

Age Related Risk Factors (Diabetes Mellitus, Hypertension, Body Mass Index/Obesity, and Hyperlipidemia) With Clinical Presentation of Coronary Artery Disease in Najaf

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Abstract

Background: Clinical characteristics and risk factor profiles of acute coronary syndrome among age groups differ. These differences are important to better preventive strategies based on age-specific detection and risk stratification.

Objective: To compare demographic, metabolic, and clinical features between acute coronary syndrome patients according to their age.

Materials and methods: Cross-sectional study, 123 patients with a diagnosis of acute coronary syndrome were enrolled. Patients were classified two groups: ≤ 50 years ($n=28$) and >50 years ($n=95$). Chi-square and Mann–Whitney U tests were performed for comparison of sex, BMI, HbA1c, hypertension, diabetes, hyperlipidemia, smoking, acute coronary syndrome subtype, and troponin status.

Results: In young acute coronary syndrome patients (<50 years), male 82.1% and smoker 64.3% were more common than older ones. Hypertension 78.9% and Diabetes 48.4% were more common in the older age group >50 years. Median BMI and HbA1c were similar in both groups. A positive troponin was much more frequent in younger patients (53.6% vs. 30.5%, $p=0.02$), with no significant difference in the proportions of STEMI, NSTEMI and unstable angina subtypes by age.

Conclusion: In younger patients with acute coronary syndrome, modifiable lifestyle risk factors such as smoking frequently are observed, while in older patients it is comorbidities that usually characterize burden of past medical history, in particular hypertension and diabetes. These results indicate that age-specific prevention and treatment strategies are needed for the prevention of CVD. Additional research is needed to examine targeted preventive interventions, especially among younger adults.

Keywords: Clinical characteristics, risk factor, Acute Coronary Syndrome, demographic, metabolic, clinical features

ACS: Acute Coronary Syndrome

BMI:

HbA1c:

CVD:

Introduction

Cardiovascular disease mortality is leading cause of death globally, it was responsible for around of 17.9 million annually, primarily resulting from ischemic heart disease and stroke [1-2]. The impact of ACS is substantial in both high-income and low/middle income regions, while age-standardized ACS mortality has declined in high-income countries, absolute mortality remains high and is increasing or plateauing in many low- and middle-income regions [3-4]. For example, one global review noted that age-standardized ACS mortality rates in 2020 were highest in lower-income regions, whereas two decades ago they were concentrated in high-income regions. In the Middle East and North Africa, cardiovascular disease accounts for roughly 1/3 of all deaths, highlighting regional importance of ACS and its risk factors [5]. Likewise, in South Asia the ACS burden is rising rapidly, and it is predicted that more than half of the world's cardiovascular disease will soon occur in South Asian populations [6]. So understanding the risk factors and clinical patterns of ACS especially as they vary by age – is critical to inform prevention and treatment strategies. Age is a determinant of ACS pathophysiology, risk profile, and presentation. Age correlates strongly with the cumulative exposure to atherosclerotic risk factors (e.g. diabetes mellitus, hypertension, dyslipidemia) and thus with the extent of coronary artery disease. Elderly patients presenting with ACS usually have had decades of traditional risk factor exposure and frequently manifest with multi vessel atherosclerosis and comorbidities, leading to greater mortality and complication. For example, studies have shown that elderly ACS patients more often have long-standing hypertension and diabetes and are more likely to develop acute heart failure and in-hospital complications [7-9]. Conversely, ACS in younger patients (often defined in studies as under 45–50 years of age) may reflect a different pathophysiological process: while atherosclerosis remains the dominant cause, there is often a greater contribution of acute triggers (e.g. smoking, plaque rupture on less calcified plaques) and non-traditional factors (such as familial hyperlipidemia or spontaneous coronary dissection). Large studies and reviews Note that younger ACS patients can have distinct phenotypes, often with more vigorous inflammatory response and a different spectrum of atherosclerotic plaque features compared to older patients. Younger ACS patients are much more likely to be male, to smoke tobacco, and to have a family history of premature coronary disease ⁽³⁾. They also tend to have higher levels of serum cholesterol and more often present with STEMI, whereas older patients more

