

Clinical profiles of patients with myocardial infarction without obstructive coronary artery disease in Iran



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Abstract

Introduction: Myocardial infarction without obstructive coronary artery disease (MINOCA) accounts for 5-15% of acute myocardial infarction (MI) cases.

Objectives: The purpose of this study is to determine the prevalence of diabetes, hypertension, hyperlipidemia, smoking, and family history of cardiovascular diseases (CVDs) and their association with gender in patients with MINOCA.

Patients and Methods: Around 1772 patients entered this cross-sectional study. Prevalence of diabetes, hypertension and hyperlipidemia was significantly higher in women compared to men ($P < 0.001$). Smoking was more common in men than women ($P < 0.001$).

Results: Women with MINOCA are more likely to have hypertension, hyperlipidemia and diabetes than men with MINOCA, whereas men are more likely to be smokers.

Conclusion: Effective blood pressure control, correction of lipid profile and proper glycemic control can prevent MINOCA and its associated morbidities and mortality, especially in women.

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Introduction

According to the World Health Organization (WHO), cardiovascular diseases (CVD) are the leading cause of death globally. In 2019, 32% of global deaths were attributed to CVD. 85% of these deaths were due to myocardial infarction (MI) and stroke. Most of these deaths occurred in low and middle-income countries (1). CVDs are also a significant cause of psychological distress and a financial burden (2). It accounts about more than 34% of total deaths in the United States every year (3). Ischemic heart disease (IHD) was the leading cause of death in 2019 Iran in. IHD-related mortality has increased by 29.9% from 2009 to 2019 in Iran (4).

IHD is caused by an imbalance between myocardial oxygen supply and demand. The most common cause of this imbalance is impaired blood flow through coronary arteries caused by atherosclerosis. Risk factors for IHD include hypertension, hyperlipidemia, diabetes mellitus, obesity and smoking. IHD can ultimately lead to acute coronary syndromes (ACSs) such

as MI (5). However, sometimes MI (as defined by the fourth universal definition of myocardial infarction) (6) occurs without any evidence of obstructive ($\geq 50\%$ stenosis) coronary artery disease (CAD) or any other explainable causes at the time of coronary angiography. This type of MI is called myocardial infarction in the absence of obstructive coronary artery disease (MINOCA). Possible reasons for MINOCA include coronary atherosclerotic plaque rupture, thrombosis, vasospasm, dissection and embolism. MINOCA accounts for 5%-15% of acute MI cases and 5% one-year mortality (7).

Accordingly, the absence of obstructive CAD does not exclude the presence of acute MI. Therefore, identifying possible risk factors for MINOCA and devising appropriate management strategies is necessary to avoid morbidity and mortality associated with this condition. Several studies have been conducted for this purpose. For example, the results of a study by Choo et al showed that patients with MINOCA had a

Key point

- Women with MINOCA are more likely to have hypertension, hyperlipidemia, and diabetes than men with myocardial infarction without obstructive coronary artery disease, whereas men are more likely to be smokers.
- Effective blood pressure control, correction of lipid profile, and proper glycemic control can prevent MINOCA and its associated morbidities and mortality, especially in women.
- In our study, women with MINOCA were more likely to undergo fibrinolytic therapy at the time of presentation compared to men.

similar risk of cardiac death and re-infarction to patients with MI due to obstructive CAD. It was also revealed that administration of renin-angiotensin system blockers and statins were associated with a lower risk of mortality in patients with MINOCA (8). Another study by Ishii et al showed that patients with MINOCA had a higher prevalence of underlying diseases such as chronic kidney and liver disease and higher in-hospital mortality than patients with MI due to obstructive CAD (9).

Objectives

Despite the high prevalence of CVD in Iran (3), data regarding MINOCA and its associated risk factors is lacking. The purpose of this study is to determine the prevalence of diabetes, hypertension, hyperlipidemia, smoking, and family history of CVD and their association with gender in patients with MINOCA admitted to Shahid Mohammadi hospital of Bandar Abbas from 2017 to 2020.

