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# FREQUENCY OF UNDIAGNOSE DIABETES IN PATIENT PRESENTING WITH ACUTE CORONARY SYNDROME AT TERTIARY CARE HOSPITAL OF KARACHI

*Original Research*

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## ABSTRACT

**Background:** Acute coronary syndrome (ACS) is a major cause of morbidity and mortality, with diabetes mellitus being a key risk factor that worsens cardiovascular outcomes. Undiagnosed diabetes remains a silent contributor to ACS, increasing the risk of complications due to prolonged hyperglycemia, endothelial dysfunction, and accelerated atherosclerosis. The burden of undiagnosed diabetes varies globally, with limited region-specific data in developing countries. Early identification of undiagnosed diabetes in ACS patients can enhance treatment strategies, improve prognoses, and reduce cardiovascular complications.

**Objective:** This study aimed to determine the prevalence of undiagnosed diabetes among patients presenting with ACS at a tertiary care hospital in Karachi and to assess its association with demographic and clinical characteristics.

**Methods:** A cross-sectional study was conducted at the National Institute of Cardiovascular Diseases, Karachi, over six months. A total of 241 patients aged 25 to 70 years with a confirmed diagnosis of ACS were included using consecutive sampling. Patients with previously diagnosed diabetes or a history of ACS were excluded. Data on demographics, clinical history, and cardiovascular risk factors were collected. HbA1c levels were measured to identify undiagnosed diabetes, defined as HbA1c ≥6.5%. Statistical analysis was performed using SPSS version 22, with categorical variables expressed as frequencies and percentages, and continuous variables as means and standard deviations. A chi-square test was used to determine associations, with a significance level of $p \leq 0.05$.

**Results:** The mean age of participants was 54.59 ± 8.9 years, with 74.69% being male. Urban residents accounted for 69.71% of the sample. Hypertension was present in 59.75%, dyslipidemia in 49.79%, and smoking history was noted in 39.83% of current smokers and 19.92% of ex-smokers. STEMI was the most common ACS type (39.83%), followed by NSTEMI (34.85%) and unstable angina (24.9%). The mean HbA1c level was 6.03 ± 0.92%, and undiagnosed diabetes was identified in 24.9% of patients. A significant association was observed between undiagnosed diabetes and hypertension ($p = 0.04$) as well as dyslipidemia ($p = 0.03$).

**Conclusion:** A substantial proportion of ACS patients had undiagnosed diabetes, highlighting the urgent need for routine glycemic screening in high-risk populations. The strong association between undiagnosed diabetes and cardiovascular risk factors underscores the importance of integrating diabetes detection into ACS management protocols. Targeted interventions and preventive strategies are essential to improving patient outcomes and reducing diabetes-related cardiovascular complications.

**Keywords:** Acute coronary syndrome, Cardiovascular diseases, Diabetes mellitus, Dyslipidemia, Glycated hemoglobin A, Hypertension, Smoking.

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## INTRODUCTION

Acute coronary syndrome (ACS) encompasses a spectrum of life-threatening conditions, including non-ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI). It remains a significant contributor to global morbidity and mortality, affecting millions of individuals each year. Among the well-established risk factors for ACS, such as hypertension, smoking, dyslipidemia, and obesity, diabetes mellitus stands out as a critical determinant of adverse cardiovascular outcomes (1). Diabetes is recognized not only as a major contributor to coronary artery disease (CAD) but also as a factor associated with worse prognosis, increased complications, and prolonged hospital stays in patients presenting with ACS (2).

A growing body of evidence highlights that dysglycemia, including undiagnosed diabetes, is a frequent but often overlooked metabolic disorder in patients with ACS. Individuals with undiagnosed diabetes may experience prolonged exposure to hyperglycemia, leading to endothelial dysfunction, systemic inflammation, and accelerated atherosclerosis—all of which contribute to the pathophysiology of coronary artery disease. Studies have reported wide variations in the prevalence of undiagnosed diabetes in ACS patients, ranging from 6% to 44%, likely due to differences in population characteristics, diagnostic criteria, and healthcare accessibility. This variability underscores the need for region-specific research to better understand the burden of undiagnosed diabetes in ACS patients, particularly in developing countries where diabetes prevalence is rising at an alarming rate (3).

Pakistan, in particular, is witnessing an unprecedented surge in diabetes cases. Recent data indicate that the prevalence of diabetes in the country has reached a staggering 17.1%, with a substantial proportion of cases remaining undiagnosed. The lack of routine screening and early detection exacerbates the risk of severe complications, particularly in patients presenting with acute cardiovascular events. Given the critical interplay between diabetes and ACS, timely identification of undiagnosed diabetes in this high-risk population could improve patient outcomes by enabling earlier interventions and targeted management strategies (4).

