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Current Status of the Clinical Epidemiology of Myocardial Infarction in Men and Women: A National Cross-Sectional Study in Iran

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ABSTRACT

Background: Cardiovascular disease is the main reason for mortality in men and women. Clinical epidemiology of myocardial infarction (MI) in men and women has not been yet studied in Iran, one of the largest Middle East countries in South-Western Asia. This study was conducted to determine the clinical epidemiology of MI in men and women in Iran.

Methods: This hospital-based, cross-sectional study used the data of 20,750 MI patients in Iran in 2012 (the codes I22, I21, I24, and I25.2). Univariate comparisons used Chi-square test for categorical variables and *t*-test for continuous variables. $P < 0.05$ was considered as significant.

Results: Totally, 20,750 MI patients (15,033 men and 5,717 women) with age range of 13–106 (mean; 61.2 ± 13.4) years were enrolled. Only 9 (0.04%) patients (8 men and 1 woman) were ≤18 years (mean age: 14.8 ± 1.9), out of whom only two men were diabetic. 22.2% (18% men and 33.4% women) of the patients had diabetes, 26.2% (28.5% men and 20.1% women) were smoker and 35.5% (28.6% men and 53.7% women) had hypertension. ST-segment elevation MI incidence was 2.8 times higher in men than women. Left bundle branch block was significantly more prevalent in men than women. Men used percutaneous coronary intervention more frequently than women did. No difference in coronary artery bypass graft was noted between men and women. Mortality incidence was approximately twice higher in men than women. The prevalence of chest pain was higher in women than men.

Conclusions: The MI incidence pattern, mortality from MI, and risk factors prevalence are significantly different between men and women in Iran. More emphasis on these issues in training people and healthcare professionals seems to contribute partially to patients' timely referring to health care centers and preventing MI-associated mortalities.

Keywords: Clinical epidemiology, gender, myocardial infarction

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INTRODUCTION

Cardiovascular disease is the main reason for mortality in men and women. Therefore, the clinical difference in myocardial infarction (MI) between men and women could affect the diagnosis and time of decision making for treatment and hence disease outcomes. Knowledge of clinical symptoms and risk factors contribute to

the prognosis of MI mortality in men and women differently. Documentation of these findings could be helpful in the management of patients' treatment and/or outcomes. Accumulating evidence over the last several decades regarding the treatment and outcomes for coronary artery disease reveals disparities that have a clear relationship to gender and the number of people above 85 years of age is growing faster than any other age group.[1,2] Gender differences in the clinical outcome of patients with MI may be partially explained by the women condition. Several conditions specific to women represent differences in the pathophysiology of coronary heart disease (CHD) between men and women. Such female-specific conditions include early menopause, gestational diabetes, peripartum vascular dissection, preeclampsia and eclampsia, polycystic ovarian syndrome, low-birth-weight infants, and hypothalamic hypoestrogenemia. Some of these states, which occur at a younger age, lead to an increased risk for later development of CHD in life.[3] Sex hormones contribute to the pathophysiology of vascular disease, as well. In addition, aging causes reduction in estrogen to approximately 1/10 of premenopausal levels. The main source of estrogen before menopause is estradiol. After menopause, low level of estrogen is produced mainly from the conversion of androgens into estrone in adipose tissue.[4] These variations could be associated with the differences in ischemic and CHD between men and women and are concurrent with the increased risk in women, which occurs after menopause. It is confirmed by the fact that younger women with endogenous estrogen deficiency have a higher than 7-fold increase in coronary artery risk.[5-7] A number of studies have reported that women with MI have higher mortality rates than men. CHD morbidity and mortality reportedly occur about 10 years earlier in men than women.[7-9] However, the women with MI history have higher rates of mortality during hospitalization or the first 30 days after MI.[10,11] Epidemiology of MI has been well-explained and gradually updated in the developed countries. This epidemic has been reported from some Asian countries, as well. The prevalence of cardiovascular disease risk factors including hypertension, type 2 diabetes, smoking, and high cholesterol as well as access to therapies including percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG), and thrombolytic therapy in the patients in Iran were reported differently from those in the patients in Persian Gulf countries. For example, the prevalence of hypertension, diabetes, and high cholesterol in study of acute coronary syndrome in six Arab countries (Kuwait, Bahrain, the UAE, Yemen, Oman, and Qatar) was reported as 68%, 36%, and 63%, respectively.[12-14] Clinical epidemiology of MI in men and women has not been yet studied in Iran, one of the largest countries in Middle East, and no relevant report is available. This study was to determine the clinical epidemiology of MI in men and women in Iran.

