

Original article

Prevalence Of Acute Myocardial Infarction In Young Patients In Kirkuk City

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Abstract:

- **Background:** Acute myocardial infarction (AMI) in the young population is associated with poor prognosis. Several modifiable risk factors have been identified as contributors to the development of AMI in this age group. This study aimed to determine the prevalence of AMI among young adults and to identify the most common associated risk factors.
- **Methods:** A prospective clinical follow-up study was conducted in the Coronary Care Units (CCU) of Azadi Teaching Hospital and Kirkuk General Hospital, Kirkuk, from June 1 to November 30, 2018. A total of 250 patients diagnosed with AMI were included and stratified into two groups: young patients (<55 years) and older patients (≥55 years).
- **Result:** The prevalence of AMI in the young age group was 40.8% (102 patients). Significant associations were observed between AMI in young patients and risk factors such as smoking, a positive family history of ischemic heart disease (IHD), diabetes mellitus, and alcohol consumption. Heart failure emerged as a notable complication among young patients with AMI. Additional findings are discussed in the main text.
- **Conclusions:** AMI is notably prevalent among the young population and is strongly linked to multiple modifiable risk factors, particularly smoking, alcohol use, and a family history of IHD.
- **Keywords:** Acute myocardial infarction, Young age population, Heart failure.



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INTRODUCTION

Coronary heart disease (CHD) remains the leading cause of death worldwide. While extensive data exist on CHD, literature focusing specifically on premature CHD and myocardial infarction (MI) in younger populations is relatively limited. The consequences of MI at a younger age can be particularly devastating due to the potential impact on psychological well-being, economic productivity, and the broader socioeconomic burden, as many of these individuals serve as the primary income earners in their families (1).

Despite significant advances in both primary and secondary prevention strategies, which have led to a reduction in cardiovascular (CV) events and mortality overall (2), similar improvements have not been observed among young adults (3). Cardiovascular disease (CVD) remains a major cause of death in this age group (4). Over the past decade, the incidence of acute myocardial infarction (AMI) in individuals younger than 55 years has remained stable (3). However, with rising rates of traditional CV risk factors—such as diabetes mellitus, obesity, hypertension, hyperlipidemia, and smoking—particularly among adolescents, the prevalence of coronary artery disease (CAD) in younger adults is expected to rise (5).

Prevention efforts in young populations face challenges. A significant proportion of young individuals are unaware of their risk factors, and existing risk prediction tools—developed

based on older populations—often lack accuracy when applied to younger patients, particularly those under 40 years of age (6). In addition, young adults, especially females, may present with atypical symptoms of CAD, contributing to delays in diagnosis and treatment (7). Medication nonadherence is also reported to be higher among young individuals (8).

Universal Definition of Acute MI

According to the universal definition, myocardial injury is defined by elevated cardiac troponin (cTn) levels, with at least one measurement above the 99th percentile upper reference limit (URL). Injury is considered acute when there is a rise and/or fall in cTn values (9).

Acute MI is classified by the presence or absence of ST-segment elevation and further subdivided into six types: type 1 (atherothrombotic event), type 2 (supply-demand mismatch not due to atherothrombosis), type 3 (sudden cardiac death without biomarker confirmation), type 4a (related to percutaneous coronary intervention), type 4b (stent thrombosis), and type 5 (related to coronary artery bypass grafting) (10).

The diagnosis of acute MI (types 1–3) requires evidence of acute myocardial injury plus clinical signs of ischemia, such as ischemic symptoms, new ischemic ECG changes, development of pathological Q waves, or imaging evidence of new regional wall motion abnormalities (9). Coronary thrombus detection also supports diagnosis (for type 1 MI). For

types 4 and 5, procedural-related biomarker elevations and associated findings are used to confirm diagnosis (9).

Acute MI in Young Adults

There is no universal definition of "young" with respect to MI. Some define it as below 40 years (11), others extend the definition up to 55 years (12). Due to this variability, the term "young" will be used in this manuscript according to the definitions provided by the cited studies (13).

