

Erectile Dysfunction in Men With Angiographically Documented Coronary Artery Disease

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Introduction: We evaluated erectile function of men with coronary artery disease (CAD) and the relation between the degree of erectile dysfunction (ED) and the extent of coronary artery stenosis on cardiac angiography.

Materials and Methods: Nondiabetic men with CAD documented by angiography were evaluated for ED. Erectile function was assessed by a 5-item version of the International Index of Erectile Dysfunction, the Sexual Health Inventory for Men (SHIM).

Results: Of 401 men, 186 (46.4%) had ED (SHIM score, 21 or less). Men with ED were more likely to have more than 1 stenotic cardiac vessel ($P < .001$). The mean SHIM score was 20.9 ± 7.6 , 12.9 ± 9.2 , and 14.3 ± 9.1 for men with 1-, 2-, and 3-vessel disease, respectively ($P < .001$). Multivariate analysis showed that only the SHIM score had a relationship with the number of involved vessels ($P < .001$); the SHIM score was lower and ED was more frequent in men with more than 1 vessel involvement. Forty-one patients (19.1%) without ED and 45 (24.2%) with ED had a positive history of myocardial infarction ($P = .21$). Symptoms of ED had appeared prior to CAD detection in 78 out of 189 patients (41.9%) with a mean time interval of about 23 months (range, 10 to 36 months).

Conclusion: Our finding showed that the prevalence of ED is relatively high in patients with CAD, and has a relationship with the extent of CAD. Furthermore, ED may occur before CAD with an average interval of 2 years.

Keywords: erectile dysfunction, coronary artery disease, vascular diseases, myocardial infarction, cardiac catheterization

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INTRODUCTION

Erectile dysfunction (ED) is a common medical problem affecting approximately 15% of men each year.⁽¹⁾ It is strongly related to both physical and psychological health status. Some major risk factors are diabetes mellitus, hypertension, hyperlipidemia, obesity, and smoking, all of which are the risk factors of coronary artery disease (CAD), too.⁽²⁾

Despite its increasing prevalence among older men, ED is rarely due to age-related hypogonadism, and a vascular disorder is present in the majority of the patients.⁽³⁾ The

association between vascular disease and ED has been recognized and well documented.⁽²⁻⁵⁾ Indeed, alternation in the vascular hemodynamics (either arterial insufficiency or venoocclusive dysfunction) is believed to be the most common cause of organic ED.⁽¹⁾ Therefore, ED can be a manifestation of a vascular disease that affects penile arteries and also other vessels such as coronary arteries.⁽³⁾ This explains the higher incidence of ED among patients with vascular diseases such as MI, cerebrovascular accident, peripheral vascular disease, and hypertension compared to the general population. Recent studies have

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shown that ED is present in 42% to 75% of men with CAD.^(2,4,6) It is speculated that ED manifests prior to CAD and consequently, it can be an index of subclinical CAD.⁽⁷⁾ It has been shown that a considerable number of men with ED have a silent CAD,⁽⁴⁾ and the degree of ED has a relationship with the severity of CAD.^(5,8) However, since ED is a common disease among middle-aged men, it is not rational to always intensively investigate CAD in these patients or to consider them as high risk for CAD, yet. Further evidence is required to correlate ED and its degree with different stages of CAD. In this study, we evaluated ED in men with angiographically documented CAD and investigated the extension of coronary artery involvement in relation to the degree of ED.

MATERIALS AND METHODS

In a cross-sectional study performed between June 2004 and April 2006, we evaluated men who were referred for angiography to Shaheed Mostafa Khomeini and Shaheed Rajaei hospitals in Tehran. All men with CAD confirmed by angiography were enrolled. Significant CAD was defined as at least 50% reduction of the luminal diameter of any of the coronary arteries or their major branches.⁽⁴⁾ The enrolled patients were interviewed and underwent physical examination. Laboratory study for hormonal profile was done in case of decreased libido or testicular atrophy.

