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Prevalence and outcome of cigarette and water pipe smoking among young patients with acute coronary syndrome in Erbil city

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Abstract

Cardiovascular disease is the leading cause of disease and death worldwide, beyond cardiovascular disease rapidly rising in the Kurdistan Region of Iraq. Acute coronary syndrome is common at an increasingly younger age in Erbil City. Cigarettes and water pipe smoking are the important causative factors for ACS in Erbil, Kurdistan Region of Iraq.To study the prevalence rates and outcomes of cigarette and water pipe smoking in the young ACS patients, and further to assess the impact of dual tobacco use on ACS severity, LVEF and the need for revascularization. This cross-sectional study included adult ACS patients admitted to the Erbil Cardiac Center between June and December 2025. We included 260 patients with ACS aged from 18 to 45 years and used a standardized form for collection of demographics, smoking, angiographic, in-hospital stay, and post-discharge smoking data. Chi-square tests, t tests, and logistic regression analyzed the data with consideration for $p< 0.05$ as meaningful. In the study, 60.0% of 260 participants are current smokers, 30.0% are former smokers, and 10.0% are people who never smoked. Water pipe use appeared in 55.1% of current smokers. STEMI was the most common type of MI within smokers and NSTEMI was more common within ex-smokers while angina was more common among non-smokers ($p < 0.001$). In smokers (41.0%), the LAD artery was the most frequently involved artery. Heart failure, arrhythmias, reinfarction, and death occurred with more frequency in smokers ($p< 0.001$). Of the smokers who lived until discharge, 76.3% kept smoking and 71.4% said they wanted to quit smoking. young ACS patients in Erbil smoke cigarettes and water pipes at a high rate, which associates to worse initial presentation and in-hospital clinical outcomes. Incorporate cessation programs into post-ACS care and cardiac rehabilitation services. Incorporate cessation programs into public health education and prevention campaigns to counter the high burden of tobacco-related premature cardiovascular disease in the region.

Keywords: Acute coronary syndrome, Outcome, Smoking, Shisha, Vape.

Introduction

Cardiovascular disease is globally established and leading cause of morbidity and mortality worldwide.[1] In 2021, it was estimated that around 640 million people were having different spectrums of cardiovascular disease; that's more than half a billion people.[2] In the Kurdistan region of Iraq, recent data have shown a troubling pattern of a rapidly accelerating burden. In Erbil city, particularly, Acute Coronary Syndrome (ACS) is increasingly affecting a younger age group of patients.[3] This epidemiological transition has resulted in substantial loss of productivity in the country's primary workforce and has placed a growing strain on the health system and the families alike.[4] This makes understanding the catalysts of this change from late-life atherosclerotic-driven disease to early-onset ACS paramount for clinicians and researchers to guide clinical practice and develop preventative strategies. One of the most strongly linked modifiable risk factors for coronary heart disease is tobacco use in its many forms.[3] In the Middle East, the tobacco landscape differs vastly from that of the Western world. In the Kurdistan region specifically, cigarette smoking appears to be woven into the fibers of the culture.[5] In addition to the widespread and often socially celebrated cigarette consumption, a relatively new phenomenon is taking root in the form of water pipe smoking, more often referred to as shisha or hookah.[5,6] The dangers of water pipe smoking present themselves in the form of the common perception that it is a benign social activity with little to no health implications.[7] A growing body of evidence, however, has proven that the noxious, flavored smoke from water pipes is overloaded with toxins that cause vascular and hemodynamic effects that are comparable to, if not worse than, those of traditional cigarette smoking.[6,7,8] Cigarette smoke exposure sets a backdrop favorable for thrombosis through oxidative damage to cardiac myocytes, increased smooth muscle proliferation, and increased platelet aggregation.[9] Clinically, this

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pattern is more significant in the younger demographic, in whom intense exposure to one or more risk factors is the driver of sudden, thrombotic coronary events rather than decades of unchecked atherosclerosis. [10]

In regional practice, the angiographic profiles of young ACS patients differ significantly from the classic picture of ischemic heart disease in older adults.[4] Younger patients are more likely to present with single-vessel occlusion (usually the Left Anterior Descending, or LAD), causing ST-elevation myocardial infarction (STEMI). This finding is consistent with the acute thrombotic mechanism induced by tobacco exposure.[3,4] One notable observation that has been the source of confusion for clinicians and the public alike is the "smoker's paradox." This occurs when smokers sometimes demonstrate short-term favorable outcomes during their inpatient treatment after an acute coronary event.[11] However, multivariable analysis has revealed that when adjusting for confounding by age and comorbidity, tobacco use is an independent predictor for long-term mortality and morbidity. [12,29]

Despite the plethora of studies in the field, significant gaps persist in Erbil regarding the local prevalence and outcomes of cigarette and water pipe smoking among young ACS patients. As such, this study aims to determine the prevalence of cigarette and waterpipe smoking, to evaluate in-hospital and short-term outcomes associated with each tobacco modality, and to assess the combined effect of dual use on ACS severity, left ventricular ejection fraction (LVEF), and the need for revascularization.