METHODS

Study design and setting

This research is a hospital-based cross-sectional study, which used the data of 20,750 MI patients in Iran in 2012. The study enrolled the patients registered in Iranian MI Registry of Iran Health and Medical Education Ministry (Department of Cardiovascular Disease Prevention) commissioned in the hospitals equipped with a cardiology ward across 31 provinces of Iran using the date at arrival in and discharge from the hospital. Inclusion criteria were defined based on International Classification of Diseases (the codes I22, I21, I24, and I25.2). Echocardiography (ECG) is used to differentiate between two types of MI, ST-segment elevation MI (STEMI) and nonSTEMI, by the shape of the tracing. An ST section of the tracing higher than the baseline is considered STEMI which usually necessitates more invasive treatment. In STEMI, the ECG must show new ST elevation in two or more adjacent ECG leads. Left bundle branch block (LBBB) and right bundle branch block were defined in accordance with recently published criteria with the exception that, for LBBB, q waves in ECG leads I, V5, and V6 were included. LBBB criteria included QRS duration of ≥120 ms; RS or QS deflection in ECG leads V1 and V2; and slurred broad r waves in ECG leads I, aVL and V6. An r wave amplitude of ≥1 mm in lead V1 was determined as a readily measurable standard.[15] The patients with no definite diagnosis of MI by the cardiologist were excluded from the study. The demographic data of the patients including age, gender, education, place of residence, and individual, clinical, and laboratory risk factors such as the date at MI incidence, duration of hospitalization, type 2 diabetes, hypertension, smoking, dyslipidemia, type of diagnosis, treatment, the place of MI, and pain pattern were gathered. The above variables were measured based on national protocol and guidelines, and World Health Organization (WHO) standards and registered by the cardiologist and matron of the cardiology ward in electronic medical records of the patients. The registry's data accuracy is acceptable, and several articles using these data have been so far published in authentic journals which have been referenced to in references.[16-18] Iran's MI Registry was developed in 1389 H.S and has been being implemented in all coronary care unit (CCU)-equipped hospitals affiliated to medical universities in Iran. By this registry, CCU head nurses are responsible for recording and completing the data. The data of in-patients in CCU

with confirmed MI diagnosis are recorded and saved in the respected software at discharge from CCU and could be used by Cardiology Department of Iran's Ministry of Health and Medical Education. All hospitals affiliated to medical universities and some nonaffiliated (social insurance, humanitarian, private, and military) hospitals have run this registry in CCUs from which the data used in this study were obtained. The access to these data was provided by an official permission within a letter of understanding to conduct a PhD thesis of epidemiology.

Statistical analysis

All continuous values are expressed as mean ± standard deviation (SD) and categorical variables are presented as a percentage. Univariate comparisons used Chi-square tests for categorical variables and *t*-test for continuous variables. The software used for data analysis was Stata statistical software: Release 12 statistical software StataCorp LP, College Station, TX, USA. $P < 0.05$ was considered as significant.

RESULTS

In this study, 20750 patients (15,033 males and 5,717 females) with age range of 13–106 (mean: 61.2 ± 13.4) years were enrolled. Mean ± SD of age was 59.6 ± 13.3 years in men and 65.4 ± 12.6 in women. Mean age at MI incidence in men was lower than women with a significant difference ($P = 0.001$). By WHO definition, adolescence refers to the ages from 10 to 19 years. Since the number of patients under 18 years (nine individuals), as adolescent subgroup, was negligible, all patients were enrolled and studied. However, as the respectful reviewer suggested, two independent analyses were run with inclusion and exclusion of these patients. Then, two independent analyses were run with inclusion and exclusion of the patients under 30 years. However, no tangible difference was found between the results. Therefore, as the data were gathered from patients in all provinces across Iran and the total sample size depicts MI epidemiology more soundly; all patients were included in the analysis. The analysis results of under 18-year-old patients' data have been reported, as well.

