

ORIGINAL ARTICLE

Sexual activity and erectile dysfunction in elderly men with angiographically documented coronary artery disease

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We studied the prevalence of erectile dysfunction (ED) in elderly men, aged 65 years or above, with coronary artery disease (CAD) documented by coronary angiography. A total of 123 men (112 men with CAD and 11 men without CAD), mean age 74.6 ± 5.9 years, was included. To detect ED and assess its severity, all participants were asked to complete the Sexual Health Inventory for Males (SHIM) questionnaire. Lack of sexual activity was more prevalent among men with CAD relative to men without CAD (31.3 vs 0.0%). Among the sexually active men, ED was more prevalent among men with CAD relative to men without CAD (85.7 vs 72.7%). A general linear model showed that age was the only factor associated with SHIM scores among the sexually active men with CAD ($P = 0.001$). Other factors, such as the number of occluded coronary arteries, diabetes mellitus, hypertension, smoking, various medications and marital status, were not associated with SHIM scores in elderly men with CAD. We conclude that lack of sexual activity and ED are very common in elderly men with CAD. Among the sexually active men with CAD, ED severity is associated only with age.

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Introduction

Erectile dysfunction (ED) is defined as the inability to attain and/or maintain penile erection sufficient for satisfactory sexual performance.¹ Most epidemiological studies on sexual activity and ED were performed on middle-aged men, and only few of them focused on the elderly population, aged ≥ 65 years. According to these studies, 33–68% of elderly men are not sexually active, although the prevalence of ED among elderly men who are sexually active is 43.5–67%.^{2–4}

Erectile dysfunction is associated with coronary artery disease (CAD) as well as its cardiovascular risk factors.⁵ This is probably because atherosclerosis and endothelial dysfunction are systemic conditions affecting both the coronary and penile arteries.^{6,7} Yet, the prevalence of ED in men with

CAD documented by coronary angiography has been studied very little,^{8–10} and none of these studies focus on the elderly population. In fact, to the best of our knowledge, the prevalence of ED in elderly men with angiographically documented CAD, risk factors or associated conditions has never been studied.

As the elderly population is rapidly growing throughout the globe,¹¹ and because coronary angiography in this population is becoming more common as its complication rates are low,¹² the prevalence of angiographically documented CAD within this population is rising. As ED is commonly associated with CAD,⁵ it is important to study its prevalence in elderly men with documented CAD, in order to increase physicians' awareness to it.

The aim of this study was to determine the prevalence of ED and its associated risk factors in elderly men aged ≥ 65 years using angiographically documented CAD.

Materials and methods

Tel-Aviv Prospective Angio Survey

The Tel-Aviv Prospective Angio Survey is a registry of all patients undergoing coronary angiography at

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the Tel-Aviv Sourasky Medical Center, Tel-Aviv, Israel. All subjects signed an informed consent for participation in the registry, which was approved by the local ethics committee. Each patient completed a detailed questionnaire regarding his medical history before coronary angiography. Angiography findings were documented for all subjects.

Study design and definitions

The Sexual Health Inventory for Men (SHIM) questionnaire was introduced to 124 elderly men, aged ≥ 65 years, all of whom had undergone coronary angiography as part of the Tel-Aviv Prospective Angio Survey between March 2006 and November 2008. CAD documented by coronary angiography was defined as $\geq 50\%$ stenosis in one or more of the epicardial coronary arteries. The number of stenotic coronary arteries defined CAD severity.

Sexual Health Inventory for Men questionnaire

The SHIM questionnaire is a widely used tool to detect ED and assess its severity. It consists of five items, each rated on a six-point scale from 0 to 5, except for one five-point scale item rated from 1 to 5. The final score, ranging from 1 to 25, is calculated by summing up individual question scores. Scores below 22 are consistent with ED and are further classified using the following categories: severe ED: 1–7, moderate ED: 8–11, mild-to-moderate ED: 12–16, and mild ED: 17–21.¹³ All subjects completed the SHIM questionnaire individually, but were later interviewed for confirmation purposes; this was a short structured sexual interview based only on the SHIM questionnaire.

