

Sexual function in male patients with obstructive sleep apnoea

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Abstract

Objective: Our objective was to investigate general and functional aspects of sexuality in male patients with a confirmed diagnosis of obstructive sleep apnoea (OSA) and compare the results with normative data.

Materials and Methods: We investigated 308 male patients (age 30–69) admitted to a sleep laboratory and receiving a diagnosis of OSA, using questions drawn from two self-administered questionnaires on sexuality [Fugl-Meyer Life satisfaction checklist (LiSat) and Brief Sexual Function Inventory (BSFI)].

Results: We found that both general (Fugl-Meyer LiSat) and functional (BSFI) aspects of sexuality were worse in patients with (untreated) OSA when compared with normative data. Both aspects were dependent on age, obesity, social factors and concomitant medication but not on the severity of OSA as reflected by the apnoea–hypopnoea index or subjective sleepiness.

Conclusion: We conclude that although sexual dysfunction is more prevalent in OSA patients than in the general population, it is a complex problem relating more to age, obesity, social factors and comorbidity than to the severity of OSA.

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Key words

male – obstructive sleep apnoea – questionnaire – sexuality

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Authorship

Marian Petersen initiated, designed and performed the study, collected and analysed the data and wrote the paper. Ellids Kristensen contributed to the design, analysed the data and wrote the paper. Søren Berg collected and co-analysed the data and wrote the paper. Bengt Midgren supervised the analysis of data and the writing of the paper.

Ethics

Informed consent was obtained, and the study was reviewed and approved by the Ethical Committee of Copenhagen.

Conflict of interest

Marian Petersen has received an unconditioned research grant from Maribo Medico.

Ellids Kristensen has no conflicts of interest. Søren Berg is one of the owners and managers of ScanSleep; otherwise he has no conflicts of interest.

Bengt Midgren has received payment from ResMed Sweden for lectures and consultant commitments.

Introduction

Obstructive sleep apnoea (OSA) is characterized by repetitive cessation of breathing during sleep due to upper airway collapse. When this is associated with daytime sleepiness it is termed obstructive sleep apnoea syndrome (OSAS). With regard to the effects of OSA on sexuality, different aspects have been investigated. Sexuality has been reported to be affected by decreased hormonal production (1), low sexual drive and satisfaction and decreased morning erection (2). These effects may lead to misconceptions by the patient with regard to his or her relationship and potentially lead to feelings of fault, blame and guilt, which may further negatively affect the relationship (3). Erectile dysfunction is estimated to be present in 30% of untreated OSAS patients (4). O'Leary *et al.* found that age is a main factor for erectile dysfunction in a normative sample of men, but that sexual desire is maintained in later years (5). Other studies have highlighted the correlation between high respiratory disturbance index and erectile dysfunction (2).

Most previous studies of the effects of OSA on sexuality in men have focused on erectile dysfunction. One of the few other studies in this area was reported by Hanak *et al.* (6). However, their study investigated only elderly snorers (51–90 years) and their risk for sexual dysfunction. We therefore designed this study to investigate general and functional aspects of sexuality in male patients with untreated OSA and to compare these findings with normative data. We have performed a similar study on females with OSA (to be published), and follow-up studies (for both sexes) after 1 year on continuous positive airway pressure (CPAP) treatment are ongoing.

Material and methods

Male patients with OSA were consecutively recruited from patients assessed in three sleep laboratories of one sleep clinic (ScanSleep) in Denmark from October 2005 to January 2008. The study comprised only patients more than 18 years old, able to read and write Danish and with a diagnosis of OSA [apnoea–hypopnoea index (AHI) >5] requiring treatment with CPAP. The material thus consisted only of patients where CPAP was considered as being the clinically relevant treatment of choice as judged by an experienced specialist. Approximately 90% of the eligible patients accepted to participate.

All patients were investigated for OSA using identical portable devices (EMBLETTA®, Embla, Broom-

field, CO, USA). The recording montage included nasal airflow using a nasal pressure catheter, respiratory movement with thoracic and abdominal bands (XactTrace, Embla, Broomfield, CO, USA), pulse oximetry and body position. Apnoeas were diagnosed as cessation of breathing more than 10 s. Hypopnoeas were diagnosed as reduction in airflow >40% associated with a desaturation of 4% or more. The number of apnoeas and hypopnoeas/hour (AHI) was calculated on estimated sleep time (as reported by the patient) as the denominator.