Patients and Methods**Study design**

In this cross-sectional study, 1772 patients with MINOCA were evaluated. At first, after acquiring the permission of the hospital ethics committee, electronic charts of all patients that presented to Shahid Mohammadi hospital of Bandar Abbas from 2017 to 2020 with acute MI and underwent coronary angiography were accessed and examined. Patients fulfilling the following criteria were included in the study:

- Below 50% stenosis in each of the coronary arteries in angiography
- Age \geq 18 years
- Complete patient chart

All of the required data, including patients' age, gender, height, weight, body mass index (BMI), smoking status, history of diabetes, hypertension or hyperlipidemia and family history of CVD, were extracted from the patient charts. The interventionist's final recommendation after coronary angiography and fibrinolytic treatment status of the patients were also documented.

Data analysis

All data were analyzed using SPSS version 24. Categorical variables were reported as frequencies and percentages. These frequencies were compared between men and

women using the chi-square test. Quantitative variables were reported as means and standard deviations. P value \leq 0.05 was considered statistically significant.

Results

Out of 1772 patients with MINOCA entered our study (age 56.4 ± 11.9), 43.6% were male, and 56.3% were female. The patients' mean BMI was $25.5 (\pm 4.7)$ kg/m². Most of the patients (43.5%) had a normal BMI (Table 1).

Out of 1772 patients with MINOCA, 21.6% were diabetic, 47.5% had hypertension, 27.9% had hyperlipidemia, 25.9% were smokers and 29.1% had a family history of CVD. Prevalence of diabetes, hypertension and hyperlipidemia was significantly higher in women compared to men ($P < 0.001$). Smoking was more common in men than women ($P < 0.001$). There was no significant difference between men and women regarding family history of CVD ($P = 0.968$). Women received fibrinolytic therapy significantly more than men at the time of presentation ($P < 0.001$; Table 2).

Table 3 shows the final recommendation of an interventionist to patients with MINOCA after angiography. The majority of patients (97.2%) were advised to undergo medical therapy.

Discussion

This cross-sectional study evaluated the prevalence of diabetes, hypertension, hyperlipidemia, smoking, and family history of CVD and their association with gender in patients with MINOCA. Hypertension, diabetes and hyperlipidemia were more common in women with MINOCA than men, whereas smoking was more common in men. Women were more likely to undergo fibrinolytic therapy at the time of presentation.

In a study by Dal Fabbro et al patients with MINOCA had a higher prevalence of hypertension, diabetes and hypercholesterolemia than patients with ACS with obstructive CAD (10). In another study by Gao et al

Table 1. General characteristics of patients with MINOCA

Patient characteristics	
Age (years) (mean \pm SD)	56.4 \pm 11.9
Gender, No. (%)	
Male	774 (43.6)
Female	998 (56.3)
Weight (kg) (mean \pm SD)	67.5 \pm 14
Height (cm) (mean \pm SD)	162 \pm 9.1
BMI (kg/m ²) (mean \pm SD)	25.5 \pm 4.7
BMI category (N %)	
Underweight	88 (4.9)
Normal	772 (43.5)
Overweight	611 (34.4)
Obese	301 (16.9)

BMI, body mass index; SD, standard deviation.

Table 2. Past medical history, smoking status, family history and fibrinolytic therapy status of patients with MINOCA

	No. (%)	P value
Diabetes		
Total	383 (21.6)	
Male	102 (13.1)	<0.001
Female	281 (21.8)	
Hypertension		
Total	839 (47.5)	
Male	252 (32.5)	<0.001
Female	587 (58.8)	
Hyperlipidemia		
Total	494 (27.9)	
Male	153 (19.8)	< 0.001
Female	341 (34.1)	
Smoking		
Total	459 (25.9)	
Male	271 (35.1)	< 0.001
Female	188 (18.8)	
Family history of CVD		
Total	516 (29.1)	
Male	225 (29)	0.968
Female	291 (29.1)	
Fibrinolytic therapy		
Total	63 (3.5)	< 0.001
Male	7 (0.7)	
Female	56 (7.2)	

Table 3. Angiographic recommendations to patients with MINOCA

Angiographic recommendation	No. (%)
Medical treatment	1724 (97.2)
Coronary artery bypass grafting	3 (0.1)
Percutaneous coronary intervention	30 (1.6)
Valvular procedure	14 (0.7)
Viability study	1 (0.06)

women with MINOCA had a higher prevalence of hypertension and diabetes than men (11). This is similar to the present study results, which showed that hypertension and diabetes were more prevalent among women with MINOCA than men. However, in the study by Gao et al women were older than men, which might explain the difference in comorbidities between men and women (11).