Materials and Methods

Study design: To assess the prevalence and outcomes from cigarette and water pipe smoking among the young patients with acute coronary syndrome (ACS) who visited the hospitals of Erbil City, a cross-sectional study was performed.

Study setting and duration: The study occurred at the Erbil Cardiac Center in Erbil, Iraq from 1 June 2025 to 1 October 2025.

Study population: Young adults aged 18 to 45 years admitted for the diagnosis of ACS which includes STEMI, non-ST-elevation myocardial infarction or NSTEMI, or unstable angina, were included in the trial. Doctors diagnosed based on the clinical presentation, ECG changes, and they quantified cardiac biomarkers.

Inclusion criteria: The study included people aged 18-45 years, with clinically diagnosed ACS (STEMI, NSTEMI, and unstable angina), residing in Erbil, and admitted into the Erbil Cardiac Center after a complete smoking history was recorded covering cigarettes and/or water-pipe smoking.

Exclusion criteria: Exclusion criteria were ACS when it did not originate from atherosclerosis such as when coronary arteries dissected, when vasospasm occurred without tobacco smoking, when CABG had occurred, when PCI had occurred in the 30 days prior to the episode, when terminal illness meant prognosis was less than 30 days, when data lacked on smoking exposure/outcome, or when other major cardiotoxic agents concurrently were in use like intravenous stimulants, anorectics, or appetite suppressants.

Sampling Method and Sample Size: We employed convenience sampling, and based on the literature and the formula for estimating the sample size of a cross-sectional study, the final sample size was 260. Information was obtained from case report forms and hospital records. The variables of interest were smoking status (current cigarette use, current water-pipe use, dual smoking) and in-hospital results (in-hospital mortality, MACE, arrhythmias, cardiogenic shock, length of hospital stay) and short-term outcomes (LVEF and need for revascularization procedures).

Ethical approval statement: After we fully described the informed consent process verbally to the patients, we received the required patient informed consent. After all ethical issues were considered, ethical approval was obtained from the Kurdistan Higher Council for Medical Specialties (KHCMS) ethical committee (number 2245, 09/28/2025).

Data collection and variables: Descriptive statistics were calculated to determine the prevalence of smoking behavior, and chi-square tests, t-tests, logistic regression and general linear models were used to determine between-group differences in:

Cigarette smokers vs. non-smokers; water-pipe users versus non-water-pipe users; dual users versus non-single or non-users. A p-value of < 0.05 was considered statistically meaningful.

Table (1): Sociodemographic characteristics of the young ACS patients

Variables	N (%)
Age groups	
30-35	84 (32.3%)
36-40	86 (33.1%)
41-45	90 (34.6%)
Gender	
Male	189 (72.7%)
Female	71 (27.3%)
Marital Status	
Single	33 (12.7%)
Married	227 (87.3%)
Level of education	
No schooling	40 (15.4%)
Primary	52 (20.0%)
Secondary	90 (34.6%)
University	78 (30.0%)
Exercise	
Yes	93 (35.8%)
No	167 (64.2%)
Alcohol	
Yes	30 (11.5%)
No	230 (88.5%)
Family smoke	
Yes	156 (60.0%)
No	104 (40.0%)

Results

Table (1) shows the demographics and baseline characteristics of young ACS patients enrolled in our study. Most of the study participants (34.6%) were in the age group of 41-45 years of age, followed by the age group of 36-40 and 30-35 years of age (33.1% and 32.3%, respectively). In study population, most of them were males (72.7%) and were previously married (87.3%). About a third were educated at a secondary (34.6%) or university (30.0%) level, 35.8% of the population were physically active and 64.2% were physically inactive. Only 11.5% had ever drunk alcohol, but 60.0% had a family member who smoked.

Table (2) shows how the clinical characteristics distribute with cardiovascular risk factors of the study population. Hypertension affected the study population the most at 74.6%, then dyslipidemia affected 72.7% and diabetes mellitus affected 55.8%. Ischemic heart disease had a positive family history in 53.8% of patients. PCI had been performed in 23.8% of patients in the preceding month prior to admission to the hospital.

