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Original Article

Risk factors for acute coronary syndrome in patients below the age of 40 years

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ABSTRACT

Background: Acute coronary syndrome (ACS) refers to a spectrum of symptoms compatible with acute myocardial ischemia. Plasma markers of inflammation have been recently identified as diagnostic aid and risk predictors. The present study, conducted in Slemani Cardiac Hospital (SCH), Sulaimaniyah, Iraq aimed to recognize some risk factors for ACS in Iraqi adults younger than 40.

Methodology: This is a prospective case-control study of 100 patients with ACS vs. a control group of 100 healthy volunteers. The study began at 1st January 2014 and ended at 31st December 2016. All patients were subjected to full history taking, clinical examination including measurement of waist circumference and body mass index (BMI). Investigations included electrocardiography (ECG), echocardiography, full blood count, measurement of lipid profile and C-reactive protein (CRP). The patients were managed by percutaneous coronary intervention (PCI).

Results: The mean age of the patients was 36 years (range 28–40). Eighty-five% of patients were male. The mean BMI (29 kg/m^2) and waist circumference (98 cm) of the patients were higher than the controls (24 kg/m^2 and 72 cm respectively). The leukocytes, lymphocytes and neutrophil counts as well as CRP in both groups were within the normal range. The most prevalent risk factor was obesity (n = 86). Other risk factors were smoking (n = 62), hypertension (n = 26), diabetes mellitus (n = 22) and positive family history of ACS (n = 24). Most patients (n = 83) had multi-vessel coronary artery disease (2–3 vessels).

Conclusion: ACS in young adults is an increasing health problem. Obesity was found to be the most prevalent risk factor.

1. Introduction

Acute coronary syndrome (ACS) refers to a range of clinical presentations almost always associated with rupture of an atherosclerotic plaque in a coronary artery with subsequent partial or complete thrombosis.[1] The syndrome includes unstable angina (UA), non–ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI). Despite a similar pathophysiology of UA and NSTEMI, the differentiation is based on the severity of symptoms and the presence of certain biomarkers. Chest pain is more severe in myocardial infarction (MI). Moreover, biomarkers of myocardial necrosis are released few hours after the onset of chest pain in NSTEMI but not after UA. These biomarkers consist of cardiac-specific troponins T or I and CK-MB (muscle and brain fraction of creatinine kinase).[2]

The risk factors for coronary artery disease (CAD) include hypercholesterolemia, hypertension, diabetes mellitus (DM), smoking and obesity.[2,3] Obese patients manifest CAD at a younger age.[3] Accurate diagnosis and early risk stratification is essential in guiding treatment and predicting the prognosis of patients with ACS. Recently, attention has been focused on the potential role of plasma markers of inflammation as risk predictors in ACS. Of these markers, C-reactive protein (CRP) and white blood cell (WBC) count are examples.[2] Acute coronary syndrome is a serious health problem particularly in young adults, the so called premature ACS. This study was conducted in the Coronary Care Unit (CCU) of Slemani Cardiac Hospital (SCH), Sulaimaniyah, Iraq in order to identify the risk factors for ACS in adult patients younger than 40.

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2. Patients and methods

In this prospective case-control study, a group of 100 young adult patients with ACS managed by PCI in the CCU of SCH, Sulaimaniyah was compared to a control group of 100 healthy volunteers. The study was started at 1st January 2014 and finished at 31st December 2016. All participants were under the age of 40. After a thorough clinical evaluation and measurement of body mass index (BMI) and waist circumference of each patient, electrocardiography (ECG) and echocardiography were done beside laboratory assessment. Full blood count, lipid profile and CRP were assessed. The study was approved by the Medical Ethical Committee of SCH; the reference number of the approval is 1036 in 12/7/2013.

3. Results

The mean age of the patients was 36 years (range 28–40). Table 1 shows the patients, characteristics.

Most patients with ACS were male (85%). The mean BMI and waist circumference of the patients were higher than the controls. The leukocytes, lymphocytes and neutrophil counts in both groups were within the normal range. Although mean hs-CRP was elevated in ACS patients compared to the control group, but both values were also within the normal range.

Table 2 shows risk factors and number of involved vessels in the diseased group.

The most prevalent risk factor was obesity; as 86 patients were either overweight or obese. The second most prevalent risk factor was smoking (62%). Hypertension and DM were found in nearly one-quarter of patients each while family history of ACS was positive in 24% of patients. Eighty-three % of patients had multi-vessel CAD (2–3 vessels). Table 3 shows the distribution of patients and controls according to BMI.

Only 14 patients had normal BMI while 42% were overweight and 44% were obese. Obesity was more common among female patients (n = 88).

Table 2
Some risk factors in the diseased group.

Risk factor		Number & %
DM		22
Hypertension		26
Smoking		62
Family history of ACS		24
Obesity		86
Number of diseased vessels	3	50
	2	33
	1	17

4. Discussion

Each year in the United States of America, approximately 1.36 million hospitalizations are required for ACS.[2] The prevalence of ACS in the Middle East differed from one country to another. For instance, it was 6% in Saudi Arabia (at 2004), 8.3% in Egypt (at 2001) and 13% in Lebanon (at 2008).[4] However, by 2030, this prevalence is expected to rise due to increasing rates of hypertension, DM, overweight, obesity, physical inactivity, smoking and dyslipidemia.[4]

Premature ACS remains a significant cause of morbidity and mortality worldwide. In 2012, CAD was the cause of death in 1894 Canadians younger than 55 years. Further, ACS remains a significant cause of lost work productivity, unemployment, and disability in this young age category.[5] In this study, all patients were under the age of 40; 85% of them were male. In contrast, in the study of Al-Mukhtar & Ahmed from Iraq, 29.2% of patients were under 50 and 58.5% were males.[6] Although attacks of coronary events are more among men, women have a higher death rate from CAD.[7]