Data on MI in younger adults are limited compared to the broader CHD literature. The Framingham Heart Study reported a 10-year incidence of MI in individuals under 55 years of age at 51.1 per 1,000 for men and 7.4 per 1,000 for women (14). McManus et al. reported an incidence of 66 per 100,000 among those aged 25–54 years (15). Autopsy findings by McGill et al. revealed advanced coronary lesions in 20% of men under 35 years (16). Other studies found that 4–10% of all MI admissions occur in individuals under 40 or 45 years (17,18).

Risk Factors

Traditional cardiovascular risk factors appear similarly relevant in both young and older populations. However, younger MI patients often present with at least one identifiable risk factor (19), with smoking, family history of premature CHD, and male gender being especially prevalent (20). A major international study identified nine key modifiable risk

factors: smoking, lipid abnormalities, hypertension, diabetes, obesity, diet, physical activity, alcohol use, and psychosocial factors, with smoking and dyslipidemia being more influential in younger patients (21).

Smoking, in particular, is highly prevalent among young MI patients, with reported rates ranging from 64.5% to 93.7% depending on the population studied (23–26). It is also the most modifiable risk factor. The "smoker's paradox" has raised clinical concerns and may be partly explained by interactions with age and metabolism, such as cytochrome P450 enzyme induction affecting clopidogrel response (28).

Dyslipidemia is another key factor, with strong evidence linking LDL-C and triglycerides to atherosclerosis and MI, and a well-established inverse relationship between HDL-C levels and cardiovascular risk (21,22,29,30).

Hypertension and diabetes, though more common in older patients, still play significant roles in younger populations. Several studies reported varying prevalence, generally lower in young individuals, but still relevant in the pathophysiology of MI through mechanisms like accelerated atherosclerosis and stress-induced hyperglycemia (25–28,31,32).

Clinical Presentation and Angiographic Findings

Most young MI patients present with non-ST elevation MI (NSTEMI), although the incidence of ST elevation MI (STEMI) in this age group appears to be rising (14). Younger

patients often lack prior history of angina, MI, or heart failure (17,33), and many present without classic chest pain, especially younger women (32,34).

Angiographic findings often show less extensive disease in younger patients, with a higher prevalence of single-vessel involvement, commonly affecting the left anterior descending artery (12,33). Normal coronary arteries or spontaneous coronary artery dissection are also more common in this age group (12,35).

Management

Management guidelines for MI are similar across age groups (36). Primary angioplasty remains the preferred strategy for STEMI, with younger patients benefiting significantly (37). Data on NSTEMI management in young patients are limited, but invasive strategies generally show favorable outcomes (12,39,40).

Risk factor modification, particularly smoking cessation, is critical. Evidence shows a 36% reduction in mortality among CHD patients who quit smoking (41), with reduced risk for recurrent coronary events as well (42,43).

Prognosis

Short-term outcomes for young MI patients are generally favorable, with in-hospital and 6-month mortality rates reported as low as 0.7% and 3.1%, respectively (44). However, long-term outcomes are less optimistic, with mortality exceeding 25% by 15 years post-MI

(45,46). Heart failure, arrhythmias, and re-infarction contribute significantly to this decline.

Early diagnosis and intervention remain critical, including consideration for implantable defibrillators in high-risk patients (47).

Post-MI depression and reduced quality of life are also prevalent among young patients, underscoring the importance of comprehensive care, including mental health support (48–50).

PATIENT and METHOD

Study Design, Setting, and Sampling

This study was designed as a prospective clinical follow-up conducted in the Coronary Care Units (CCU) of Azadi Teaching Hospital and Kirkuk General Hospital, located in Kirkuk city. The study period extended from June 1 to November 30, 2018. The study population included all patients admitted to the CCU with a diagnosis of acute myocardial infarction (AMI).

Inclusion criteria comprised adults aged ≥ 28 years presenting with typical ischemic chest pain, electrocardiographic (ECG) changes, and/or elevated cardiac biomarkers confirming acute MI.