commonly present with NSTEMI or unstable angina [10]. For instance, a recent Middle Eastern cohort found that patients <50 years with a first ACS had higher rates of smoking, elevated cholesterol, and family history of CAD, and were more likely to have STEMI on presentation. These age-related distinctions extend to clinical outcomes and resource implications. Older ACS patients often present later to the hospital after symptom onset and are less likely to receive reperfusion therapies like thrombolysis. They also experience higher rates of in-hospital complications (e.g. heart failure, arrhythmias, cardiogenic shock) and have a higher short-term mortality risk. In contrast, younger patients typically have less extensive coronary disease on angiography and lower short-term mortality, but their STEMI presentations mean they may require urgent intervention. From a public health perspective, ACS in younger adults is particularly concerning, it represents premature disease that imposes a heavy socio-economic burden and indicates potential gaps in primary prevention. With rising obesity and diabetes incidence in many populations, there is evidence that ACS is affecting younger age groups more than in previous decades. In South Asia and the Middle East especially, “younger” presentations of ACS are increasingly recognized [11]. Therefore, systematic comparison of risk factor profiles and presentations by age is critical. Hospital-based studies are well suited to this task, as they capture detailed clinical and metabolic data on diverse ACS patients in real-world practice. By quantifying how key risk factors (diabetes mellitus, hypertension, body mass index/obesity, and hyperlipidemia) and presentation characteristics differ between patients aged ≤50 years versus >50 years, clinicians can better tailor prevention messages and treatment strategies. Moreover, identifying age-specific gaps (for example, undiagnosed risk factors in young patients or suboptimal management in elderly) has epidemiological importance for regionally targeted interventions. Despite this knowledge, the balance of risk factors and clinical features by age can vary by population and setting, and direct comparisons in specific regions are needed. The present paper aims to compare patients age difference (≤50 years versus >50 years with ACS), in the prevalence of major risk factors (diabetes mellitus, hypertension, body mass index/obesity, hyperlipidemia) and in clinical presentation and severity.

Patient and Methods

Study Design and Setting

Cross-sectional study was conducted at two teaching hospitals in Najaf, Iraq (Al Najaf Teaching Hospital and Al Sader Teaching Hospital). Data collection was from August 1, 2024, to April 1, 2025. All data were collected at a single time point (the time of hospital admission for ACS) with no follow-up, consistent with a cross-sectional design, data collection sheet was used to gather information.

Participants

The study population included patients admitted with Acute Coronary Syndrome (ACS) during the study period. We enrolled all eligible patients as they were admitted.

Inclusion criteria

Adults' patients with a confirmed diagnosis of ACS for first time (including ST-elevation myocardial infarction [STEMI], non-ST elevation myocardial infarction [NSTEMI], or unstable angina) were eligible for inclusion.

Exclusion criteria

- Any patient with incomplete data for any major study variable.
- Those with a history of prior myocardial infarction or any coronary revascularization procedure (percutaneous coronary intervention or CABG).
- Patients with a previous ischemic heart disease are excluded to focus only on people having (ACS) for the first time. This is important because people with past ischemic heart disease may already be on treatment, which can change their risk and affect the results. By studying only new cases, we can better understand how age affects the risk of getting ACS for the first time. ACS diagnoses were confirmed based on standard clinical criteria (ischemic symptoms, electrocardiographic changes, and cardiac biomarker elevations for myocardial infarction).

Applying these criteria, a total of 123 patients met the inclusion criteria and were enrolled in the study.

Data Collection and Variables

Data were collected at the time of each patient's admission using a structured information sheet. Key variables recorded for each patient included:

- Age
- Sex
- Smoking status
- Body mass index (BMI)
- Glycated hemoglobin (HbA1c)
- Cardiac troponin status
- The presence of major cardiovascular risk factors (history of hypertension, disease, alcohol, and socioeconomic status).

For analysis purposes, patients were stratified into two age groups:

≤50 years and >50 years based on their age at admission. This age cutoff was chosen a priori to compare risk profiles between relatively younger and older ACS patients.