Statistical analysis

The continuous variables were expressed as mean \pm s.d. The one-way Kolmogorov–Smirnov test was used to assess the distributions of continuous variables such as age and SHIM scores. Spearman's correlation coefficients were calculated to determine the correlation between age and SHIM scores. The Kruskal–Wallis and Mann–Whitney tests were used to compare mean ages and SHIM scores between men with no CAD, and men with one-, two- or three-vessel disease. The χ^2 test was used to compare the prevalence of categorical variables between men with no CAD, and men with one-, two- or three-vessel disease. Using a general linear model, we tested the association between SHIM scores and several explanatory variables among men with CAD, such as age, number of occluded coronary arteries, presence of various cardiovascular risk factors, using anti-hypertensive agents, using statins, number of drugs used and marital status. P -values ≤ 0.05

were considered statistically significant. All statistical analyses were performed using Version 16.0 of the SPSS statistical package (SPSS Inc., Chicago, IL, USA).

Results

The initial cohort included 124 men, all but one of whom completed the SHIM questionnaire (99.2% compliance). All men were in relationships during the study or within the previous 6 months. The final cohort included 123 men, with mean age 74.6 ± 5.9 years. Eleven men had no CAD. Overall, 112 men had CAD: 21 (18.8%) men had one-vessel disease, 44 (39.3%) men had two-vessel disease and 47 (42.0%) men had three-vessel disease. Overall, 94 (76.4%) of the men suffered from hypertension, 39 (31.7%) from diabetes mellitus and 29 (23.6%) were smokers. No significant differences were found between men with and without CAD regarding the mean age and the prevalence of diabetes mellitus, hypertension and smoking. No significant differences were found between men with one-, two- and three-vessel disease regarding the mean age and the prevalence of diabetes mellitus, hypertension and smoking (Table 1).

The mean SHIM score for the entire cohort was 11.6 ± 8.4 . The mean SHIM score for men without CAD was significantly higher relative to men with CAD (16.9 ± 6.7 vs 11.1 ± 8.4 ; $P = 0.02$). No significant differences were found between men with one-, two- and three-vessel disease regarding the mean SHIM score (Table 1).

The lack of sexual activity was more prevalent among men with CAD relative to men without CAD (35/112 vs 0/11; 31.3 vs 0.0%), although this difference was a trend ($P = 0.06$). No significant differences were found between men with one-, two- and three-vessel disease regarding the prevalence of lack of sexual activity (Table 1).

Among the sexually active men, ED was more prevalent among men with CAD relative to men without CAD (66/77 vs 8/11; 85.7 vs 72.7%), although this difference was not statistically significant ($P = 0.57$). Significant differences were not found between men with one-, two- and three-vessel disease regarding the prevalence of ED (Table 1). Among the 66 men with CAD and ED, 26 (33.8%) men had mild ED; 22 (28.6%) men had mild-to-moderate ED; 7 (9.1%) men had moderate ED; and 11 (14.3%) men had severe ED.

A general linear model found age to be the only factor associated with SHIM score in sexually active men with CAD ($P = 0.001$), rather than cardiovascular risk factors, CAD severity, using anti-hypertensive agents or statins, overall number of medications, and marital status (Table 2). SHIM scores were inversely associated with age in the

Table 1 Mean age, prevalence of cardiovascular risk factors and sexual characteristics by number of stenotic coronary arteries

		No CAD (n = 11)	CAD			P-value ^a	P-value ^b	P-value ^c
			1VD (n = 21)	2VD (n = 44)	3VD (n = 47)			
<i>Clinical characteristics</i>								
Age	Mean ± s.d.	72.8 ± 6.2	75.3 ± 6.8	74.6 ± 5.6	74.7 ± 5.9	0.36	0.95	0.81
Diabetes mellitus	n (%)	2 (18.2%)	9 (42.9%)	13 (29.5%)	15 (31.9%)	0.40	0.67	0.68
Hypertension	n (%)	8 (72.7%)	18 (85.7%)	27 (61.4%)	41 (87.2%)	0.88	0.32	0.52
Smoking	n (%)	2 (18.2%)	5 (23.8%)	10 (22.7%)	12 (25.5%)	0.70	0.96	0.97
<i>Sexual characteristics</i>								
SHIM scores	Mean ± s.d.	16.9 ± 6.7	10.8 ± 8.5	11.6 ± 7.8	10.8 ± 8.9	0.02	0.93	0.11
No sexual activity	n (%)	0 (0.0%)	6 (28.6%)	11 (25.0%)	18 (38.3%)	0.06	0.51	0.18
ED	n (%)	8 (72.7%)	13 (61.9%)	30 (68.2%)	23 (48.9%)	0.57	0.48	0.62
Mild ED	n (%)	4 (36.4%)	4 (19.0%)	11 (25.0%)	11 (23.4%)	0.40	0.90	0.82
Mild-to-moderate ED	n (%)	1 (9.1%)	5 (23.8%)	10 (22.7%)	7 (14.9%)	0.44	0.63	0.66
Moderate ED	n (%)	2 (18.2%)	1 (4.8%)	5 (11.4%)	1 (2.1%)	0.16	0.20	0.20
Severe ED	n (%)	1 (9.1%)	3 (14.3%)	4 (9.1%)	4 (8.5%)	0.94	0.77	0.91