Exclusion criteria included patients with other cardiac diseases, non-specific chest pain, inconclusive ECG findings, or absence of changes in cardiac biomarkers.

A convenient sample of 250 eligible patients was enrolled based on the inclusion and exclusion criteria. Patients were stratified into two groups according to age:

- **Young group:** <55 years
 - **Older group:** ≥55 years
-

Data Collection

Data were collected by the researcher through direct interviews using a structured questionnaire. The questionnaire included the following components:

1. **Sociodemographic data:** age, gender, occupation, marital status
2. **Clinical presentation** of AMI
3. **Atherosclerotic risk factors**
4. **Family history** of ischemic heart disease and other risk factors
5. **Physical examination findings**
6. **ECG findings**
7. **Cardiac enzyme results**

8. **Outcomes and complications**, including arrhythmia, heart failure, post-MI angina, and hypotension

The diagnosis of AMI was confirmed by a supervising physician in accordance with the European Society of Cardiology/American College of Cardiology Foundation guidelines, based on clinical features, ECG findings, cardiac biomarkers, and echocardiography.

Monitoring and clinical assessments were performed by CCU resident physicians. ECGs were conducted using a NIHON KOHDEN Cardiofax ECG machine, and cardiac enzyme testing was performed at the Azadi Teaching Hospital laboratory using the BIOZEC Medical 1-step rapid test.

Follow-Up

Patients were followed in the CCU by the researcher for an average duration of three days to monitor clinical outcomes and detect complications.

Statistical Analysis

Data were analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) version 23. Continuous variables were expressed as means and standard deviations, while categorical variables were presented as frequencies and percentages.

- **Chi-square test** was used to analyze differences between categorical variables; **Fisher's exact test** was applied when expected frequencies were <20% of the total.
- **Independent samples t-test** was used to compare means between two groups.
- A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

This study included a total of 250 patients diagnosed with acute myocardial infarction (AMI), with a mean age of 56.4 ± 14 years, ranging from 28 to 80 years. Among them, 102 patients (40.8%) were classified as belonging to the young age group (<55 years), while the remaining 148 patients (59.2%) were in the older age group (≥ 55 years), as illustrated in **Figure 1**.