Data of self-reported daytime sleepiness were collected using the Epworth Sleepiness Scale (ESS). The ESS assesses the likelihood of the patient dozing off or falling asleep in eight daily situations using a score between 0 and 3. The maximum score is thus 24, with a score of 11 or more being taken to indicate significant levels of daytime sleepiness (7). ESS data were collected from only 192 patients because of a late change of procedures.

Data on sexual function were obtained using two self-administered questionnaires. One was the Fugl-Meyer Life satisfaction checklist (LiSat) (8), from which we selected four questions concerning general satisfaction with life: Life as a Whole and three domains of closeness (Sexual Life, Partner Relationship, Family Life). The referent population consisted of both sexes, but we used data on male only received from Fugl-Meyer (A. Fugl-Meyer, pers. comm.). Satisfaction was scored on a scale from 1 to 6, with higher scores indicating greater satisfaction. The other questionnaire was the Brief Sexual Function Inventory (BSFI) (9) in which the first 10 items cover functional aspects of male sexuality during the past 30 days: Sexual drive and level of sexual drive (two items), partial or full erection, capability to intercourse and difficulties in getting erection (three items), difficulty ejaculating and satisfaction with the amount of semen (two items) and problem assessment concerning sexual drive, erection and ejaculation (three items). The last item covers overall sexual satisfaction and consists of one question. The items were scored from 0 to 4, with higher scores indicating better function. The total score was calculated for the first 10 items. Item 11 (overall satisfaction) is not a functional question and was therefore analysed separately, and not included in the statistical analyses for total score.

Socio-demographic data on age, body mass index (BMI), marital status and education were collected for all individuals, and their current use of medication was recorded as a proxy for comorbidity. No control data on Fugl-Meyer LiSat or on BSFI has been reported for the Danish population. We therefore used normative

Table 1. Clinical and demographic characteristics of obstructive sleep apnoea male patients according to age

	Age 30–39 <i>n</i> = 43	Age 40–49 <i>n</i> = 99	Age 50–59 <i>n</i> = 98	Age 60–69 <i>n</i> = 68
BMI, mean (SD)	34.2 (4.5)	33.2 (7.4)	31.6 (6.0)	30.5 (4.7)
AHI, mean (SD)	46.5 (26.5)	41.4 (25.4)	35.6 (24.1)	39.0 (22.3)
ESS, mean (SD)	12.1 (3.7)	11.5 (3.9)	12.3 (4.1)	10.5 (3.9)
Having a partner, <i>N</i> (%)	36 (83.7)	80 (80.8)	84 (85.7)	59 (86.8)
Education ≥ 10 years, <i>N</i> (%)	27 (62.8)	60 (60.0)	53 (54.1)	27 (39.7)
Employed, <i>N</i> (%)	38 (88.4)	86 (86.9)	53 (54.1)	27 (39.7)
*Cardiovascular medication, <i>N</i> (%)	3 (7.1)	25 (26.0)	30 (32.3)	34 (50)
†Psychopharmaca, <i>N</i> (%)	3 (7.3)	12 (12.5)	7 (7.5)	11 (16.2)
Antidiabetics, <i>N</i> (%)	1 (2.4)	6 (6.3)	6 (6.5)	7 (10.3)

*Digoxin, antihypertensive, diuretics, beta blockers, calcium antagonists, ACE inhibitors.

†Anti-psychotics, anxiolytics, antidepressants.

BMI, body mass index (kg/m²); AHI, Apnoea Hypopnoea Index; ESS, Epworth Sleepiness Scale.

male data from Sweden and Norway since they are countries linguistically, culturally and sociologically closely related to Denmark. From Sweden, Fugl-Meyer LiSat-11 data were collected by questionnaires and face-to-face interviews, and participants were drawn from the Swedish Central Population Register (8) and from Norway (for BSFI) participants were recruited by using public address lists and sending questionnaires (9).

Statistical analysis was performed with SPSS (version 15.0 for Windows). Descriptive statistics [mean and standard deviation (SD)] were used to summarize the clinical and socio-demographic data. A power analysis with respect to the 6-point scale Fugl-Meyer LiSat showed that 80 patients would be sufficient to demonstrate with 95% certainty a difference between normals and patients of 0.5 points at the 0.05 one-side significance level, assuming that the patients had the same SD as the normal subjects. Regression analysis was performed for the Fugl-Meyer LiSat and BSFI, to assess the specific impact of BMI, AHI, ESS, being in a relationship, education, employment and medication. *T*-tests were used when comparing study data with reference subjects based on available data for *n* and SD. A significance level of $P \leq 0.05$ was used for all statistical analyses.