Abbreviations: CAD, coronary artery disease; ED, erectile dysfunction; SHIM, Sexual Health Inventory for Men; VD, vessel disease.

^aComparing between men with and without coronary artery disease.

^bAmong men with coronary artery disease, comparing between men with one-, two- and three-vessel disease.

^cComparing between men without coronary artery disease, men with one-, men with two- and men with three-vessel disease.

Table 2 A general linear model testing the association between SHIM questionnaire scores and cardiovascular risk factors, coronary artery disease severity, using anti-hypertensive agents or statins, overall number of medications, and marital status, among men with coronary artery disease

	Mean square	F	P-value
Age	339.091	12.319	0.001
Number of stenotic coronaries	0.195	0.007	0.933
Smoking	95.983	3.487	0.067
Diabetes mellitus	82.997	3.015	0.088
Hypertension	52.143	1.894	0.174
Using statins ^a	0.698	0.025	0.874
Using thiazides ^a	2.192	0.08	0.779
Using ACE inhibitors ^a	11.95	0.434	0.513
Using β-blocker ^a	77.006	2.797	0.100
Overall number of drugs ^a	95.067	3.454	0.068
Marital status ^a	19.206	0.698	0.407

Abbreviations: ACE, angiotensin-converting enzyme; SHIM, Sexual Health Inventory for Men.

^aThese data were available in 68 of the 77 sexually active men.

entire cohort of men with CAD ($r = -0.49$; $P < 0.0001$; Figure 1) and in the sexually active group specifically ($r = -0.29$; $P = 0.01$).

Discussion

Very few epidemiological studies on sexual activity and ED in the elderly exist. According to Lindau *et al.*,² 33–61.5% of men aged 65–85 years are not sexually active, and the prevalence of ED in this age group is 43.5–44.6%. According to Chew *et al.*,³

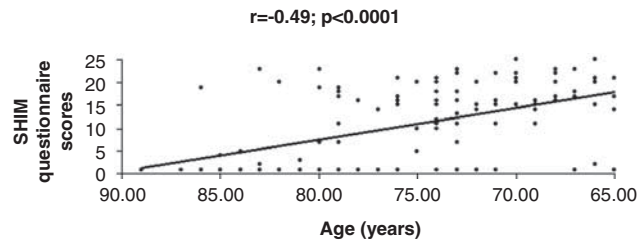


Figure 1 The correlation between ED severity, as reflected by SHIM score, and age among men with CAD. Abbreviations: CAD, coronary artery disease; ED, erectile dysfunction; SHIM, Sexual Health Inventory for Men.

68% of men aged ≥ 65 years are not sexually active, and the prevalence of ED in this age group is 67%. According to our findings, 31.3% of elderly men are not sexually active and the prevalence of ED in elderly men who are sexually active is 85.7%. In other words, sexual activity rates in our cohort were consistent with those found in earlier cohorts, whereas the prevalence of ED was higher than that found in earlier cohorts. As our cohort is unique^{2,4} only in its population, consisting strictly of elderly men with CAD, we suggest that the lack of sexual activity in this sub-population is not associated with CAD, although the prevalence of ED is. As only 11 of the men in our cohort had no documented CAD on angiography, we could not reach any population-based conclusions. Nonetheless, the association between CAD and ED is well recognized in the literature,^{5,8–10} and because atherosclerosis and endothelial dysfunction are systemic conditions that affect both coronary and penile arteries,^{6,7} we have no reason to believe that CAD and ED are not

associated in the elderly population as well. However, lack of sexual activity in elderly men is not necessarily associated with CAD; according to Lindau *et al.*,² 24.2–28.5% of elderly men lack sexual interest, and 69.9–74.3% of the non-sexually active men avoid sex because of non-sexual reasons.