Men with hormonal, anatomic, neurogenic, or psychologic ED were excluded from this study. Other exclusion criteria were age of less than 40 years, inactive sexual function, ejection fraction less than 40%, valvular heart disease, myocardial infarction (MI) within the past 2 weeks, history of trauma to the pelvis, perineum, genitalia, or spinal cord, history of colorectal surgery, radical prostatectomy, or orchidectomy, urinary incontinence, diabetes mellitus, chronic kidney disease, constant administration of drugs that impact erectile function (antihypertensive, antiandrogen, estrogens, digitals, alcohol, narcotic), and history of pelvic radiotherapy. A written informed consent was signed by all eligible patients. This study was approved by the ethics committee of Shahed University.

Erectile function was assessed by a 5-item version of the International Index of Erectile Dysfunction

(IIEF), the Sexual Health Inventory for Men (SHIM).⁽⁹⁾ According to the SHIM scores patients were diagnosed with mild (score, 17 to 21), mild to moderate (11 to 16), moderate (8 to 10), and severe (7 or less) ED.

SHIM in detail available from:

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In addition, the patients' sociodemographic and clinical data were collected including age, weight, height, education, cigarette smoking, history of unstable angina and MI, hyperlipidemia, and duration of ED and cardiac symptoms.

Comparisons between the groups were done by chi-square, Student *t*, and one-way ANOVA tests, where appropriate. Correlations were assessed by Pearson and Spearman correlation tests. The binary logistic regression analysis was used to evaluate the relation of ED and classical risk factors of CAD with the extent of coronary artery stenosis. A value for *P* less than .05 was considered significant.

RESULTS

The clinical and demographic characteristics of the patients are shown in Table 1. Of 401 men aged between 40 and 84 years, 186 (46.4%) had ED (SHIM score, 21 or less). The frequency of ED was higher in heavy smokers (*P* = .002), older patients (*P* = .01), and those with hyperlipidemia (*P* = .03). However, the SHIM score correlated only with age (*r* = -.15; *P* = .002).

Table 2 demonstrates the degree of ED based on SHIM scores in relation to the angiography results. Men with ED were more likely to have more than 1 stenotic vessel and the number of involved coronary arteries correlated with the SHIM score (*r* = -.31; *P* < .001). The mean SHIM score was 20.9 ± 7.6 , 12.9 ± 9.2 , and 14.3 ± 9.1 for men with 1-, 2-, and 3-vessel disease, respectively (*P* < .001; Figure 1). Other than ED, the level of education (*r* = -.10; *P* = .047) and cigarette smoking (*r* = .12; *P* = .02) were associated with the number of the stenotic vessels. Using binary logistic regression, only the SHIM score was associated with the number of involved vessels; the SHIM score was lower in men with more than 1 vessel involvement (*P* < .001). Concerning ED

Table 1. Clinical and Sociodemographic Characterizations of Men With CAD*

Characteristics	Values
Mean age, y	53.3 ± 10.7
Mean weight, kg	74.3 ± 12.8
Mean height, cm	168.9 ± 7.2
Mean BMI, kg/m ²	26.0 ± 4.1
Education level	
Illiterate	59 (14.7)
Under high school degree	273 (68.1)
High school degree	32 (8.0)
Bachelor's degree	25 (6.2)
Higher degrees	12 (2.9)
Cigarette smoking, pack-y	
0	208 (51.9)
< 10	47 (11.7)
10 to 20	41 (10.2)
> 20	105 (26.2)
Hyperlipidemia	
Positive	63 (34.1)
Negative	122 (65.9)
CAD history	
Myocardial infarction	86 (21.4)
Unstable angina	315 (78.6)
Mean duration of CAD, mon	17.2 ± 29.7
Mean ejection fraction, %	54.8 ± 7.38
Stenotic coronary vessels	
1	166 (41.4)
2	120 (29.9)
3	115 (28.7)
Mean SHIM score	16.6 ± 9.3
ED degree	
No ED	215 (53.6)
Mild	6 (1.5)
Mild to moderate	15 (3.7)
Moderate	36 (9.0)
Severe	129 (32.2)
Mean duration of ED, mon	23.6 ± 33.7