Laboratory measurements

All patients were underwent laboratory testing as part of their ACS work-up. Admission blood samples were analyzed for:

- Cardiac troponin levels using a high-sensitivity assay in the hospital laboratory. Troponin values above the reference limit were considered positive, indicative of myocardial injury (defining myocardial infarction), whereas values below this threshold were considered negative (consistent with unstable angina in the context of an ACS presentation).
- HbA1c was measured from admission blood samples (EDTA anticoagulated) using standard high-performance liquid chromatography methods (or an equivalent accredited assay) to assess chronic glycemic status. The HbA1c results (reported as a percentage) were recorded for all patients.
- Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m²).

Participants were categorized based on BMI into the following groups:

- Normal weight (BMI 18.5–24.9)
- Overweight (BMI 25.0–29.9)
- Obesity Class I (BMI 30.0–34.9)
- Obesity Class II (BMI 35.0–39.9)

According to World Health Organization (WHO) classification criteria.

Definition of variables

Hypertension: defined as a documented blood pressure of >130/90 mmHg on at least two separate readings or current use of antihypertensive medication (American heart association).

Diabetes mellitus (DM): defined as a fasting plasma glucose ≥126 mg/dL on two occasions or current treatment with insulin or oral hypoglycemic agents. Plasma glucose in random sample ≥ 11.1 mmol/L (200 mg/dL), In addition, an HbA1c ≥6.5% (48 mmol/mol) was considered diagnostic of diabetes in patients without a prior DM diagnosis, in line with international criteria (American Diabetes Association guidelines).

Dyslipidemia: defined as total serum cholesterol >200 mg/dL, serum triglycerides >150 mg/dL, or current use of lipid-lowering therapy (such as statins), LDL ≥160 mg/dL is high, ≥190 mg/dL is very high and often prompts more aggressive evaluation / treatment, HDL ≥40 mg/dL in men and ≥50 mg/dL in women; levels above 60 mg/dL are considered optimal, while values below thresholds increase risk.

Smoking status: was classified based on patient self-report, patients were classified as current smokers if they were actively smoking tobacco (or had quit within the last month), former smokers if they had a history of regular smoking but had quit more than one month prior to admission, or never smokers if they had no history of smoking. Smoking is a leading preventable cause of illness and death, driven by the addictive nicotine in tobacco smoke and numerous carcinogens. Nicotine reaches the brain rapidly, triggering dopamine and reinforcing addiction, while tolerance and withdrawal—like irritability, anxiety, and cravings—perpetuate continued use. The damage of smoking spans virtually every organ: it causes heart attacks, strokes, COPD, various cancers, reproductive and immune dysfunction, and impairs healing. Globally, tobacco kills around 8 million people each year, and smokers lose an average of 10 years of life. Quitting begins to restore health within minutes and progressively over years cutting risks of heart disease, cancer, and stroke in half between 1 and 10 years' post-cessation. For analytic purposes, smoking was classified into (current smoker vs. non-smoker) in some subgroup analyses. Body mass index (BMI) was treated as a continuous variable.

Ethical Considerations

Verbal informed consent was obtained from each participant before enrollment. Patient confidentiality was strictly maintained by using anonymized data collection sheets and secure data storage, the study's objectives and procedures were explained to all participants.

Statistical Analysis

Statistical analysis was performed using a software package (JAMOV 2.3.28). Continuous variables were summarized as means with standard deviations (SD) if normally distributed, or medians with interquartile ranges if data were not normally distributed. Categorical variables were summarized as frequencies and percentages. We classified the analysis by the two age groups (≤50 vs. >50 years) to compare patient characteristics and risk factor profiles between younger and older ACS patients. Group comparisons for categorical variables (such as sex, risk factor prevalence, troponin positivity, smoking status) were made using the Chi-square test (or Fisher's exact test when expected cell counts were small). For continuous variables (such as BMI and HbA1c), an independent sample t-test was used to compare means between the two age groups when the data approximated a normal distribution. If continuous data were non-normally distributed, a non-parametric Mann-Whitney U test was used as an alternative, P value < 0.05 was considered statistically significant for all analyses.

Results

Demographic and Metabolic Characteristics

The characteristics of the patients are presented in table (1).