Results

Three hundred fifteen male patients aged 26–77 years (mean 50.6, SD 10.3) were included in the study. Because of the low number of OSA patients in age groups 20–29 years ($N = 5$) and 70–79 years ($N = 2$), these age groups were excluded from the analyses. The age distribution and other clinical data for the remaining 308 OSA patients are presented in Table 1. Mean

BMI was 31.5 (SD = 6.3) and AHI was 39.9 (SD = 24.2) for the selected age groups. The mean score for ESS was 11.5 (SD = 4.0). Socio-demographic data for OSA patients showed that 84% lived with a partner, 54% had 10 or more years of education and 77% were employed. Ninety-two (29.9%) patients received medication for cardiovascular reasons. Thirty-three (10.7%) received psychopharmaca and 20 (6.5%) were receiving treatment for diabetes. Data for age groups are given in Table 1.

Fugl-Meyer LiSat

Scores on Life as a Whole were significantly lower in all OSA patients than in the control group (Table 2). For Family Life, the groups of 40–49 and 50–59 years scored significantly lower than the control group. Regarding Partner Relationship, only the group of 50–59 scored lower than the control group, and for Sexual Life, the age groups 40–49, 50–59 and 60–69 scored significantly lower than controls. To assess the specific impact on OSA patients of BMI, AHI, ESS, having a relationship, education, employment and medication, a regression analysis was performed for each of the four items: Life as a Whole, Family Life, Partner Relationship and Sexual Life. Life as a Whole was significantly negatively associated with age ($P = 0.005$), with cardiovascular medication ($P = 0.012$) and with psychopharmaca ($P = 0.001$). No association with BMI, AHI, ESS, having a relationship, education, employment or diabetes was found. For Family Life, being in a relationship had a significant (positive) impact ($P = 0.021$) and for Partner Relationship, living with a partner was the only significant (positive) factor ($P = 0.042$). Sexual Life was significantly negatively affected by BMI

Table 2. Scores from Fugl-Meyer LiSat for obstructive sleep apnoea male patients and control group

	OSAS patients	Control group [†]	P value
Life as a Whole, mean (SD)			
Age 30–39	4.06 (1.47)	4.75 (0.98)	<0.001
Age 40–49	4.05 (1.29)	4.81 (0.82)	<0.001
Age 50–59	4.31 (1.28)	4.60 (1.09)	<0.05
Age 60–69	4.42 (1.14)	4.95 (0.82)	<0.001
Family life, mean (SD)			
Age 30–39	4.83 (1.03)	5.09 (0.96)	ns
Age 40–49	4.84 (1.01)	5.09 (0.99)	<0.05
Age 50–59	4.90 (1.11)	5.32 (0.89)	<0.001
Age 60–69	4.98 (1.16)	5.20 (0.98)	ns
Partner Relationship*, mean (SD)			
Age 30–39	4.86 (1.02)	5.00 (1.11)	ns
Age 40–49	5.00 (1.10)	5.05 (1.13)	ns
Age 50–59	4.89 (1.14)	5.28 (1.06)	<0.01
Age 60–69	5.19 (1.14)	5.22 (0.97)	ns
Sexual life, mean (SD)			
Age 30–39	3.94 (1.35)	4.31 (1.30)	ns
Age 40–49	4.01 (1.32)	4.60 (1.20)	<0.001
Age 50–59	3.47 (1.52)	5.28 (1.06)	<0.0005
Age 60–69	3.57 (1.56)	4.05 (1.43)	<0.05

Statistical analysis performed with *t*-test. Scale is from 1 to 6, with higher scores indicating greater satisfaction.

*Those with a partner.

[†]Normative Swedish sample of male (8).

($P = 0.032$), and positively affected by being in a relationship ($P = 0.032$). No other variables showed any significant association.

BSFI

The BSFI (Sexual Drive, Erection, Ejaculation, Sexual Problem Assessment, Total Score of the aforementioned, Overall Sexual Satisfaction) assessment showed that OSA patients generally scored worse than the control group of comparable age (age 30–69, $n = 1185$) (Fig. 1). To assess the specific impact on OSA patients of BMI, AHI, ESS, being in a relationship, education, employment and medication, a regression analysis was performed. A significant negative relationship was found between Sexual Drive and cardiovascular medication ($P = 0.015$). Erection showed a significant negative association with employment ($P = 0.038$) and age ($P = 0.001$). Ejaculation showed negative association with cardiovascular medication ($P = 0.016$), psychopharmaca ($P = 0.043$) and age ($P = 0.017$). Sexual Problem Assessment showed negative association with cardiovascular medication ($P = 0.012$), psychopharmaca ($P = 0.010$) and age ($P = 0.001$). Total Score was negatively asso-

ciated with cardiovascular medication ($P = 0.008$), psychopharmaca ($P = 0.010$) and age ($P = 0.001$). No significant associations were found for Overall Satisfaction.

