, including smoking, hypertension, and diabetes. STEMI was the most common diagnosis. The findings underscore the need for early prevention and guideline-based management to improve patient outcomes.

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