Table 1: demographic and metabolic characteristics by age group:

Variable	Age ≤50 (n= 28)	Age >50 (n = 95)	P** - value
Sex - n (%)			
Male	23 (82)	63 (66)	0.109
Female	5 (17)	32 (33)	
BMI - n (%)			
Normal / healthy weight	14 (50)	30 (31.6)	0.35
Over weight	8 (28.6)	39 (41.1)	
Obesity class 1	5 (17.9)	22 (23.2)	
Obesity class 2	1 (3.6)	4 (4.2)	
HbA1C (%)*	6.2 (5.38 - 8.3)	6 (5.5 - 7.85)	0.87
Diabetes mellitus - n (%)			
Yes	14 (50)	46 (48)	0.88
No	14 (50)	49 (51)	
Hypertension - n (%)			
Yes	17 (60)	75 (78.9)	0.051
No	11 (39)	20 (21)	
Dyslipidemia - n (%)			
Yes	13 (46.4)	50 (52.6)	0.56
No	15 (53.5)	45 (47.4)	
Smoking - n (%)			
Yes	18 (64.3)	49 (51)	0.23
No	10 (35.7)	46 (48)	

*Data shown as median (IQR) for skewed variables. , ** chi square was used for categorical data, and Mann - Whitney for continuous data.

A total 123 patients were recruited into the study and divided into two groups according to age: ≤50 years (n=28) and >50 years (n=95). There is no significant difference in sex distribution between the groups $p = 0.109$. The proportion of males was higher in young group 82.1 than older 66.3%, figure (1). The distribution of BMI categories did not differ significantly between the two groups $p=0.35$. Among group one, 50% of participants had a normal or healthy weight, 28.6% were overweight, 17.9% were classified as obesity class 1, and 3.6% as obesity class 2. In contrast, among group two, 31.6% had a normal BMI, 41.1% were overweight, 23.2% had obesity class 1, and 4.2% had obesity class2. Median HbA1c was also similar between the two age groups: 6.2% (IQR: 5.38–8.3) in the younger group and 6.0% (IQR: 5.5–7.85) in the older group $p=0.87$. No statistically significant differences were observed in BMI or HbA1c.

- Diabetes mellitus was present in 14(50.0%) and 46 patients 48% of patients who were ≤50 and >50 years, respectively $p=0.88$

- Hypertension existed in 17 patients 60.7% in the younger group and 75 patients 78.9% in the older group. It was more prevalent in the older age group, but no significantly different $p=0.051$.

- Dyslipidemia was diagnosed in 13 patients 46.4% and 50 patients 52.6%, aged ≤50 and >50 years respectively, and the difference between the groups was not significant $p=0.56$.

- Smokers were more prevalent in the younger group, $n=18$ patients 64.3%, versus $n=49$ (51.6%) in the older group. However, this difference did not statistically significance $p=0.23$.

Acute Coronary Syndrome Characteristics, summarized in table (2).

Figure (2) ST-elevation myocardial infarction (STEMI) was most prevalent subtype of ACS in both age groups: 60.7% and 54.7% of the cases in patients' ≤50 years >50 years, respectively $p=0.85$. The distribution of non-STEMI and unstable angina was also consistent through all age groups. However, there was a statistically significant $p=0.02$ difference in the expression of biomarkers by age group, with troponin positivity being much more prevalent in the younger population (53.6% vs. 30.5%).

Table 2: acute coronary syndrome characteristics by age group

Variable	Age ≤50 (n= 28)	Age >50 (n = 95)	P - value
Acute coronary subtype - n (%)			
STEMI	17 (60.7)	52 (54.7)	0.85
NSTEMI	6 (21.4)	24 (25.2)	
Unstable angina	5 (17.85)	19 (20)	
Troponin status - n (%)			

Positive	15 (53.6)	29 (30.5)	0.02
Negative	13 (46.4)	66 (69.5)	