Discussion

The present study is, to our knowledge, the first investigation of general sexual activity and functional sexual aspects in patients with a confirmed diagnosis of OSA compared with age-matched controls. Most other studies focus on (self-reported) erectile function, whereas the present study also deals with self-reported sexuality in a wider context. Our results show that male patients with OSA severe enough to make them candidates for CPAP treatment score worse than control groups not only on questions regarding health in general but also on questions regarding general and specific aspects of sexuality.

The strength of our study is that it is based on a series of patients with a verified diagnosis of OSA with an age ranging from 30 to 69, a group that we consider representative of the typical OSA patient seen in sleep clinics. These findings are not explained by the AHI, which is the most commonly used index of severity of OSA.

The socio-demographic data of our patients were compared with the Danish Health and Morbidity Survey (SUSY2000) based on a random sample of 8188 Danish male citizens aged 16 or older (10). More of our OSA patients (84%) lived with a partner versus SUSY 2000 (68%). The percentage of patients living with a partner (84%) may reflect a selection bias, because OSA patients living alone may go undetected. Other socio-economic aspects that might influence sexual life (income, social status) were not covered by our questionnaire. However, our results are based on a consecutive series of sleep apnoea patients from Denmark's largest sleep clinic. The public health care system of Denmark ensures that all patients are entitled to receive adequate investigations and treatment without any financial restrictions. We therefore believe that the socio-economic profile of our patients is likely to be representative of the Danish population as a whole. It is difficult to draw any firm conclusions concerning the true prevalence of comorbidities from the data concerning cardiovascular or psychopharmacological medication. However, it seems reasonable to assume that OSA patients who already have regular contacts with the health care system also have a shorter way to referral for OSA investigations, thereby creating a selection bias.