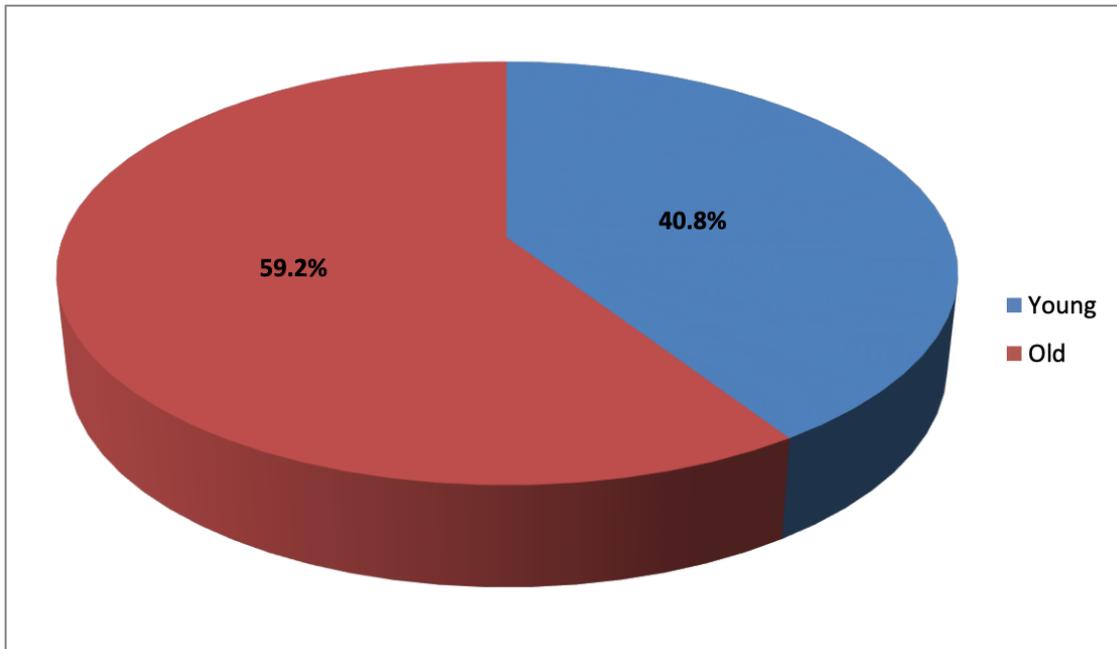


Figure 1: Prevalence of young age Acute Myocardial Infarction patients.

There was no statistically significant difference between the two age groups regarding gender distribution ($p = 0.1$). However, a highly significant association was observed between employment status and younger age ($p < 0.001$), indicating that young AMI patients were more likely to be employed. Marital status also showed a significant association with younger age, with married individuals more frequently affected ($p = 0.01$). These demographic characteristics are detailed in **Table 1**.

Table 1: Distribution of sociodemographic characteristics according to age of AMI patients

Variable	Young age		Old age		P
	No.	%	No.	%	
Gender					0.1*NS

Male	78	76.5	102	68.9	<0.001*S
Female	24	23.5	46	31.1	
Occupation					
Housewife	24	23.5	48	32.4	
Public servant	40	39.2	55	37.2	
Self employed	38	37.3	13	8.8	
Retired	0	-	32	21.6	
Marital status					0.01**S
Married	100	98.0	139	93.9	
Single	2	2.0	0	-	
Widow	0	-	9	6.1	
Divorced	0	-	0	-	

* Chi-square test, **Fishers exact test, S=Significant, NS=Not significant

Regarding the type of acute coronary syndrome, no significant difference was found between young and old AMI patients ($p = 0.1$). However, a highly significant association was observed between younger age and chest pain as the presenting symptom ($p < 0.001$), as presented in **Table 2**.

Table 2: Distribution of clinical presentation according to age of AMI patients

Variable	Young age No.	Young age %	Old age No.	Old age %	P
Acute coronary syndrome type					0.1*NS
ST elevation-MI	84	82.4	127	85.8	

Non-ST elevation-MI	15	14.7	16	10.8	
New LBBB	3	2.9	5	3.4	
Presenting complaints					<0.001*S
Chest pain	41	40.2	57	38.5	
Dyspnea	8	7.8	11	7.4	
Palpitations	1	1.0	11	7.4	
Syncope	0	-	6	4.1	
Others	5	4.9	12	8.1	
Chest pain + palpitations	5	4.9	2	1.4	
Chest pain + dyspnea	26	25.5	32	21.6	
Chest pain + dyspnea + syncope	3	2.9	8	5.4	
Chest pain + dyspnea + others	2	2.0	0	-	
Chest pain + dyspnea + palpitations	6	5.9	7	4.7	
Chest pain + syncope	2	2.0	1	0.7	
Dyspnea + palpitations	3	2.9	1	0.7	

* *Fishers exact test, S=Significant, NS=Not significant.*

Diabetes mellitus was significantly associated with younger patients ($p = 0.02$), as shown in **Table 3**. Furthermore, a strong association was found between a positive family history

of ischemic heart disease (IHD) and young AMI patients ($p < 0.001$). Smoking history also showed a significant association with younger age ($p = 0.02$); 55.9% of young patients were smokers compared to 41.2% of older patients.