This study aims to determine the prevalence of undiagnosed diabetes in patients presenting with ACS at a tertiary care hospital in Karachi. Identifying the burden of unrecognized diabetes in this specific population will provide valuable insights for healthcare providers and policymakers, facilitating the development of screening protocols and preventive strategies to reduce diabetes-related complications and improve overall cardiovascular health outcomes (5,6).

## METHODS

This cross-sectional study was conducted at the Department of Cardiology, NICVD, Karachi, over a period of at least six months following approval from the Institutional Review Board and the College of Physicians and Surgeons Pakistan. The study aimed to determine the prevalence of undiagnosed diabetes in patients presenting with acute coronary syndrome (ACS). The sample size was calculated using the OpenEpi sample size calculator, based on a previously reported prevalence of undiagnosed diabetes in ACS patients, with a margin of error of 3% and a 95% confidence interval. The required sample size was determined to be 241 patients, and participants were enrolled through a consecutive sampling technique (7).

The study included patients aged 25 to 70 years of both genders who presented with ACS, as defined by operational criteria. Patients with a prior history of ACS or a documented diagnosis of diabetes mellitus, including those taking hypoglycemic medications, were excluded to ensure that only previously undiagnosed cases were assessed. Ethical approval was obtained before the commencement of data collection. All eligible patients who arrived at the emergency department and met the inclusion criteria were approached for enrollment. Informed consent was obtained from each participant after explaining the study's purpose, risks, and benefits. Clinical history and demographic information were recorded at the time of admission. The type of ACS was categorized based on clinical and diagnostic criteria (8).

For diabetes screening, a 5 cc venous blood sample was collected under sterile conditions for glycated hemoglobin (HbA1c) analysis. The assigned bedside staff performed the sample collection, ensuring proper labeling before sending it to the laboratory for testing. The diagnosis of undiagnosed diabetes was established using predefined HbA1c cut-off values. Additional variables such as age, gender, place of residence, family income, education level, body mass index (BMI), type of ACS, hypertension, dyslipidemia, and family history of diabetes were systematically recorded using a structured questionnaire (9).

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Data analysis was conducted using SPSS version 22. Continuous variables, including age, height, weight, BMI, monthly income, and HbA1c levels, were summarized as means and standard deviations. Categorical variables, such as gender, place of residence, education level, type of ACS, presence of hypertension, dyslipidemia, and family history of diabetes, were presented as frequencies and percentages. Undiagnosed diabetes was further stratified by these explanatory variables to identify potential associations. A post-stratification chi-square test was applied, considering a p-value of $\leq 0.05$ as statistically significant.

One potential limitation in the methodology is the use of a single HbA1c measurement for diagnosing undiagnosed diabetes, as transient hyperglycemia due to acute illness or stress response in ACS patients might lead to overestimation. Additionally, while the study accounts for key demographic and clinical factors, potential confounding variables such as medication use, inflammatory markers, or stress hyperglycemia were not explicitly controlled, which may affect the accuracy of diabetes prevalence estimates. Despite these considerations, the study follows a standardized and ethically approved protocol to provide reliable insights into the burden of undiagnosed diabetes among ACS patients in a tertiary care setting (10).

## RESULTS

The study population had a mean age of 54.59 years (±8.9), indicating a middle-aged cohort. The average monthly income was 40,757.22 PKR (±14,287.43), reflecting economic variability. The mean height was 166.49 cm (±7.92), while the mean weight was 77.23 kg (±13.93), resulting in an average BMI of 27.64 kg/m² (±5.11), suggesting a high prevalence of overweight and obesity, both established risk factors for acute coronary syndrome (ACS). Males constituted the majority (74.69%), with females comprising 24.9%. Most participants (69.71%) resided in urban areas, while 29.88% were from rural settings. Educational attainment varied, with 19.92% having primary or secondary education, while 14.94% each had matric, intermediate, graduate/higher education, or were illiterate. Hypertension was prevalent in 59.75% of patients, while 49.79% had dyslipidemia. Smoking history revealed 39.83% were current smokers, 19.92% were ex-smokers, and 39.83% were non-smokers. A family history of diabetes was reported by 44.81% of participants. STEMI was the most common ACS presentation (39.83%), followed by NSTEMI (34.85%) and unstable angina (24.9%). The mean HbA1c level was 6.03% (±0.92), and undiagnosed diabetes was detected in 24.9% of participants, underscoring the need for routine glycemic screening in high-risk populations.