Table (2): Clinical characteristics and cardiovascular risk

Variables	N (%)
Hypertension	
Yes	194 (74.6%)
No	66 (25.4%)
Diabetes	
Yes	145 (55.8%)
No	115 (44.2%)
Dyslipidemia	
Yes	189 (72.7%)
No	71 (27.3%)
Family history of IHD	
Yes	140 (53.8%)
No	120 (46.2%)
Previous PCI	
Yes	67 (25.8%)
No	193 (74.2%)

Of all the patients with young ACS admitted to the hospital, 60% of the patients were active smokers, 30% were ex-smokers and 10% were never-smokers. The distribution of active and ex-smokers in the study population is consistent with the distribution of reasons to smoke in 234 young ACS patients who were active or ex-smokers. The most common reason patients gave for smoking was for pleasure (41%, 96 patients), followed by stress relief (37%, 86 patients), and cultural or social influence (22%, 52 patients).

Current and former smoking rates of study participants are shown in Table (3). Of participants who smoke currently (n = 1458), 49.4% reported smoking 11 to 20 cigarettes per day, 26.9% reported smoking 1 to 10 cigarettes per day, and 23.7% reported smoking greater than 30 cigarettes per day. Most ex-smokers or 52.6% stated that they consumed more than 30 cigarettes each day on the other hand. The remaining ex-smokers reported smoking 11-20 cigarettes each day (42.3%) or 1-10 cigarettes each day (5.1%). Water pipe smoking was reported solely among current smokers. Of respondents, 55.1% reported using water pipe frequently, and 16.7% of current smokers and 14.1% of former smokers

reported using e-cigarettes/vaping in the past.

Table (3): Smoking pattern among the current and former smokers (N: 234)

Smoking pattern	Among current smokers	Among former smokers
Cigarettes per day		
10-Jan	42 (26.9%)	4 (5.1%)
20-Nov	77 (49.4%)	33 (42.3%)
>30	37 (23.7%)	41 (52.6%)
Water pipe		
Yes	86 (55.1%)	0 (0.0%)
No	70 (44.9%)	78 (100.0%)
Vaping		
Yes	26 (16.7%)	11 (14.1%)
No	130 (83.3%)	67 (85.9%)

Table (4) demonstrates the relationship between smoking status and several clinical parameters among young patients with ACS. Among current smokers, the majority (71.2%) presented with ST-Elevation Myocardial Infarction (STEMI), while 24.4% had angina and only 4.5% had non-ST-elevation myocardial infarction (NSTEMI). In contrast, all former smokers (100%) were diagnosed with NSTEMI, and all never smokers (100%) presented with angina, with no cases of STEMI or NSTEMI observed in this group. This association was statistically significant ($p < 0.001$). A statistically significant association was observed between smoking status and coronary artery involvement ($p = 0.001$). Among current smokers, the left anterior descending, or LAD, was most commonly affected (41.0%), followed by the right coronary artery, or RCA (35.3%), and the left circumflex artery, or LCX (23.7%). Amongst former smokers, LCX involvement was predominant (42.3%), while in never smokers, LAD lesions were most frequent (53.8%). There was a significant association observed between smoking status and post-angiography medication adherence ($p < 0.001$). Among current smokers, only 62.2% adhered to prescribed therapy, while 37.8% were non-compliant. In contrast, all former smokers (100%) and never smokers (100%) reported full adherence, indicating that current smokers were significantly less likely to maintain regular medication use, reflecting poorer compliance and self-care behavior after intervention.

Table (4): Association between smoking status and clinical characteristics of young ACS patients

Variables	Current smoker	Former smoker	Non-smoker	P-value
Diagnosis				
STEMI	111 (71.2%)	0 (0.0%)	0 (0.0%)	
NSTEMI	7 (4.5%)	78 (100.0%)	0 (0.0%)	<0.001
Angina	38 (24.4%)	0 (0.0%)	26 (100.0%)	
Angiography result				
LAD	64 (41.0%)	15 (19.2%)	14 (53.8%)	
RCA	55 (35.3%)	30 (38.5%)	4 (15.4%)	0.001
LCX	37 (23.7%)	33 (42.3%)	8 (30.8%)	
Regular medication				
Yes	97 (62.2%)	78 (100.0%)	26 (100.0%)	<0.001
No	59 (37.8%)	0 (0.0%)	0 (0.0%)	