Table 3: Distribution of atherosclerotic risk factors according to age of AMI patients

Variable	Young age		Old age		P
	No.	%	No.	%	
Atherosclerotic risk factors					0.02*S
Smoking	26	25.4	45	30.4	
HT	12	11.8	21	14.2	
Obesity	10	9.8	12	8.1	
DM	7	6.9	4	2.7	
Dyslipidemia	0	-	7	4.7	
HT, obesity and DM	5	4.9	1	0.7	
Smoking and HT	9	8.8	9	6.1	
Smoking and dyslipidemia	4	3.9	3	2.0	
Smoking, HT and DM	3	2.9	9	6.1	
Smoking, Obesity and DM	5	4.9	5	3.4	
HT and obesity	3	2.9	0	-	
Smoking, HT, obesity and DM	1	1.0	3	2.0	

HT, obesity, DM and dyslipidemia	2	2.0	0	-
Smoking and DM	6	5.9	5	3.4
HT and DM	1	1.0	11	7.4
Smoking, HT, DM and dyslipidemia	2	2.0	5	3.4
Smoking, HT, obesity and	0		3	2.0
DM and dyslipidemia	3	2.9	2	1.4
Obesity and dyslipidemia	2	2.0	2	1.4
Smoking and obesity	1	1.0	1	0.7

* *Fishers exact test, S=Significant.*

Alcohol consumption, particularly the use of Arak, was significantly higher among young patients ($p = 0.003$ for alcohol overall and $p = 0.02$ for Arak specifically). In addition, menopausal status was significantly associated with acute MI in younger women ($p = 0.003$). These findings are summarized in **Table 4** and **Figure 2**.

Table 4: Distribution of family history of IHD and other risk factors according to age of AMI

patients.

Variable	Young age		Old age		P
	No	%	No	%	
Family history of IHD					<0.001*s
No	51	50.0	112	75.7	
Father	21	20.6	10	6.8	
Mother	5	4.9	8	5.4	
Brother	2	2.0	8	5.4	
Sister	0	-	1	0.7	
Father, mother, brother and sister	10	9.8	1	0.7	
Father and mother	4	3.9	0	-	
Father and brother	5	4.9	5	3.4	
Mother and brother	4	3.9	3	2.0	
Smoking					0.02**s
Yes	57	55.9	61	41.2	
No	45	44.1	87	58.8	
Alcohol consumption					0.003**s
Yes	16	15.7	7	4.7	
No	86	84.3	141	95.3	

Alcohol types					0.02
Beers	2	12.5	0	-	
Whiskey	4	25.0	6	85.7	
Arak (traditional Iraqi alcohol)	10	62.5	1	14.3	
Menopause					0.003**S
Yes	20	83.3	20	43.5	
No	4	16.7	26	56.5	

* *Fishers exact test*, ***Chi-square test*, *S=Significant*, *NS=Not Significant*