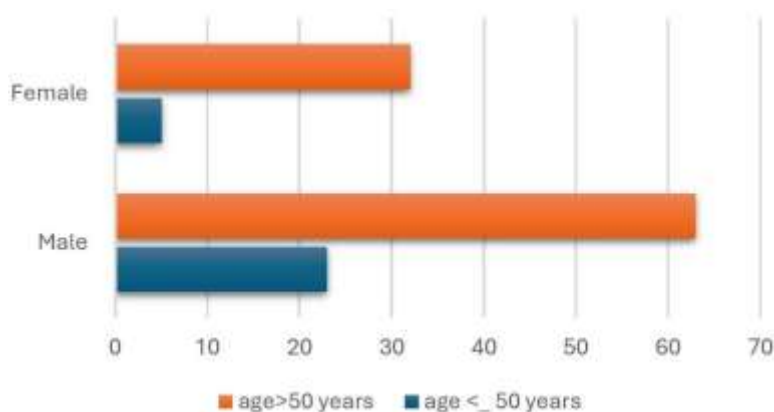


Figure 1: the sex distribution between two age groups

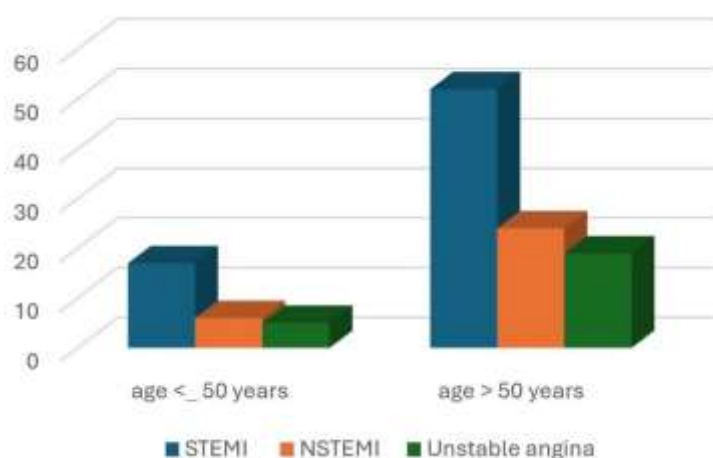


Figure 2: the acute coronary syndrome distribution between age groups

Discussion

In this study, we observed distinct age-related patterns in acute coronary syndrome (ACS) risk factors. Adults with age 50 years or below, ACS were predominantly male and exhibited a higher incidence of troponin-positive ACS, i.e., STEMI/NSTEMI), whereas older patients >50 years more often had troponin-negative unstable angina and a greater burden of chronic risk factors. Troponin positivity was significantly more common in patients below age 50 years, suggesting they frequently presented with true myocardial infarctions rather than unstable angina. This finding aligns with evidence that younger individuals tend to experience ST-elevation MI as an initial presentation, while older patients more often present with non-ST-elevation MI or angina [12-13]. Also smoking and alcohol use were strongly associated with STEMI in younger patients, whereas hypertension and prior angina were significantly more frequent in NSTEMI/unstable angina patients (who tended to be older) [14]. These patterns support the explanation that younger ACS patients often suffer from acute plaque-rupture events leading to large MIs, whereas older patients may develop ACS via more chronic, sub-total occlusions or demand ischemia, presenting as NSTEMI or angina. Consistent with this, prior research studies had shown that NSTEMI patients are, on average, older than STEMI patients in both Western and Asian populations [15]. Age differences in troponin-positive ACS likely reflect underlying pathophysiology, younger patients' first coronary event is more often an abrupt, full-thickness infarction, whereas older individuals (with long exposure to atherosclerosis with multiple comorbidities and collateral circulation that predispose to subtler presentation it is also important to note that advancing age itself can influence troponin dynamics—studies have demonstrated that troponin assays have reduced specificity in the elderly, meaning troponin elevations in older patients are not always due to acute MI [16]. This could partly explain why troponin positivity was proportionally lower in older group in this study, as some may have had non-ACS causes of mild troponin elevation or truly negative biomarkers due to presenting with unstable angina. Younger ACS patients in our study had a distinctive risk factor profile, being more likely to be smokers and less likely to have pre-existing conditions like hypertension or diabetes. This align with a registry of 1,199 MI patients found that those ≤50 years old were disproportionately male, with a high prevalence of current smoking and obesity, while having significantly lower rates of hypertension, dyslipidemia, and diabetes compared to