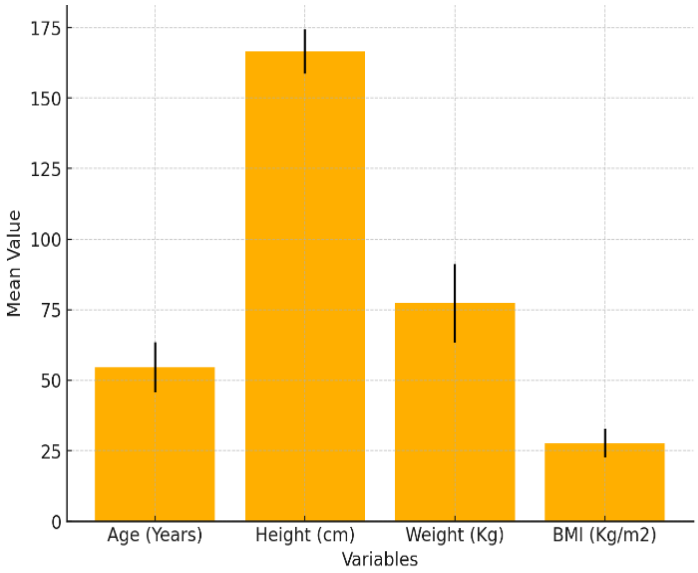


**Figure 1 Demographics**

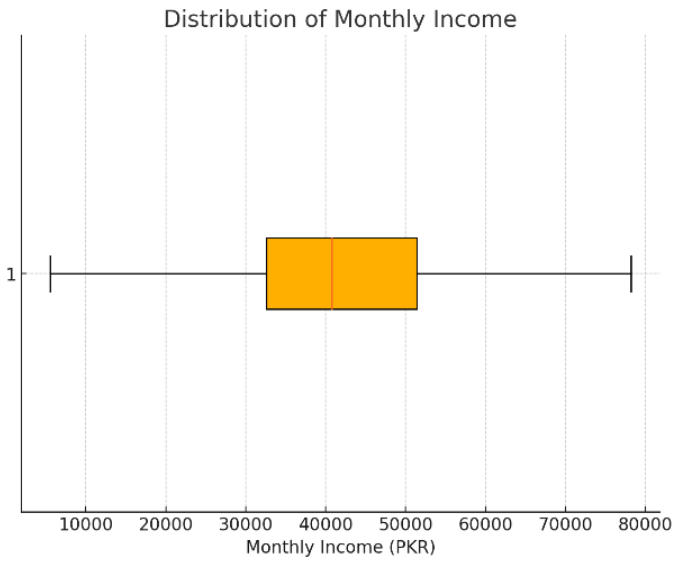


**Figure 2 Distribution of Monthly Income**

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**Table 1 Study Demographics**

| | Age (Years) | Monthly Income (PKR) | Height (cm) | Weight (Kg) | BMI (Kg/m2) |
|---|---|---|---|---|---|
| mean | 54.59 | 40757.22 | 166.49 | 77.23 | 27.64 |
| std | 8.9 | 14287.43 | 7.92 | 13.93 | 5.11 |

The study sample had a mean age of **54.59 years** (±8.9), indicating a middle-aged population. The average **monthly income** was **40,757.22 PKR** (±14,287.43), reflecting economic variability among participants. The mean **height** was **166.49 cm** (±7.92), with an average **weight** of **77.23 kg** (±13.93). The mean **BMI** was **27.64 kg/m²** (±5.11), suggesting that many participants were overweight or obese, which aligns with known risk factors for acute coronary syndrome.

**Table 2 Demographic and Educational Distribution**

| | Gender Frequency | Gender Percentage (%) | Residence Frequency | Residence Percentage (%) | Education Frequency | Education Percentage (%) |
|---|---|---|---|---|---|---|
| Female | 60 | 24.9 | | | | |
| Male | 180 | 74.69 | | | | |
| Rural | | | 72 | 29.88 | | |
| Urban | | | 168 | 69.71 | | |
| Graduate/Higher | | | | | 36 | 14.94 |
| Illiterate | | | | | 36 | 14.94 |
| Intermediate | | | | | 36 | 14.94 |
| Matric | | | | | 36 | 14.94 |
| Primary | | | | | 48 | 19.92 |
| Secondary | | | | | 48 | 19.92 |

The study sample consisted predominantly of **males (74.69%)**, with **females comprising 24.9%**. Most participants **(69.71%)** resided in **urban areas**, while **29.88%** were from rural areas. Educational background varied, with **19.92% having primary education**, **19.92% having secondary education**, and **14.94% each in the matric, intermediate, graduate/higher, and illiterate categories**. This distribution highlights the diverse socioeconomic and educational backgrounds of the participants.