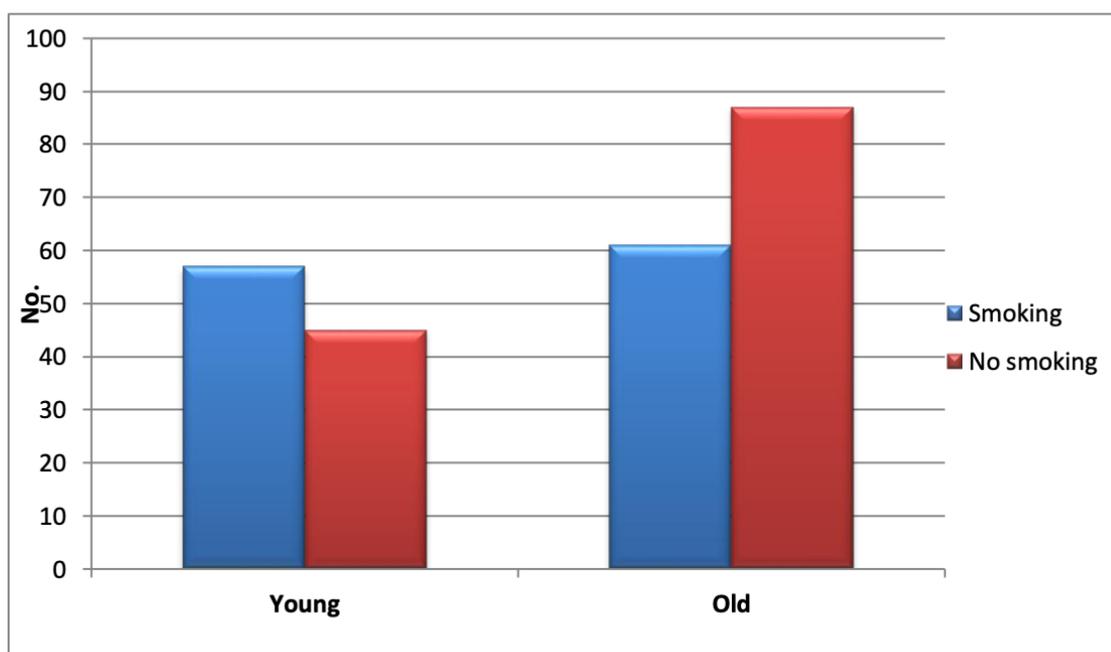


Figure 2: Distribution of smoking according to age of AMI patients.

Electrocardiographic findings revealed a significantly higher incidence of ST-segment elevation and ST-segment depression among young AMI patients ($p = 0.03$). However,

there were no significant differences between age groups in levels of cardiac biomarkers, including myoglobin, CK-MB, and troponin. These results are presented in **Table 5**.

Table 5: Distribution of ECG and cardiac enzymes according to age of AMI patients.

Variable	Young age		Old age		P
	N0	%	N0	%	
ECG findings					0.03*S
ST elevation	57	55.9	85	57.4	
ST depression	21	20.6	19	12.8	
LBBB	5	4.9	15	10.1	
T inversion	6	5.9	2	1.4	
AF	2	2.0	0	-	
Q wave	7	6.9	18	12.2	
Q wave and ST elevation	4	3.9	9	6.1	
Myoglobin					0.8**NS
Positive	29	28.4	40	27.0	
Negative	73	71.6	108	73.0	
CK-MB					0.7**NS
Positive	30	29.4	41	27.7	
Negative	72	70.6	107	72.3	
Troponin					0.7**NS
Positive	101	99.1	147	99.4	
Negative	1	0.9	1	0.6	

* Fishers exact test, **Chi-square test, S=Significant, NS=Not significant.

With respect to complications, there were no significant differences between the two groups in terms of arrhythmia, post-MI angina, or hypotension. However, heart failure occurred significantly more often among young AMI patients ($p = 0.01$), as detailed in **Table 6** and illustrated in **Figure 3**.

Table 6: Distribution of complications and outcome according to age of AMI patients.

Variable	Young age		Old age		P
	No	%	No	%	
Arrhythmia					0.6*NS
Yes	23	22.5	30	20.3	
No	79	77.5	118	79.7	
Heart failure					0.01*S
Yes	21	20.6	14	9.5	
No	81	79.4	134	90.5	
Post MI angina					0.1*NS
Yes	10	9.8	8	5.4	
No	92	90.2	140	94.6	
Hypotension and shock					0.3**NS
Yes	6	5.9	13	8.8	
No	96	94.1	135	91.2	

* Chi-square test, S=Significant, NS=Not significant.