Family history of ACS was positive in 24% of patients in this series and 29.2% in a previous Iraqi study. Rate of smoking among our patients (62%) was higher than reported before (52.3%). On the other hand, hypertension was found in 24% of the present series vs. 54.4% in the previous Iraqi study.[6] Diabetes mellitus is a well known absolute risk factor for ACS.[4,8] The outcome is reported to be poor even among non-diabetic ACS patients who have hyperglycemia on admission especially if associated with increased body fat.[8,9] More than half (50.8%) of ACS patients in Al-Mukhtar & Ahmed study[6] and 22% of our patients were diabetics. In a study from Sudan, ACS occurred in 5.44% of diabetic patients.[4]

In regard to obesity, the guidelines recommend an ideal BMI of 25 kg/m^2 and suggest a reduction in body weight if BMI > 30 kg/m^2 or when waist circumference is >102 cm for men and >88 cm for women [Steg et al. cited in 3]. In the present series, the mean BMI of the control group was 24 kg/m^2 (acceptable) while the patients had a high mean BMI of 29 kg/m^2. Most of our patients (86%) were obese or overweight; higher than that reported before (69.2%).[6] Obese individuals have a higher incidence of cardiovascular risk factors, such as hypertension, dyslipidemia and DM. Therefore, this group of patients has higher morbidity and mortality associated with diseases of the cardiovascular system.[3]

Symptoms and signs suggestive of ACS are non-specific and have low sensitivity for diagnosis of this condition. According to the World Health Organization, the diagnosis of AMI is based on two out of three criteria: characteristic chest pain, diagnostic electrocardiographic changes and elevation of serum biochemical markers.[2,6] Worthy to note, the ECG may never show the classical features of ST elevation and new Q waves. On the other hand, studies have shown that early accurate diagnosis and risk stratification of patients with ACS can be made by identification of biochemical markers of myocardial necrosis.[6]

Table 1
Characteristics of patients and control groups.

Characteristic	Disease		Control	
Age (yr)	Mean	Range	Mean	Range
	35	28–40	28	18–40
Male/female ratio	85/15		62/38	
BMI (kg/m^2)	29	19–41	24	19–32
Waist circumference (cm)	98	66–119	72	58–100
WBC count (cell/mcL) (N = 3.5–10.5 × 10^3)	8.4 × 10^3	5.4–14.5 × 10^3	7.13 × 10^3	2.5–14 × 10^3
Neutrophil count (cell/mcL) (N = 2.0–7.0 × 10^3)	4.54x 10^3	2.2–11.5 × 10^3	4.28 × 10^3	1.6–9.7 × 10^3
Lymphocyte count (cell/mcL) (N = 1.0–3.0x10^3)	2.5 × 10^3	1.08–4.95 × 10^3	2.2 × 10^3	0.17–4.6 × 10^3
Hs-CRP[a] (N = <3 mg/L)	0.25	0.043–17.3	0.156	0.041–2.46

[a] hs CRP = high sensitivity C-reactive protein.

Table 3
Distribution of patients and controls according to BMI.

Number	Disease group			Control group		
	Obese	Overweight	Normal	Obese	Overweight	Normal
	44	42	14	1	24	75

The past decade has seen an increasing recognition of the central role of inflammatory mechanisms in the pathogenesis of atherosclerosis. Further, plasma markers of inflammation such as CRP and WBC count have been shown to be risk predictors in ACS. An elevated WBC count was associated with higher mortality rates and recurrent MI in patients with UA/NSTEMI. Similarly, a death rate of 0.4% in patients with normal CRP in one study rose to 5.8% when the CRP level increased.[2] In the present study, the WBC count and CRP level of both patients and controls were within the normal range.

C-reactive protein may activate the complement system in the intima of the atherosclerotic coronary artery lesion [Klouche et al. cited in 11]. Hence, complement activation has been implicated in the pathogenesis of MI [Delves et al. cited in 11]. Hiad et al. from Iraq studied C3 levels in ACS, stable angina and healthy individuals and found a significant elevation of C3 level in patients with ACS in comparison to others particularly on the 4th day of admission.[11] Furthermore, many studies suggested a role of Interleukin-1Alpha and Interleukin-6 in ACS. Luo et al. [cited in 12] and Hamzah & Turki from Iraq[12] reported that serum levels of IL-6 were significantly elevated in ACS patients. In patients who have ACS, an elevated level of cardiac Troponin is a well-known risk factor for fatal events.[10] Troponin may be positive even in the minority of patients with acute MI and normal coronary arteries. However, the prognosis of such patients remains uncertain.[10] Recently, a novel endogenous peptide named (Apelin) has been reported as a possible biomarker in ACS. This substance is synthesized in the smooth muscle and fibroblast cells of coronary arteries and is shown to be reduced in the serum of patients with STEMI.[13]

5. Conclusions

Acute coronary syndrome in young people is an increasing health problem. Among the well-known risk factors for atherosclerosis, obesity was the most prevalent in this series. It is crucial to make an early and accurate diagnosis of ACS with risk stratification to guide therapy accordingly. Plasma biomarkers of inflammation can be helpful for diagnosis and predicting the outcome.

Conflict of interests

None to be declared.

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Authors contribution

Dr. Aram J. Mirza designed the study and collected the data.

Prof. Abdulsalam Y. Taha analysed the data, reviewed the literature and wrote the manuscript.

Dr. Bahar Khdhir participated in the data collection.

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