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ORIGINAL ARTICLE

Prevalence of erectile dysfunction in male stroke patients, and associated co-morbidities and risk factors

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Abstract
Background Sexual problems have been a common finding in chronically ill and physically disabled patients such as those with cerebrovascular accidents. Previous studies have supported the association between stroke and erectile dysfunction (ED).
Objectives The aim of this study was to investigate the prevalence of ED and its severity in male stroke patients in Qatar and to assess the co-morbidities and risk factors associated with ED.
Design This was a cross-sectional study.
Setting The study was conducted from January to December 2006 at the Hamad General Hospital, Hamad Medical Corporation (HMC).
Subjects Eight hundred Qatari and non-Qatari patients 35–75 years of age were invited to participate in this study; 605 patients gave their consent, which was a response rate of 75.6%.
Methods Face-to-face interviews were based on a questionnaire that included socio-demographic factors. The classification of the type of stroke was made according to the criteria of stroke by the World Health Organization (WHO). All patients completed a second questionnaire addressing their general medical history, type of treatment and co-morbidity with other diseases or risk factors. Sexual function was evaluated with the International Index of Erectile Function (IIEF).
Results The mean age of subjects was 56.1 ± 9.8 years. Approximately 48.3% of the studied population reported some degree of erectile dysfunction. Of the stroke patients with ED, 36% had severe ED, 32.9% had moderate ED and 31.2% had mild ED. More than half of the stroke patients (59.6%) with ED were in the age group 60–75 years. The prevalence of ED increased with increasing age. The co-morbidities and risk factors were significantly more prominent in ED patients than in those without ED for hypercholesterolemia ($P < 0.001$), diabetes ($P = 0.002$), and hypertension ($P = 0.031$). Medication taken for these diseases also had a significant association with ED.

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Conclusions Our study findings revealed a greater prevalence of ED in stroke patients in the population of Qatar. The most important co-morbid factors for ED in stroke patients were diabetes, hypertension and hypercholesterolemia, and the risk factors were smoking and obesity.

Keywords Diabetes · Epidemiology · Erectile dysfunction · Hypertension · IIEF · Qatari population · Risk factors · Stroke

Introduction

The global burden of stroke is well known, and it is the third-ranked cause of death, affecting 5.5 million people a year, and is responsible for 50 million disability adjusted life years (DALY) [1]. It is predicted that over the next 20 years, stroke will rise from 7th in DALY league table to 4th, influenced largely by the aging of populations in less economically developed countries. Many studies have reported that sexual functioning, sexual activity or satisfaction in sexual relationship often change after stroke [2–9]. As stroke is a major health problem in the community, it has become a major risk factor of erectile dysfunction (ED).

Sexual dysfunction in stroke patients is known to be complex and etiologically multifactorial and includes both organic and psychosocial factors [4]. The quality of sexual life after stroke might be impaired because of pre-morbid medical conditions, such as hypertension, diabetes mellitus, cardiac diseases, or medication or various psychosocial factors [4]. Sexual dysfunction is a frequently encountered problem in patients with stroke and hypertension and may occur as a side effect of some types of medications. Different groups of medications for stroke and other co-morbid diseases can improve the medical condition of patients, but they have dissimilar effects on ED [10–12].

The dramatic socio-economic and rapid changes in many aspects of life during the past two decades in the State of Qatar have had a great impact on urbanization and lifestyle of the Qatari community, and, as a result, stroke, diabetes and hypertension have become the main public health problem [11, 12].

The development of the International Index of Erectile Function (IIEF), a validated, self-administered, five-item questionnaire to evaluate male sexual function [13–16], and a widely used abbreviated version [2–7], the IIEF-5, have facilitated the study of the prevalence of ED. The aim of our study was to use the IIEF-5 to determine the prevalence of ED and its severity in male stroke patients and to assess the co-morbid and risk factors associated with ED.