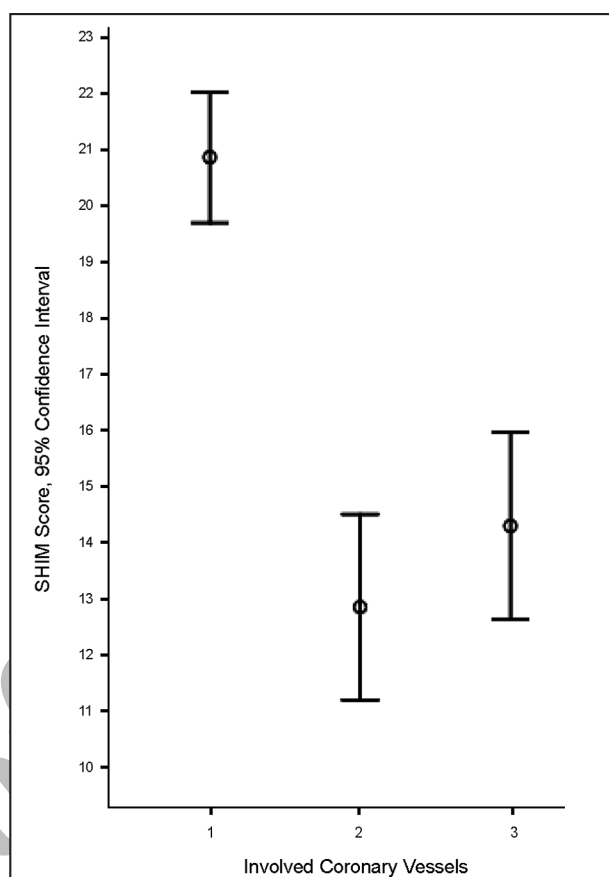
*Values are means ± standard deviations, or otherwise, numbers (percents). ED indicates erectile dysfunction and CAD, coronary artery disease.

Table 2. Degree of ED Based on SHIM Scores in Relation to Angiography Results*

ED	Number of Coronary Arteries with Stenosis		
	1	2	3
No	127 (76.5)	42 (35.0)	46 (40.0)
Mild	4 (2.4)	2 (1.7)	0
Mild to moderate	2 (2.2)	2 (1.7)	11 (9.6)
Moderate	8 (4.8)	14 (11.7)	14 (12.2)
severe	25 (15.1)	60 (50.0)	44 (38.3)

*Values in parentheses are percents. ED indicates erectile dysfunction and SHIM, sexual health inventory for men.

(SHIM score, 21 or less), the same association was present ($P < .001$); however, the SHIM score was not associated with the number of involved vessels



The SHIM scores in men with 1, 2, and 3 vessels involved with coronary artery disease. SHIM indicates sexual health inventory for men.

when only men with ED were considered ($P = .10$). Furthermore, 41 patients (19.1%) without ED and 45 (24.2%) with ED had a positive history of MI ($P = .21$).

Symptoms of ED had appeared prior to CAD detection in 78 out of 189 patients (41.9%) with a mean time interval of about 23 months (range, 10 to 36 months). However, there was no significant relationship between length of time interval from ED to CAD onset and the number of involved vessels.

DISCUSSION

In the present study, we evaluated men with established CAD confirmed by angiography and found ED in nearly half of them. This rate is significantly higher than that in the general male population in Iran. Safarinejad has studied 2674 Iranian men aged 20 to 70 years and found that 18.8% of men interviewed reported ED.⁽¹⁰⁾ Using the 5-item version of IIEF (SHIM), the degree of ED

was determined in our patients, which was associated with the number of stenotic vessels according to angiography. However, this finding was diminished when only men with ED were considered. The final analysis was indicative of 2- vessel or 3-vessel disease in men with ED.