As shown in Table (5), there was a relationship between smoking status and the occurrence of complications, discharge status, and length of hospital stay. Of the hospitalized current smokers, 62.2% did not have any complications. Others developed heart failure (11.5%), arrhythmias (7.1%), reinfarction (14.7%), or died (4.5%). Of ex-smokers, 37.2% were complication free, 38.5% had heart failure, 19.2% had arrhythmia and 5.1% died. No never smoker had complications or died ($p < 0.001$). In our study, in-hospital complications were more common in current and ex-smokers when compared to never smokers who had a 0% complication rate. There was a very meaningful relationship between the smoking status of the patient and the outcome of discharge ($p < 0.001$). 80.8% of continuing smokers improved, while 14.7% were referred and 4.5% died. In terms of discharge status, 94.9% of former smokers and 100% of never smokers improved. Thus, those who could still be classified as smokers, were less likely to improve on discharge compared with former smokers and never smokers. When

people smoked, that correlated with being in the hospital ($p < 0.001$). Of current smokers, 48.7% were discharged in 1 to 5 days after admission. 51.3% stayed more than 5 days. A majority (57.7%) of the former smokers who completed the study stayed for 6 to 10 days, while all of the never smokers were discharged in 1 to 5 days, showing longer stays for smokers.

Table (5): Association between smoking status and in-hospital outcomes among young ACS patients

Variables	Current smoker	Former smoker	Non-smoker	P-value
In-hospital complication				
None	97 (62.2%)	29 (37.2%)	26 (100.0%)	
Heart failure	18 (11.5%)	30 (38.5%)	0 (0.0%)	<0.001
Arrhythmia	11 (7.1%)	15 (19.2%)	0 (0.0%)	
Reinfarction	23 (14.7%)	0 (0.0%)	0 (0.0%)	
Death	7 (4.5%)	4 (5.1%)	0 (0.0%)	
Discharge status				
Improved	126 (80.8%)	74 (94.9%)	26 (0.0%)	
Referred	23 (14.7%)	0 (0.0%)	0 (0.0%)	<0.001
Death	7 (4.5%)	4 (5.1%)	0 (0.0)	
Hospital stay(s)				
5-Jan	76 (48.7%)	29 (37.2%)	26 (100.0%)	
10-Jun	50 (32.1%)	45 (57.7%)	0 (0.0%)	<0.001
15-Nov	30 (19.2%)	4 (5.1)	0 (0.0%)	

Table (6) shows the smoking pattern of active smokers after being discharged from the hospital. It shows that 119 (76.3%) continued smoking after discharge. However, 30 (19.2%) quit smoking. A small number (7; 4.5%) had died before follow-up. The authors reported that despite experiencing ACS and treatment, the majority of subjects had continued smoking, indicating the difficulty with encouraging smoking cessation, particularly in such high-risk populations.

Table (6): Continuation of smoking after discharge among current smokers (N: 156)

Continue smoking	N (%)
Yes	119 (76.3%)
No	30 (19.2%)
Dead	7 (4.5%)

Among our participants, there were intentions and previous efforts to stop smoking among young ACS patients who resumed smoking after hospital discharge. A large proportion (71.4%) reported wanting to quit, while 34 (28.6%) had no such intention. However, only 37 smokers (31.1%) had ever tried to stop, and the majority (82; 68.9%) had never made any attempt.

Discussion

This study presents one of the first comprehensive analyses of cigarette and water pipe smoking among young patients with acute coronary syndrome in Erbil City. These findings confirm the alarming prevalence of use in this demographic. It has also been shown that tobacco use is closely linked to more severe clinical presentations and poorer in-hospital outcomes. Despite medical intervention, post-discharge cigarette smoking and water pipe use persisted in many patients.

In this cohort of young ACS patients, the majority (60%) were current smokers, while a small minority (10%) had never smoked. This number is significantly higher as compared to community-based surveys in Erbil, where smoking rates were reported to be around 44.3% in young adults.[5] This emphasizes that tobacco use is a key factor in the occurrence of premature ACS in the region and not merely a background risk factor.