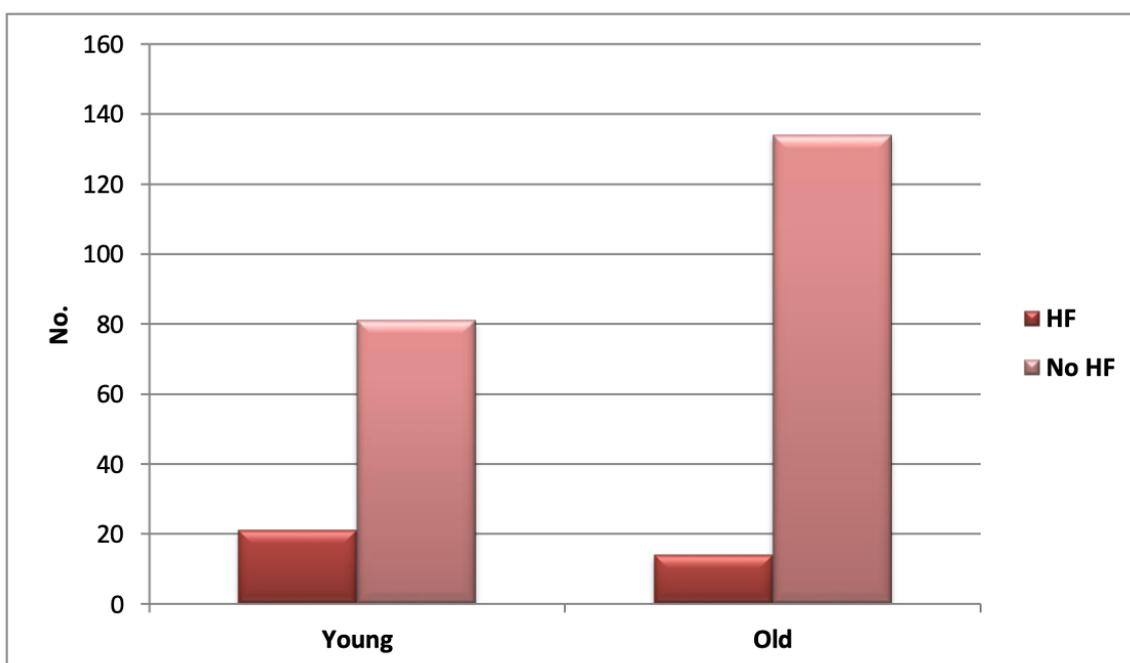


Figure 3: Distribution of HF according to age of AMI patients.

DISCUSSION

Globally, the incidence of coronary artery disease (CAD) among young adults has been increasing, now accounting for approximately 10% of cases (51). The reported incidence of acute myocardial infarction (AMI) among young adults is 51.1 per 1,000 in males and 7.4 per 1,000 in females (13). In Iraq, the first documented prevalence of CAD in young individuals revealed a complete occlusion rate of 37% and severe stenosis in 14% of cases (52).

In the present study, 40.8% of AMI cases occurred in young adults. This finding is consistent with a study conducted by Chaudhary et al. in India, which reported a prevalence of 40.5% (53). However, our prevalence was higher than the 31% reported by

Mohammad et al. in Iraq (51), and significantly higher than the 6.8% prevalence reported by Morillas et al. in Spanish hospitals (54). This variation may be attributed to differences in age definitions, methodological approaches, and the higher prevalence of risk factors among the population in Kirkuk city. Shah et al. in Pakistan found that 16% of patients undergoing coronary angiography for AMI were aged 40 years or younger (55), while another study from India reported that 60.8% of AMI patients were within the 30–40 year age range (56).

A multicenter study in the United States by Gupta et al., analyzing data from over 230,000 AMI patients over ten years, showed that the incidence of AMI in individuals under 55 years had not declined during the study period. Furthermore, young female patients had higher complication rates, longer hospital stays, and increased mortality compared to males (3). In contrast, a Danish study by Alzuhairi et al. demonstrated a significant decline in AMI incidence among young adults of both genders from 1978 to 2012 (57).

Our study found no significant gender difference in the incidence of AMI between young and older adults. Although males generally had a higher incidence, the male-to-female ratio was similar across both age groups. This contradicts the findings of Farhan and Al-Saffar in Iraq, who reported a higher prevalence of AMI in young men (58), but aligns with Canto et al.'s study in the U.S., which found no significant gender difference in AMI

prevalence by age, though young women had higher mortality and longer hospital stays compared to men (59).

A highly significant association was observed between occupational status and AMI in younger patients ($p < 0.001$). This aligns with findings from Shahan et al. in Turkey, which identified physically demanding occupations as a significant risk factor for AMI in young adults (60). Additionally, a significant association was found between marital status and young age AMI ($p = 0.01$), although this contrasts with findings from Schultz et al. in the U.S. and Hu et al. in China, where being unmarried was associated with a higher risk of AMI and mortality (61,62). The discrepancy in our results may be due to the small number of unmarried patients in our sample.