Participants and methods

This was a cross-sectional designed study aiming to investigate the prevalence of ED and its severity in male stroke patients attending the outpatient medical clinics at the Hamad General Hospital, Hamad Medical Corporation (HMC), in Qatar. Approval for the study was obtained from the Medical Ethics Committee of the Hamad Medical Corporation. The selected participants gave consent to be included in this study after explanation of the aims and the nature of the study. All interviews were conducted privately, and confidentiality and anonymity of the participants were maintained.

The study was conducted during the period January to December 2006. Of the 800 Qatari and non-Qatari male stroke patients who were approached for the survey, 195 were excluded from the study because either they declined to give their consent, or they did not complete their questionnaires. In all, 605 male stroke patients (75.6%) were included in the study.

Definitions

The classification of the type of stroke was made in accordance with the criteria of stroke defined by the World Health Organization (WHO) [17, 18]. The definition includes most cases of subarachnoid hemorrhage, intracranial hemorrhage and cerebral infarction. Patients with transient ischemic attacks or those with asymptomatic lesions detected by brain imaging (silent infarction) were excluded. Only patients with their first-ever stroke during the study periods were registered and counted for the measurement of stroke prevalence and the 28-day case fatality rate.

The presence of *diabetes mellitus* was determined by the documentation in the patient's previous or current medical record of a diagnosis of diabetes mellitus that had been treated with medications or insulin [19]. The presence of *hyperlipidemia* was determined by the demonstration of a fasting cholesterol level >5.2 mmol/l in the patient's medical record, or any history of treatment for hyperlipidemia by the patient's physician.

The presence of *hypertension* was determined by any documentation in the medical record of hypertension or if the patient was on treatment for hypertension [19]. Hypertension was diagnosed when the average of two or more diastolic blood pressure measurements on at least two subsequent visits (at least 2 weeks apart) was 90 mmHg, or when the average of multiple readings of systolic blood pressure on two or more subsequent visits was consistently equal to or greater than 140 mmHg [19, 20].

Face-to-face interviews were based on a questionnaire that included socio-demographic factors. All patients completed a second questionnaire addressing their general medical history, type of treatment and co-morbidity with other diseases such as hypertension, diabetes mellitus, hypercholesterolemia, hypertriglyceridemia, myocardial ischemia and risk factors like smoking.

In our study, the abridged five-item version of the International Index of Erectile Function (IIEF-5) was used as a diagnostic tool for assessing the erectile dysfunction [10, 13–16]. Prior to the beginning of the study, the Arabic translation of IIEF-5 was judged by 50 persons for clarity and conformity with the local culture and was stated to be appropriate. Reliability analysis showed that the Cronbach's alpha value was 0.87 for the stroke group. The IIEF and its scoring system were found to be a reliable and valid measure of the five relevant domains of sexual function in men, including erectile function (EF), orgasmic function (OF), sexual desire (SD), intercourse satisfaction (IS), and overall satisfaction (OS). The IIEF items EF, IS, and OF are considered to reflect predominantly physical functions, and SD and OS to reflect mainly psychological functions. The responses to each of the five questions were rated on a 0–5 point scale [21–23], and the total IIEF score ranged from 0 to 25, a higher score indicating better sexual function. Direct help was given to the patients during completion of the IIEF, if needed, and, using the IIEF scores, patients were classified as having no (22–25), mild (17–21), moderate (12–16), or severe (1–11) ED; a higher score indicates better function [10, 13–16].

Student's *t*-test was used to ascertain the significance of differences between mean values of two continuous variables, and the Mann–Whitney was used as a non-parametric test. Chi-square and Fisher's exact test were performed to test for differences in proportions of categorical variables between two or more groups. Pearson's correlation coefficient was used to evaluate the strength of association between variables. $P < 0.05$ was considered as the cutoff value for significance.