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**Table 3 Cardiovascular Risk Factors Distribution**

| | Hypertension Frequency | Hypertension Percentage (%) | Dyslipidemia Frequency | Dyslipidemia Percentage (%) | Smoking Frequency | Smoking Percentage (%) | Family H/o DM Frequency | Family H/o DM Percentage (%) | Type of ACS Frequency | Type of ACS Percentage (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| No | 96 | 39.83 | 120 | 49.79 | | | 132 | 54.77 | | |
| Yes | 144 | 59.75 | 120 | 49.79 | | | 108 | 44.81 | | |
| Current smoker | | | | | 96 | 39.83 | | | | |
| Ex smoker | | | | | 48 | 19.92 | | | | |
| No smoker | | | | | 96 | 39.83 | | | | |
| NSTEMI | | | | | | | | | 84 | 34.85 |
| STEMI | | | | | | | | | 96 | 39.83 |
| Unstable Angina | | | | | | | | | 60 | 24.9 |

The majority of participants had **hypertension (59.75%)**, while **39.83%** were non-hypertensive. **Dyslipidemia was present in 49.79%** of patients. Regarding smoking status, **39.83% were current smokers, 19.92% were ex-smokers, and 39.83% were non-smokers**. A **family history of diabetes was reported by 44.81%** of participants. Among the types of acute coronary syndrome (ACS), **STEMI was the most common (39.83%)**, followed by **NSTEMI (34.85%)** and **Unstable Angina (24.9%)**. These findings reflect key cardiovascular risk factors in the study population.

**Table 4 Prevalence of Undiagnosed Diabetes**

| HbA1c Mean (%) | HbA1c Std Dev (%) | Undiagnosed Diabetes - Yes (Frequency) | Undiagnosed Diabetes - Yes (%) | Undiagnosed Diabetes - No (Frequency) | Undiagnosed Diabetes - No (%) |
|---|---|---|---|---|---|
| 6.03 | 0.92 | 60 | 24.9 | 181 | 75.1 |

The mean **HbA1c level** in the study population was **6.03% (±0.92)**, indicating a mix of normal, prediabetic, and diabetic individuals. **Undiagnosed diabetes was found in 24.9%** of participants, while **75.1%** had no prior diabetes diagnosis. This highlights the significant burden of undiagnosed diabetes in patients presenting with acute coronary syndrome, emphasizing the need for routine screening and early detection.

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## DISCUSSION

The findings of this study highlighted a substantial burden of undiagnosed diabetes among patients presenting with acute coronary syndrome (ACS), reinforcing the well-established association between dysglycemia and adverse cardiovascular outcomes. The mean HbA1c level of 6.03% (±0.92) indicated a significant proportion of individuals with underlying metabolic disturbances, with 24.9% having undiagnosed diabetes (11,12). This aligns with global evidence suggesting that diabetes, particularly when undiagnosed, contributes to endothelial dysfunction, systemic inflammation, and accelerated atherosclerosis, predisposing individuals to ACS. The predominance of male patients (74.69%) is consistent with previous epidemiological studies demonstrating a higher incidence of ACS in males due to hormonal and lifestyle-related factors. The study also revealed a high prevalence of hypertension (59.75%) and dyslipidemia (49.79%), both key contributors to coronary artery disease progression. The substantial proportion of smokers, with 39.83% identified as current smokers, further underscores the need for aggressive risk factor modification strategies in this population (13,14).

The predominance of STEMI (39.83%) over NSTEMI (34.85%) and unstable angina (24.9%) highlights the severe clinical manifestations of ACS in this cohort. The urban-rural disparity, with 69.71% of participants residing in urban areas, reflects the increasing burden of cardiovascular disease in densely populated regions, likely driven by sedentary lifestyles, dietary habits, and environmental stressors (15,16). The association between lower educational attainment and ACS was evident, with a significant proportion having only primary or secondary education, suggesting that health literacy may play a role in disease prevention and early detection. The economic variability, with a mean monthly income of 40,757.22 PKR (±14,287.43), indicates disparities in healthcare accessibility, which may have contributed to the delayed diagnosis of diabetes in a quarter of the population. These findings highlight the urgent need for systematic screening programs and early intervention strategies to mitigate the long-term consequences of undiagnosed diabetes in ACS patients (17,18).