Very few epidemiological studies on the prevalence of ED in men with CAD exist. According to Montorsi *et al.*,⁸ 49% of men with angiographically documented CAD suffer from ED; according to Foroutan and Rajabi,⁹ 46.4% of men with angiographically documented CAD suffer from ED. Yet, a remarkable 85.7% of men with angiographically documented CAD in our cohort were found to suffer from ED. These findings can be rationalized in several ways: earlier studies used self-assessment questionnaires to detect ED,^{8–10} whereas subjects in our study completed the SHIM questionnaire individually, but were later interviewed for confirmation purposes. After this procedure, their final SHIM score was often lower as compared with their initial score. We believe our findings to be more reliable because of this questioning method. Another possible explanation to the discrepancy between findings is the fact that our cohort is older than all earlier cohorts.^{8–10} Age is a crucial factor in our study, being the only variable associated with SHIM score within the sexually active group. Nevertheless, the association between age and ED is well recognized in the medical literature⁵ and it is not surprising to observe it also in elderly men with CAD.

Contrary to earlier studies in younger men with angiographically documented CAD,^{9,10,14} ED severity was not associated with the number of narrowed coronary arteries in our cohort. It could be that our cohort was too small to make population-based conclusions regarding the association between ED severity and the number of stenotic coronary arteries in elderly men with CAD; yet this was the largest study in this population of elderly men. Instead, we believe this has been related to the fact that all earlier studies were based on the ‘artery size hypothesis’.¹⁵ According to this hypothesis, atherosclerosis is a systemic condition affecting both coronary and penile arteries.⁶ As the penile artery diameter is smaller than that of the coronary arteries, mild ED precedes symptomatic one-vessel CAD. Men with three-vessel CAD will thus suffer from severe ED, stroke and claudication.¹⁵ This hypothesis, however, overlooks the natural history of advanced atherosclerosis, which may reach a plateau in the elderly once the plaque and arterial media start to calcify.¹⁶ At this point, the penile artery lumen diameter may remain stable regardless of the continuing atherosclerotic process in the coronary arteries. We believe this is the point from which ED severity is no longer associated with the number of stenotic coronary arteries, yet is highly associated with the residual lumen diameter of the penile arteries.

Study limitations

Not all patients undergoing coronary angiography during the above-mentioned period completed the SHIM questionnaire. The SHIM questionnaire was not introduced to mechanically ventilated patients or non-Hebrew speakers. Hence, the study might bear a selection bias. We tried to overcome this bias by introducing the SHIM questionnaire to as many patients as possible. Thus, we feel that the high compliance rate to the questionnaire helped overcome this as well as any other selection bias.

Although taking a thorough sexual history and performing a Doppler ultrasound of the penis are more sensitive in detecting ED compared with the SHIM questionnaire,¹³ it is widely used in clinical trials for its high compliance rates, as we have shown in this study. Subjects in our study completed the SHIM questionnaire individually, but to further increase its sensitivity, they were also interviewed for confirmation purposes. Hence, we believe that the diagnoses of ED made in this study were reliable.

Clinical implications and conclusions

The lack of sexual activity and ED are very common phenomena in elderly men with CAD, which should be addressed by their physicians. ED severity in elderly men with CAD is associated with age alone, and not with the number of stenotic coronary arteries, or history of diabetes mellitus, hypertension or smoking. Hence, aggressive intervention addressing cardiovascular risk factors in this population is probably useful in improving cardiovascular morbidity and mortality, although its role in treating ED is questionable. Phosphodiesterase-5 inhibitors might be the appropriate solution for elderly men with CAD and ED. Data show that their therapeutic potential extends beyond ED to treat the ischemic myocardium and inflamed coronary arteries, resolve sub-clinical inflammation, relieve oxidative stress and lower the risk for thrombosis.¹⁷ Either way, physicians’ awareness to these issues is highly called for.

Conflict of interest

The authors declare no conflict of interest.

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