Only 9 (0.04%) patients (8 men and 1 woman) were ≤18 years (mean age: 14.8 ± 1.9), of whom two men were diabetic. Total/≤18-year-old patient's ratio of diabetes history was 0.009%.

Age and risk factors of coronary artery disease in individuals with acute MI are shown in Table 1. 22.2% (18% men and 33.4% women) of the patients had diabetes, 26.2% (28.5% men and 20.1% women) were smoker, 35.5% (28.6% men and 53.7% women) had hypertension, and 17.8% (15%% men and 25.3% women) had hypercholesterolemia. In-hospital complications after acute MI in-patients are shown in Table 2. The prevalence of LBBB was significantly higher in men than women. Men used PCI more frequently than women did. No difference in CABG was noted between men and women. Mortality was approximately twice higher in men than women.

DISCUSSION

In this study, epidemiologic status of MI incidence in men and women was reported for the first time in Iran through a hospital-based study. The findings of the present study indicated that the MI incidence pattern, mortality from MI, and risk factors prevalence were significantly different between men and women in Iran. In Kuwait, 87% of MI patients were male, and the mean age was reported to be 55 years,[12] which is lower than in our study. According to registries of acute coronary events in 65 hospitals in six Arab countries (Yemen, Oman, Bahrain, Kuwait, Qatar, and United Arab Emirates), the mean age at incidence was 55 years.[13,14] Our study indicates that the mean age at incidence is higher in the Islamic republic of Iran than in these Arab countries (except for Yemen with a mean age at incidence of 61 years). The difference in mean age across different studies could be attributed to different population age distributions, differences in life expectancies and lifestyles and variations in the distribution of and coping with cardiovascular diseases risk factors. There was a significant difference in chest pain between men and women. However, some studies reported no difference in this regard and some others reported a higher prevalence of chest pain in women than men.[19-21] Our findings indicated that different factors, including chest pain, could be used as a prognosis for MI, and hence patients' delayed referring to emergency centers and mortality could be partially prevented. In a similar study, 73% of the patients were male, and their mean age was 61.8 years, which is similar to our study. History of CABG, PCI, and diabetes was reported, respectively, 4.4%, 12.5%, and 25.3%,[22] which are higher compared to our study.

In a study in India, mean age of the patients was reported 57.5 years, which is lower compared to Iran. In India, 30.4% of the patients had type 2 diabetes, 37.7% had hypertension, and 40% were smoker; the corresponding figures in our study are, respectively, 22.2, 35.5, and 26.2%.[23] In Korea, 19.2% of MI patients had diabetes, 67.3% were smoker, and 61.2% had STEMI. In our study, the prevalence of diabetes was 22.2%, which is higher compared to Japan.[24] The age at MI incidence was lower in India than in Iran. Furthermore,

Table 1: Age and risk factors in MI patients

Characteristics	Frequency (%)		*P*
	Men	Women	
Age (year)			
≤18	8 (0.05)	1 (0.02)	0.001
19-29	105 (0.7)	15 (0.26)	
30-64	9701 (64.5)	2674 (46.7)	
65-84	4743 (31.5)	2734 (47.8)	
≥85	476 (3.1)	293 (5.1)	
Gender	15,033 (72.45)	5717 (27.55)	0.001
Education illiterate	5488 (36.5)	4123 (72.12)	0.001
Primary	3906 (25.9)	1035 (18.1)	
School	4426 (21.4)	506 (8.8)	
University	1213 (8.1)	53 (0.93)	
Smoking	4291 (28.5)	1152 (20.1)	0.001
Hypertension	4303 (28.6)	3073 (53.7)	0.001
Type 2 diabetes	2701 (18)	1911 (33.4)	0.001
Hypercholesterolemia	2265 (15)	1445 (25.3)	0.001
MI family history	2409 (11.6)	1353 (6.52)	0.001
Hospital stay (day)	6.56±14.6	6.53±14.5	0.885
Age (mean±SD) years	59.5±13.3	65.4±12.6	0.001