Many patients with MINOCA (47.5%) had hypertension in the present study. Hypertension has been previously identified as a significant risk factor for CVD (5). Before 40 years of age, blood pressure is lower in women than men, however this trend is reversed after 55 years of age. Estrogen has been shown to maintain normal endothelial function, increase nitric oxide production and increase elastin deposition in arterial walls. Therefore, lack of estrogen in post-menopausal years can lead to arterial stiffness and hypertension (12). The mean age of patients in our study was 56.4, which indicates that

most women with MINOCA in our research were post-menopausal. The majority of women with MINOCA in our study (58.8%) had hypertension. These findings warrant further investigation to define the relationship between hypertension and MINOCA. Strategies should be implemented to effectively prevent and control hypertension in postmenopausal women to prevent future adverse cardiovascular events.

Around 21.6% of patients with MINOCA in our study had diabetes. Patients with type 2 diabetes have a 2 to 4 times greater risk of cardiovascular events than the general population (13). Rawshani et al showed that a glycated hemoglobin level outside the target range was the strongest predictor of stroke and acute MI in patients with type 2 diabetes (13). Another study by Paolisso et al showed that admission hyperglycemia was a strong predictor of mortality in patients with MINOCA and MI due to obstructive CAD regardless of their diabetes status (14). These findings emphasize the importance of proper glycemic control in preventing adverse cardiovascular events.

Hyperlipidemia was also more prevalent in women with MINOCA than men in our study, which agrees with the results of an investigation by Mohammed et al (15). This study showed that total cholesterol and low-density lipoprotein cholesterol levels were higher in women with MINOCA compared to men (15). Mohammed et al also found that smoking was more prevalent in men with MINOCA than women (15), similar to the present study results, which also showed that smoking was more prevalent in men with MINOCA. A meta-analysis by Hackshaw et al showed that smoking even one cigarette per day is associated with an increased risk of CVD and stroke (16). However, both Gao et al and Mohammed et al found no difference in the incidence of major adverse cardiovascular events, including cardiovascular death, non-fatal re-infarction, stroke, heart failure and re-hospitalization for angina between men and women with MINOCA (11, 15).

In our study, women with MINOCA were more likely to undergo fibrinolytic therapy at the time of presentation compared to men. The survey by Nicolau et al showed that gender does not affect the prognosis of patients with MI undergoing fibrinolytic therapy (17).

Conclusion

Women with MINOCA are more likely to have hypertension, hyperlipidemia and diabetes than men with MINOCA, whereas men are more likely to be smokers. All of these risk factors have been previously linked to CAD. Effective blood pressure control, correction of lipid profile and proper glycemic control can prevent MINOCA and its' associated morbidities and mortality, especially in women. Further research is required to establish the link between these risk factors and MINOCA and define prevention strategies (18).

Limitations of the study

This study was conducted in Bandar Abbas, Iran. Despite the adequate sample size, expanding this research to a nationwide study is advised to achieve a better outcome.

Authors' contribution

SS and SB were the principal investigators of the study. HF and FK were included in preparing the concept and design. ARR revisited the manuscript and critically evaluated the intellectual contents. All authors participated in preparing the final draft of the manuscript, revised the manuscript and critically evaluated the intellectual contents. All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Hormozgan University of Medical Sciences approved this study (IR.HUMS.REC.1400.193). Accordingly, written informed consent was taken from all participants before any intervention. This study was extracted from M.D thesis of Setayesh Sotoudehnia at this university. Besides, the authors have ultimately observed ethical issues (including plagiarism, data fabrication and double publication).

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