Results

Table 1 shows the socio-demographic characteristics and prevalence of erectile dysfunction in male stroke patients. The highest proportion of the stroke patients were in the age group 60 years and above (38%). The majority of the patients were non-smokers (74.4%). Within the total study population (605), 292 (48.3%) reported some degree of erectile dysfunction. Of the stroke patients with ED, 36% had a severe IIEF score (1–11), 32.9% had a moderate score (12–16) and 31.2% had a mild score (17–21).

Table 2 shows the important characteristics of the stroke patients with ED and those without. More than half of the stroke patients with ED (59.6%) were in the age group 60–75 years. Prevalence of ED increased with advancing age. Diabetes ($P = 0.002$), hypertension ($P = 0.031$) and hypercholesterolemia ($P < 0.001$) were significantly higher in stroke patients with ED than in those stroke patients without ED. Nearly half of the stroke patients were smokers (49%). Smoking and obesity were significantly associated with the prevalence of ED in stroke patients.

Table 3 explains the drugs taken by the studied stroke patients with ED and without. Aspirin was the most common drug taken by stroke patients with ED (75%) and without (78%). After aspirin, Plavix-clopidogrel (70.2%), diuretic (57.5%), Amaryl (50%), warfarin (44.9%) and angiotensin converting enzyme (ACE) inhibitors (34.9%) were the most common drugs taken by stroke patients with ED. There was statistically a significant association found

Table 1 The socio-demographic characteristics and prevalence of erectile dysfunction in the male stroke patients studied

Variables	Stroke male patients (N = 605) Frequency (n)	Percentages (%)
Age group (years)		
<40	35	5.8
40–49	136	22.5
50–59	204	33.7
>60	230	38.0
BMI		
Normal weight (<25 kg/m^2)	190	31.4
Overweight (25–29 kg/m^2)	198	32.7
Obese (≥30 kg/m^2)	217	35.9
Nationality		
Qatari	240	39.7
Non-Qatari	365	60.3
Marital status		
Single/divorced/widowed	92	15.2
Currently married	513	84.8
Educational level		
Illiterate	122	20.2
Primary	118	19.5
Intermediate	114	18.8
Secondary	152	25.1
University	16.4	16.4
Occupation		
Retired	107	17.7
Business	134	22.1
Clerical/administrative	217	35.9
Police/military	48	7.9
Professional	99	16.4
Smoking status		
Smoker	155	25.6
Non-smoker	450	74.4
Erectile dysfunction		
Yes (<21 IIEF)	292	48.3
No (22–25)	313	51.7
Severity of ED by IIEF score		
Severe (1–11)	105	17.4
Moderate (12–16)	96	15.9
Mild (17–21)	91	15.0
None (22–25)	313	51.7

IIEF International Index of Erectile Function

BMI body mass index

between medication for diabetes, hypertension and heart diseases and ED.

Table 4 gives the mean ± SD scores of all stroke patients with and without ED according to IIEF domains. The mean scores of all stroke patients with ED in various sexual activity domains were lower than those of stroke patients without ED. The scores of all sexual activity domains were highly significant and showed higher risk in stroke patients with ED than in those without ED.

Figure 1 reveals the severity of ED in stroke patients by age group. The severity of ED increased

Table 2 Important characteristics of the studied male stroke patients with and without erectile dysfunction

Variables	Patients with ED (n = 292) n (%)	Patients without ED (n = 313) n (%)	P
Mean age ± SD			
Age group (years)			
<40	–	35 (11.2)	0.000
40–49	42 (14.4)	94 (30.0)	
50–59	76 (26.0)	128 (40.9)	
60–75	174 (59.6)	56 (17.9)	
Co-morbid and risk factors[a]			
Hypertension	116 (39.7)	98 (31.3)	0.031
Hypercholesterolemia	90 (30.8)	44 (14.1)	<0.001
Diabetes	151 (51.7)	123 (39.3)	0.002
Hypertriglyceridemia	73 (25.0)	68 (21.7)	NS
Myocardial ischemia	101 (34.6)	115 (36.7)	NS
Smoking (current)	64 (21.9)	91 (29.1)	0.013
Smoking (past)	79 (27.1)	99 (31.6)	
Non-smoker	149 (51.0)	123 (39.3)	
Obesity (BMI > 30)	123 (42.1)	89 (28.4)	0.0005