older patients [17]. Older ACS patients in our study had a higher proportion of hypertension (and often multiple risk factors) is also well documented. An Australian analysis similarly noted that adults ≥ 75 years with ACS had a greater cumulative risk factor burden (e.g. higher rates of hypertension, diabetes, and dyslipidemia) than those under 55 [18]. Young MI patients globally are more often male, smokers and with obesity or adverse lifestyles, whereas older patients more frequently have metabolic risk factors such as long-standing hyperlipidemia and familial cardiovascular disease history [19]. The male predominance among younger ACS cases (and female predominance in older age groups) seen in our study is likewise reflected in regional registries⁽⁸⁾. Estrogen's protective effects and differences in risk exposure likely to delay acute coronary events in women, contributing to a greater proportion of men in younger ACS demographics [20]. The age-related characteristics of ACS in this study carry important implications for both clinical practice and public health strategy. First, the occurrence of ACS in younger adults emphasize a need for earlier screening and risk factors management. Our results support aggressive cardiovascular risk screening (for cholesterol, blood pressure, diabetes mellitus, etc.) to younger populations, especially in regions where young people commonly have risk factors like smoking and dyslipidemia. Early identification of high-risk individuals (for example, young adults with a strong family history or with lifestyle risks) could facilitate timely interventions (such as lifestyle modification, smoking cessation, or treatment of elevated lipids) before a first MI occurs [21]. In this study, many young ACS patients had few or no traditional risk factors, indicating that risk stratification tools reliant on age may underestimate risk in this group. Clinicians should therefore be alert not to dismiss chest pain in a young patient as "non-cardiac" without proper evaluation [22]. The average age of ACS is much younger than in the West [23], thus public health authorities should tailor prevention campaigns accordingly. This could include anti-tobacco campaigns, nutritional programs to combat obesity and dyslipidemia from an early age, and routine blood pressure/glucose screening in early adulthood rather than waiting until middle age. The finding that older patients had an overwhelming prevalence of hypertension suggests that better blood pressure control in mid-life might delay or prevent many ACS cases in later years. Strengthening primary care systems to manage hypertension, diabetes, and hyperlipidemia in the general population will particularly benefit those entering older age, where these risks translate into ACS events. Finally, our study results confirm the need for community awareness: both young and old individuals (and healthcare providers) should be educated that ACS is not only a "disease of old age." Younger people with chest discomfort should seek prompt medical attention, and healthcare systems in regions with younger ACS burdens must be prepared with appropriate triage and management strategies. In that study, younger patients had a lower prevalence of diabetes and hypertension compared to those ≥ 50 years [24]. Similarly, research from other regions has shown that young ACS patients often have a group of metabolic and lifestyle risk factors such as obesity and hyperlipidemia, while older patients accumulate chronic conditions. In one Pakistani tertiary-center study of 18–40-year-olds with ACS, hypertension (46.3%), smoking (41.9%), dyslipidemia and diabetes (31.3%) were already highly prevalent, reflecting that even younger patients bear significant modifiable risks [25].

Conclusion

Age plays an essential role in expression of the profile of patients affected by acute coronary syndrome. Younger patients of our study typically presented with a large MI (troponin positive) secondary to lifestyle risk factors (especially smoking and dyslipidemia) and older patients presented with hypertension-mediated coronary disease as NSTEMI/unstable angina. These data are similar to those reported not only in the western population in Asia but indicate an especially young age at ACS in our area (approximately ten years earlier than in the west). Our findings emphasize the importance of early adult cardiovascular risk screening and prevention strategies, for early detection and optimal management of ACS. Identifying the distinct profiles of young and older ACS patients enables improved risk stratification and management, ultimately aiming to reduce the overall burden of coronary disease.

Recommendations

- Adopt early screening and lifestyle-based prevention (smoking cessation, blood pressure control) of younger adults.
- Perform larger multicenter prospective studies with long follow-up.
- Add other risk markers (such as, lipid profiles, and inflammatory markers) in future studies.
- Educate the general public that young people can also be affected by ACS.
- Analyzing by gender may contribute to explaining the sex-related differences in ACS

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