Chest pain was significantly associated with younger AMI patients in our study ($p < 0.001$), supporting the findings of Sinha et al. in India, who identified chest pain as the most common presenting symptom of AMI in young adults (63).

Among the atherosclerotic risk factors, diabetes mellitus showed a significant association with AMI in young patients ($p = 0.02$), in agreement with Akram et al. in India, who reported a high prevalence of smoking, hypertension, dyslipidemia, and diabetes among young AMI patients (64). A strong association was also noted between family history of ischemic heart disease (IHD) and young age AMI ($p < 0.001$), consistent with the findings of Oslu et al. in the UK (65).

Smoking was another significantly associated risk factor in our study ($p=0.02$), consistent with reports by Nafakhi in Iraq (66), Al-Khadra in Saudi Arabia (67), and Singh in the U.S. (68), all of whom identified smoking as a leading risk factor for AMI in young populations. However, Mirza et al. suggested that obesity might be a more significant risk factor than smoking among young Iraqi patients (69).

Alcohol consumption was also significantly associated with young AMI patients in our study ($p=0.003$). Motofsky et al. found that daily alcohol intake increased AMI risk in young adults by 1.72-fold (70). The type and frequency of alcohol intake appear to influence risk as well. Biyik and Ergene reported that Arak consumption had both protective and harmful effects depending on its frequency and quantity (71), while advising caution due to its potential link to liver disease and AMI (72).

Our study found a significant association between menopausal changes in women and the incidence of AMI in young adults ($p=0.003$), corroborating findings from Chandrasekhar et al. in the U.S., which identified hormonal changes as a key risk factor for AMI in young women (72).

ECG findings, particularly ST elevation and ST depression, were significantly more frequent among younger AMI patients ($p=0.03$), a result consistent with the findings of Rajeev Bhardwaj et al. in Nigeria (73). Heart failure emerged as the most significant complication among young AMI patients in our study ($p=0.01$), aligning with Cahill and

Kharbanda's findings in the UK, which identified heart failure as a frequent late complication of AMI, especially among younger individuals (74).

Limitations of the study include loss to follow-up, the single-center setting, and a relatively short study duration.

CONCLUSION

This study highlights that the prevalence of acute myocardial infarction (AMI) among the young population is notably high. The most common clinical presentations in these patients were chest pain and shortness of breath, often prompting urgent medical attention. Electrocardiographic evaluation frequently revealed ST-elevation myocardial infarction (STEMI) as the predominant pattern in younger individuals.

Several risk factors were significantly associated with AMI in the young population, including cigarette smoking, a positive family history of ischemic heart disease (IHD), diabetes mellitus, Arak alcohol consumption, and menopause in women. Occupational strain and marital status also showed notable associations.

Importantly, young patients with AMI were found to have an increased likelihood of developing heart failure as a complication, emphasizing the need for early recognition,

targeted prevention, and comprehensive management of cardiovascular risk factors in this age group.

RECOMMENDATIONS

Young adults presenting with symptoms suggestive of myocardial infarction should be considered a high-risk group requiring vigilant monitoring and tailored clinical care.

Given that most risk factors associated with acute MI in this population are modifiable, focused preventive strategies are essential. These include promoting smoking cessation, encouraging the reduction or elimination of alcohol consumption—particularly among habitual drinkers—and ensuring strict glycemic control in patients with diabetes.

Additionally, targeted public health education campaigns should be implemented to raise awareness among young individuals about the serious cardiovascular risks associated with smoking and its direct role in the development of acute myocardial infarction.

Ethical Clearance:

- Approval was obtained from the Internal Medicine Scientific Committee of the Iraqi Board.
- Official permissions were secured from the administrations of Azadi Teaching Hospital and Kirkuk General Hospital.
- Oral informed consent was obtained from all patients or their legal guardians.

- All patients received appropriate management for any complications arising from AMI.

Financial support and sponsorship:

Nil.

Conflicts of interest:

There are no conflicts of interest.

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