ED erectile dysfunction
NS not significant
BMI body mass index
[a] Multiple options

Table 3 Drugs taken by the male stroke patients with and without erectile dysfunction (multiple options)

Variables	Patients with ED (n = 292) n (%)	Patients without ED (n = 313) n (%)	P
Aspirin	219 (75.0)	244 (78.0)	NS
ACE inhibitors	102 (34.9)	80 (25.6)	0.012
Diuretic	168 (57.5)	78 (24.9)	0.002
Beta blocker	54 (18.5)	94 (30.0)	0.001
Calcium channel blocker	49 (16.8)	43 (13.7)	NS
Plavix-clopidogrel	205 (70.2)	188 (60.1)	0.009
Heparin	85 (29.1)	56 (17.9)	0.001
Warfarin	131 (44.9)	110 (35.1)	0.015
Amaryl	146 (50)	104 (33.2)	0.001

ED erectile dysfunction
NS not significant

with increasing age. Most of the male stroke patients aged 40–49 years and 50–59 years experienced very mild and moderate ED. However, severity of ED increased in patients aged 60–69 years, and nearly all patients in the age group 70–75 years reported severe ED.

Discussion

Cerebrovascular diseases are the third leading cause of death and one of the major causes of long-term disability in western countries [24]. Despite the high prevalence of sexual dysfunction, very little information is available about the consequences of stroke on sexual behavior. Our study aimed to find the prevalence of ED in male stroke patients and assess the co-morbidities and risk factors associated with ED by analyzing a large group of male stroke patients (605) attending the outpatient medical clinics of the main tertiary hospital in Qatar.

Few previous studies have focused on the physiological aspects of sexual behavior, rather than on the associated risk factors, which may be important elements in determining the quality of sexual life after stroke. In Qatar, it is important to find the prevalence and risk factors of ED because no such study has been conducted, so far, on ED in stroke

Table 4 Mean ± SD scores of all male stroke patients with and without erectile dysfunction according to IIEF domains

IIEF domain	Patients with ED $n = 292$	Patients without ED $n = 313$	P
Erectile function	1.93 ± 0.67	4.430 ± 0.46	<0.001
Sexual desire	2.51 ± 0.82	4.54 ± 0.49	<0.001
Orgasmic function	2.69 ± 0.95	4.68 ± 0.47	<0.001
Intercourse satisfaction	2.99 ± 1.13	4.85 ± 0.36	<0.001
Overall satisfaction	3.10 ± 1.22	4.87 ± 0.36	<0.001
Overall average score	2.74 ± 0.93	4.64 ± 0.20	<0.001

IIEF International Index of Erectile Function

ED erectile dysfunction

patients. Furthermore, the major changes in a developing society such as Qatar have had obvious influences on many different aspects of life, which include behavioral, social and life style patterns, such as smoking, unfavorable eating habits, and the change in the nature of daily physical activities [25]. These changes can increase the incidence of stroke, resulting in more problems of sexual dysfunction in men in Qatar. Although the majority of stroke survivors maintain consistent levels of sexual desire and believe that sexual function is important, most will experience sexual dysfunction following stroke.