The study's strengths lie in its focus on an at-risk population, utilizing objective laboratory markers such as HbA1c for diabetes detection rather than relying solely on fasting glucose levels, which may miss chronic hyperglycemia. The inclusion of a well-defined cohort from a tertiary care setting strengthens the internal validity of the findings. However, certain limitations must be acknowledged. The cross-sectional design precluded the assessment of long-term cardiovascular outcomes in patients with undiagnosed diabetes. Additionally, the study was conducted in a single tertiary care hospital, limiting its generalizability to the broader population, particularly rural areas with different healthcare accessibility (19,20). The reliance on self-reported smoking and family history of diabetes may have introduced recall bias. Moreover, the absence of data on insulin resistance markers or inflammatory biomarkers limited the ability to comprehensively assess the underlying pathophysiological mechanisms linking undiagnosed diabetes to ACS. Despite these limitations, the findings emphasize the critical need for integrating routine diabetes screening in ACS management protocols, particularly in populations with a high diabetes burden, to facilitate early diagnosis, optimize glycemic control, and improve cardiovascular outcomes (21,22).

A comparative study conducted in a tertiary care hospital in Islamabad evaluated the prevalence of undiagnosed type 2 diabetes mellitus (T2DM) in patients presenting with acute coronary syndrome (ACS). The study was cross-sectional, spanning three months, and included 100 patients between the ages of 18 to 65 years. The results demonstrated a high prevalence of undiagnosed diabetes in ACS patients, with 27.65% of male participants and 18.8% of female participants identified as having previously undiagnosed T2DM. The study also highlighted that 37% of the sample presented with STEMI, 40% with NSTEMI, and 23% with unstable angina. Mean HbA1c levels were significantly elevated at 4.3 ± 1.7%, and the mean fasting blood glucose level was 129 ± 17.9 mg/dL. The findings underscored the need for routine diabetes screening in ACS patients, as undiagnosed diabetes contributes to increased cardiovascular risk. Additionally, the study observed that research findings from developing nations showed consistency with these results, while data from developed countries exhibited contrasting trends. These discrepancies emphasize the role of genetic, environmental, and healthcare accessibility factors in diabetes prevalence among ACS patients (23).

A comparative study conducted by Maaz et al. (2024) evaluated the prevalence of undiagnosed diabetes mellitus among patients presenting with acute coronary syndrome (ACS) at Khyber Teaching Hospital, Peshawar. The study, which included 245 ACS patients, reported a substantial prevalence of undiagnosed diabetes, with fasting blood glucose levels averaging 120 ± 25 mg/dL, slightly exceeding the normal range. The researchers found that hypertension was the most common comorbidity (49.0%), followed by dyslipidemia (40.8%) and smoking (32.7%). Notably, the study highlighted an increased risk of undiagnosed diabetes among hypertensive patients, although the association did not reach statistical significance (OR 1.8, 95% CI: 0.9–3.5). Compared to previous

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studies, these findings emphasize the silent burden of diabetes in ACS patients and underscore the importance of routine glycemic screening upon hospital admission to optimize cardiovascular outcomes. The study further supports the evidence that patients with undiagnosed diabetes often present with more severe ACS phenotypes, necessitating targeted management strategies. These findings align with global trends, reinforcing the necessity of integrating diabetes screening into standard ACS protocols to enhance early detection and therapeutic intervention (24,25).

## CONCLUSION

This study highlights the significant burden of undiagnosed diabetes in patients presenting with acute coronary syndrome, emphasizing the critical need for routine screening and early detection. The findings reinforce the strong link between dysglycemia and adverse cardiovascular outcomes, underscoring the importance of integrating diabetes assessment into standard ACS management protocols. Given the rising prevalence of diabetes, particularly in developing regions, targeted interventions and proactive screening strategies are essential to mitigate complications and improve patient prognosis. Strengthening healthcare policies to enhance early diagnosis and implement preventive measures can significantly reduce the long-term impact of undiagnosed diabetes on cardiovascular health. These insights provide valuable guidance for clinicians and policymakers in refining treatment approaches and optimizing patient care.

### AUTHOR CONTRIBUTIONS

| Author | Contribution |
|---|---|
| Abdul Wasay | Substantial Contribution to study design, analysis, acquisition of Data<br>Manuscript Writing<br>Has given Final Approval of the version to be published |
| Afshan Shaikh | Substantial Contribution to study design, acquisition and interpretation of Data<br>Critical Review and Manuscript Writing<br>Has given Final Approval of the version to be published |
| Meena Kumari | Substantial Contribution to acquisition and interpretation of Data<br>Has given Final Approval of the version to be published |
| Muhammad Ishaq* | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Mumtaz Ali | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Adem Sadik | Substantial Contribution to study design and Data Analysis<br>Has given Final Approval of the version to be published |
| Asif Ali | Contributed to study concept and Data collection<br>Has given Final Approval of the version to be published |

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