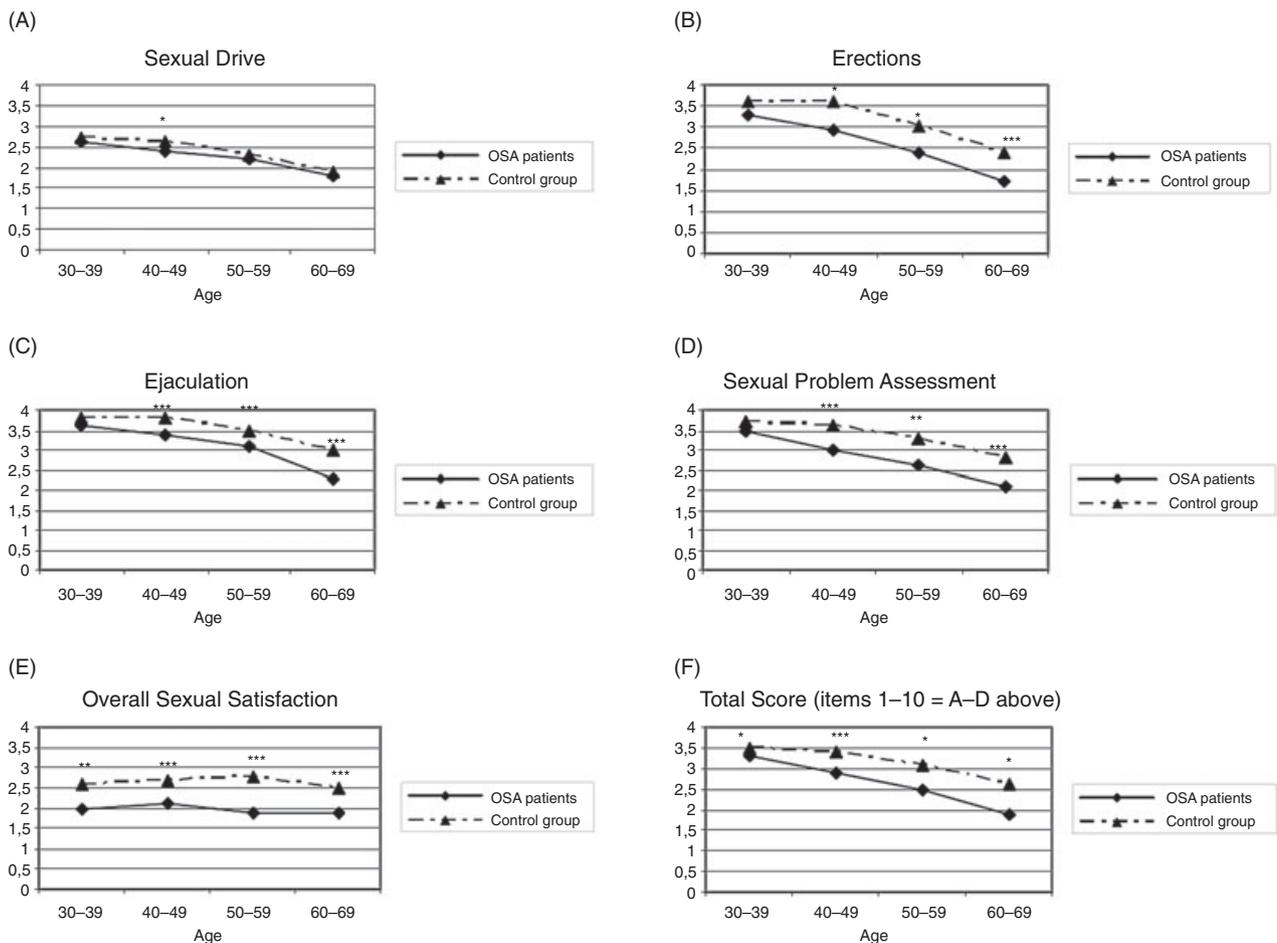


Figure 1. Age-related scores from the Brief Sexual Function Inventory for OSAS male patients: $n = 308$ and control group $n = 1185$. Statistical analysis performed with t -test. OSAS, obstructive sleep apnoea syndrome. Values are expressed as mean. Scored from 0 to 4, with higher scores indicating better function. * $P < 0.05$, ** $P < 0.005$, *** $P < 0.0005$.

Fugl-Meyer LiSat

OSA patients considered their Life as a Whole (Fugl-Meyer LiSat) to be worse than the control groups. This may be a consequence of disturbed sleep. It has been reported that disturbed sleep may have a negative effect on immune response and affect mood (11). When looking at specific sexual items, we found that sexual life was negatively associated with BMI. This finding corresponds with the results in Kolotkin *et al.*, who found that a higher BMI was associated with greater impairment in sexual quality of life (12). However, we found no relationship with AHI or ESS measures that are commonly used to assess the severity of sleep apnoea (syndrome).

BSFI

We found that age had a negative association with Sexual Drive, Erection, Ejaculation, Sexual Problem Assessment and Total Score on the BSFI. Only Overall Satisfaction (BSFI) showed no significant relationship with age. These findings are consistent with the results of O’Leary *et al.*, who found an age-related decrease in erectile function and sexual functioning using BSFI (5). Chung *et al.* conclude that obesity in itself does not seem to be an underlying factor for erectile dysfunction, but does increase the risk of vasculogenic impotence through the development of chronic vascular diseases of diabetes, hypertension, heart diseases and hyperlipidaemia (13). Although we could not demonstrate any association with diabetes, our results con-

cerning BMI and cardiovascular medication support the conclusion by Chung *et al.* (13). In addition, and to our knowledge, this had not been investigated in OSA patients before; psychopharmacology also has a negative association with Ejaculation, Sexual Problem Assessment and Total Score.

A separate analysis only for those patients not on medication (thus eliminating a powerful confounding factor) was performed. This analysis also failed to reveal any effect of AHI or ESS on any of the outcome variables. Categorization of AHI with a cut-off of 30 gave essentially similar results to treating AHI as a continuous variable, i.e. no effect. Our findings are at variance with the results of Margel *et al.*, who found a relationship between severity of OSA and the degree of erectile dysfunction (2). An explanation may be that our recruitment process included only those patients who were scheduled for CPAP treatment. Some of these patients were, after physicians' evaluation, prescribed CPAP because of significant symptoms of OSA, even though they had only a moderate or even low AHI. These patients were therefore likely to have more symptoms or comorbidities, which might affect the outcome on sexual questionnaires.

Nevertheless, these data point to the fact that a simple quantitative relationship between AHI and sexual dysfunction (lack of well-being, decreased general well-being, sexual problem) is an oversimplification. Sexual dysfunction in OSA is a complex problem; for example, obesity and comorbidity may interact through hormonal, vascular or psychoneurological mechanisms.

Conclusion

The important finding in this study is that although OSA *per se* seems to be associated with an impairment in most aspects of male sexuality, not only erectile dysfunction, the degree of sexual problems was not quantitatively related with AHI but rather with age and comorbidity and, to some extent, with obesity and social factors.

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