SD=Standard deviation, MI=Myocardial infarction

Table 2: In-hospital status and complications of acute MI

Characteristics	Frequency (%)		*P*
	Men	Women	
LBBB	229 (1.1)	154 (0.74)	0.001
RBBB	218 (1.5)	71 (1.3)	0.253
AF	471 (2.27)	217 (1.05)	0.017
STEMI	11681 (77.7)	4048 (70.81)	0.001
NSTEMI	3352 (22.3)	1669 (29.19)	0.001
Lateral MI	680 (3.28)	310 (1.49)	0.007
Anterior MI	3142 (15.14)	1190 (5.73)	0.892
Inferior MI	5383 (25.94)	1796 (8.66)	0.001
Posterior MI	631 (3.04)	222 (1.07)	0.308
Anterolateral	1055 (5.08)	339 (1.63)	0.005
Heart failure	1187 (5.72)	495 (2.39)	0.072
CABG	162 (1.1)	75 (1.3)	0.156
PCI	1101 (7.3)	330 (5.8)	0.001
Chest pain	1551 (10.3)	678 (11.9)	0.001
Lack of thrombolytic	6966 (46.3)	2256 (39.4)	0.001
VF	389 (2.6)	122 (2.2)	0.537
VT	916 (6)	282 (4.9)	0.001
Mortality	1656 (7.98)	855 (4.12)	0.001

LBBB=Left bundle branch block, RBBB=Right bundle branch block, AF=Atrial fibrillation, STEMI=ST-segment elevation myocardial infarction, NSTEMI=Non-ST-segment elevation myocardial infarction, MI=Myocardial infarction, CABG=Coronary artery bypass grafting, PCI=Percutaneous coronary intervention, VF=Ventricular fibrillation, VT=Ventricular tachycardia

the prevalence of type 2 diabetes and other risk factors including hypertension and smoking in MI patients was lower in Iran than in India. The prevalence of type 2 diabetes in MI patients was higher in Iran than in Korea, and lower than in Japan. In this study, men/women frequency was 2.62. In the Framingham study, this ratio was 10:1 in-patients under 45 years old, declining progressively to approximately 2:1 in-patients over 75 years old.[24,25] Finally, approximately 11.6% and 6.5% of men and women, respectively, in our study had a family history of early coronary artery disease, with a significant difference. Our results indicated that the familial history of early coronary artery disease was an important cardiovascular risk factor in both male and female patients. Our findings are consistent with several studies in other countries. However, in some studies, the prevalence of hypertension and diabetes was similar in male and female patients, which is not consistent with our study.[22-24]

CONCLUSIONS

In this study, MI developed about 5 years earlier in men than women. The prevalence of diabetes and hypertension was significantly higher in women than men. In contrast, smoking and family history of cardiovascular disease were reported higher in men than women. The findings of this study confirm the higher relative risk of hypercholesterolemia, diabetes, and hypertension and MI development in women. The MI incidence pattern, mortality from MI, and risk factors prevalence are significantly different between men and women in Iran. More emphasis on these issues in training people and healthcare professionals seems to contribute partially to patients' timely referring to health care centers and preventing MI-associated mortalities.

The key message of the present study addresses the difference in MI incidence pattern and risk factors between men and women in Iran. Therefore, the approach to managing, preventing, and controlling MI as the leading cause of death in Iran must be different for men and women. Informing patients appropriate with their risk factors and preventing delayed referral to emergency in case of MI prognosis is the first step to incorporate the findings of this study into health system. Further empowerment of health system staff in dealing with and triaging MI patients and adoption of appropriate care and treatment with male and female patients' characteristics could be the second step.

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