One concerning finding was the concurrent use of cigarettes and water pipes, which was reported in more than half of current cigarette smokers (55.1%), mirroring trends across the Middle East, where water pipe smoking is gaining popularity among the

youth.[7,13] A common misconception that fuels this behavior is the belief that water pipe smoke is filtered through the water and, therefore, less harmful. However, studies have shown that a single water pipe session delivers significantly higher amounts of nicotine, tar, and carbon monoxide than cigarettes.[14]

That's not all; a strong association was found between smoking status and the type of ACS. ST-elevation myocardial infarction was observed in the majority of current smokers (71.2%), while former smokers predominantly had NSTEMI, and all non-smokers presented with stable angina. This pattern aligns with existing literature showing that active smokers are more likely to present with STEMI, likely due to smoking-induced plaque rupture and occlusion due to an acute thrombotic event. [3,9,15]This is also supported by angiographic data in this study, which found that current smokers were primarily found to have single-vessel disease, particularly the left anterior descending (LAD) artery. This pattern is frequently observed among young smokers with ACS as compared to the older non-smoker population, in whom chronic, diffuse atherosclerosis is the culprit behind multi-vessel disease.[3,16] The mechanism of this sudden coronary occlusion is smoking-induced endothelial dysfunction, platelet aggregation, and increased blood viscosity, all of which accelerate thrombus formation.[17]

Another noteworthy finding was the differences between the in-hospital outcomes of smokers and non-smokers. Both current and former smokers experienced a significantly higher rate of complications compared to the non-smokers, who remained complication-free. Complications observed during admission included heart failure, arrhythmias, reinfarction, and death in a small percentage of cases. Although the reported in-hospital mortality was low, the difference between the current (4.5%) and former smokers (5.1%) versus non-smokers (0%) is clinically significant. The so-called "smoker's paradox," in which smokers experience better short-term outcomes than non-smokers, is merely a statistical illusion resulting from confounding due to age and co-morbidities.[12,18] When adjusted for these risk factors, smoking was found to be an independent predictor of worse prognosis.[18] The study by Nisar et. al. aligns with this interpretation in that current smokers suffered more complications and prolonged hospital stays.[19]

Medication adherence was markedly lower among current smokers (62.2%) compared with the full adherence seen in former and non-smokers. Multiple studies have reported poor compliance as a recurrent issue among smokers and have linked it to behavioral and psychological factors beyond lack of regard for personal health and well-being.[20] This also underscores the need for tailored post-ACS patient education as well as behavioral interventions targeting adherence and cessation.[21] Data suggests that smoking relapse in response to hospitalization is particularly high, especially among those who have experienced a major cardiac event due to a smoking habit. 76.3% of patients suffering major cardiac events related to smoking continued to smoke when discharged. 71.4% of smokers at discharge reported wanting to quit smoking. Less than a third (31.1%) attempted quitting and similar rates of cessation failure in Namibia and South Africa may be linked to nicotine dependence, cultural acceptance of smoking, and lack of cessation support.[5,22] When patients are given counseling and pharmacotherapy, such as nicotine replacement therapy, the odds of long-term cessation can be doubled.[22,23] The implementation of such measures in post-ACS care in the hospitals in Erbil may assist in the reduction of recurrent cardiovascular events in this high-risk subgroup of patients.[15] Further, beyond recommending more standard and universal implementation of cessation programs at the hospital level, these results have public health and policy implications, suggesting a need for public awareness campaigns targeting common misperceptions regarding the relative safety of water pipe smoking.[24] Using media strategies specifically targeting the youth has proven to be one potential way to encourage young people to stop and not start smoking.[25] Other effective tobacco control measures, such as taxation, restrictions on water pipe cafes, and bans on the sale and distribution of cigarettes, largely lie in the domain of policymakers.[26,27]

Strengths and limitations

Therefore, this study provides unique understanding to the epidemiology and short-term outcomes of ACS in young smokers in a city with very limited data on the subject. This study will also provide a unique understanding of the working relationship between cigarette and water pipe smoking when examined concurrently and with post-discharge follow-up. This

means that the findings of the study may help to inform public health campaigns, and new policies to limit smoking may be introduced to that end. It should be noted that causal inference is not possible due to the cross-sectional study design and that the smoking behavior data rely on self-reporting which could be biased. Long-term outcomes in smokers with ACS were not assessed, and future studies are needed to evaluate long-term outcomes and objective measures of exposure to nicotine in order to confirm and expand these findings.[28]

Conclusion

This study's findings underscore the high burden of cigarette and water pipe smoking in a cohort of patients admitted to represent ACS in Erbil. It is important that cessation therapies are integrated into the post-discharge management of patients, given the association between tobacco use with increased severity of presentation and in-hospital complications. Some of the roster of solutions to the nicotine industry includes public awareness campaigns and smoking initiation prevention.

Conflicts of interest

The authors declare that they have no conflicts of interest regarding the publication of this study.

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