The link between ED and CAD has now been well established.^(2,3,10) It was shown that in the Iranian male population, history of diabetes, hypertension, smoking, peripheral vascular disorders, hypercholesterolemia, and coronary artery disease (odds ratio, 1.61; 95% confidence interval, 1.21 to 2.85) were significantly associated with ED.⁽¹⁰⁾ In a prospective study by Vlachopoulos and colleagues, of 50 men with organic ED, 12 had a positive noninvasive test for CAD and 1 developed MI. They performed cardiac angiography in 10 that showed coronary vessel involvement in 9 of them.⁽⁴⁾ The degree of ED was studied by Solomon and colleagues.⁽⁸⁾ They found that the IIEF score of men with angiographically confirmed CAD correlated with their atherosclerotic disease burden. In a study on 40 patients who underwent coronary angiography, a statistically significant correlation was found between erectile function and the number of involved coronary vessels. Patients with 1-vessel disease had a more effective erection with fewer difficulties in achieving an erection than men with 2-vessel or 3-vessel disease.⁽⁵⁾ However, in another study on 300 patients, the clinical and angiographic characteristics were not different in regard to erectile function.⁽⁶⁾ Although men with ED had a more extensive CAD (multivessel disease), our study failed to depict a correlation between the degree of ED and the clinical severity of CAD. Patients in our study were those with an established heart disease. Besides, ED was mostly severe in our cases (129 out of 186). Accordingly, it can be assumed that patients with milder forms of ED might have had asymptomatic or mild CAD and did not need to undergo angiography. Thus, our findings do not necessarily oppose the hypothesis of a linear correlation between ED and CAD degrees.

Most investigators suggest that patients with ED should undergo further cardiovascular evaluation to detect asymptomatic CAD.^(2,4) However, Montrosi and colleagues dispute this approach as ED is a very common disease and a systematic cardiologic

screening would not be cost effective.⁽³⁾ Thus, ED may not be a valuable predictor of ischemic heart disease. Whereas, the presence of ED, as our data supported, can be indicative a more extensive CAD in patients with symptomatic cardiac disease, warranting invasive studies such cardiac angiography.

Recently, a hypothesis of “artery size” is proposed by Montrosi and colleagues,⁽⁷⁾ suggesting a temporal relationship of ED and CAD. They consider these two disorders as two different aspects of a same disease. In the presence of a series of risk factors, a vascular disease affects the endothelium of the arteries. Since the coronary arteries are larger vessels than the penile ones, they better tolerate the resultant stenosis and thus, ED develops prior to CAD. In contrast, more than half of the patients in this series mentioned the onset of ED to be simultaneous or after the start of CAD manifestations. In line with our study, Solomon and colleagues found that 58% of men with established ischemic heart disease had experiences ED before the diagnosis of CAD.⁽⁸⁾ There might be other factors that influence different vessels separately. The artery size theory comes mostly from retrospective data and needs to be tested in a large-scale prospective study evaluating ED and CAD.

An interesting finding in our study was that despite the association of erectile function with the extent of coronary artery stenosis, the frequency of previous MI was not higher in men with ED than those without ED. This is in agreement with the studies that demonstrated nearly 70% of MIs occur in cases with uncritical coronary stenosis (less than 50%).⁽¹¹⁾ Coronary artery disease causes a clinical spectrum including silent ischemia, chronic angina pectoris, MI, ischemic cardiomyopathy, and sudden cardiac death. Although the same pathophysiology plays a role in ED and CAD, not all the manifestations of CAD are in association with ED. This emphasizes the role of other mechanisms other than the obstruction of the coronary vessels involved in progression of clinical CAD that can make it different from ED.

Some limitations in our study need to be addressed. Anatomical and functional evaluation of penile circulation through ultrasonography evaluation and dynamic Doppler test were not systematically carried out in this patient population. Coronary angiography was considered as the gold standard technique to

detect CAD. However, this technique detects only changes in the artery lumen and not the true plaque volume extension. Thus, in patients with uniform lumen artery reduction, small vessel disease, or plaque with positive remodeling change, angiography results will be normal despite a significant atherosclerotic burden. Coronary intravascular ultrasonography represents a more appropriate technique for CAD even at early stages.

The important goal of this study was to explore the association between CAD and ED; therefore, factors such as ejection fraction and heart failure, or diabetes mellitus, that influence sexual function and perfect erection on many ways, were excluded.

CONCLUSION

The key findings of this study were as follows: first, ED rate significantly differs among the patients with established CAD according to coronary clinical presentation and atherosclerosis burden. Second, the ED severity, but not ED prevalence is related to the extent of CAD. Third, the ED symptoms come prior to CAD symptoms in about half of the patients with ED.

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CONFLICT OF INTEREST

None declared.

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