Within the study population, 48.3% reported some degree of erectile dysfunction. This result is similar to that of the study conducted in Finland [2, 3], in which the majority of stroke patients (79%) reported an active sexual life before their stroke. After the stroke, those with an active sexual life markedly decreased to 45%. Moreover, the number of patients satisfied with their sexual life decreased in stroke patients (89% before stroke, 49% after stroke). A study by Kimura et al. [7] revealed that 58.6% of male stroke patients reported dissatisfaction with their sexual functioning after stroke. Another two studies reported a higher

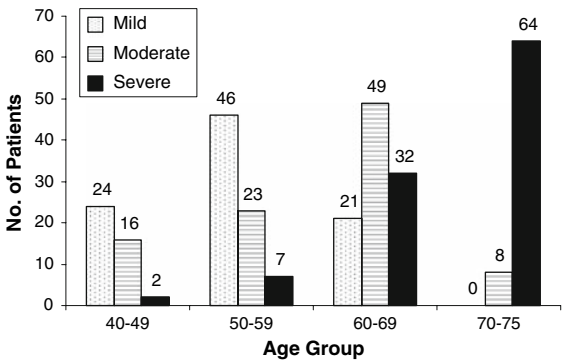

Fig. 1 Severity of erectile dysfunction by International Index of Erectile Function score in male stroke patients by age group

proportion of stroke patients who experienced sexual dysfunction and dissatisfaction with sexual life after stroke. Monga et al. [5] reported erectile disorders in 62% of male stroke patients, and another study conducted by San Carlos University Hospital in Spain [26] reported a marked decline in sexual function: 70.8% 1 year after stroke. All these studies show that sexual decline was common in men during the period after the stroke.

Although stroke is often viewed as a disease of the elderly, it sometimes affects younger individuals. The incidence of stroke increases with age, but nearly a quarter of all strokes occur in people under the age of 60 years. In our study population, the number of stroke patients and the prevalence of ED increased with advancing age. Severity of ED was higher in patients aged 60–69 years, and nearly all the age group 70–75 years reported severe ED.

Monga and Osterman [4] suggested in their review that sexual problems in stroke patients are never a consequence of stroke alone; rather, they may be due to a variety of associated medical conditions and psychosocial factors. Increased prevalence rates of ED have been reported in patients with vascular disorders such as myocardial infarction and peripheral vascular and cerebrovascular diseases [27]. Co-morbid factors are also important, as several diseases can cause impotence regardless of the presence of stroke. A previous study carried out in Belgium by Mak et al. [28] reported that, apart from age, a number of additional risk factors for ED have been described, the most important ones being diabetes mellitus, hypertension, peripheral vascular disorder and cardiac problems. According to our data, diabetes, hypertension, and hypercholesterolemia were significantly higher in stroke patients with ED than in those without ED. The interesting finding from this study was that there was a significant association between the drugs taken for diabetes,

hypertension and cardiac problems, and ED. This leads to the finding that the real risk association was the underlying co-morbid conditions. A similar finding was documented [29], in that treatment with antihypertensive agents may cause or exacerbate existing erectile dysfunction. Some studies [30] point towards ACE inhibitors, in particular, as playing a causative role in ED.

In the study population, smoking and obesity were significantly associated with the prevalence of ED in stroke patients. A recent Italian study [31] of 2,010 men also suggested that cigarette smoking is a risk factor for ED. However, Mak et al. [28] failed to demonstrate such an association. The role of life style factors in the development of ED is controversially discussed in those studies.

Scores for all sexual activity domains were highly significant and indicated higher risk in the studied stroke patients with ED, and the mean IIEF score was significantly lower in stroke patients with ED than in those without ED. In Korea [32], a survey using the five-item version of the IIEF was conducted on male stroke patients. A similar result was reported in this study that statistically lower sexual function was found in the stroke patient group than in the unaffected control group ($P < 0.01$).

To the best of our knowledge, our study is one of the few to investigate ED in patients with stroke, using a well-validated erectile function questionnaire, all over the world [18–21] and the first in the Gulf Cooperation Council countries.

Conclusion

Our results have shown a greater prevalence of ED in stroke patients in the population of Qatar. The most important co-morbid factors for ED in stroke patients were diabetes, hypertension and hypercholesterolemia. Smoking and obesity were risk factors for ED and were significantly associated with the prevalence of ED. Counseling stroke survivors for sexual problems is a challenging experience, but it is necessity for improving their quality of life.

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