ORIGINAL RESEARCH

Urooncology

Prevalence of Poor Sleep Quality and Its Determinants Among Men Suffering from Erectile Dysfunction

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What's known on the subject? and What does the study add?

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Abstract

Objective: Recent findings implicate a higher prevalence of erectile dysfunction (ED) among men with sleep disorders. We investigated sleep quality among men with ED and reveal possible interrelations in a reverse manner.

Materials and Methods: A prospective study was conducted at 12 different andrology outpatient clinics among men with complaints of insufficient erections. The subjective quality of sleep was measured using the Pittsburgh Sleep Quality Inventory. Erectile function and its dimensions were measured using the International Index of Erectile Function (IIEF) questionnaire. The age-adjusted Charlson comorbidity index and Beck Depression Inventory were used to evaluate interrelations with comorbid disease severity and depression of the subjects consecutively in the study.

Results: Among 431 eligible men, the median age of the participants and their erectile function scores in the IIEF were 51 [interquartile range (IQR)=43-59] and 16 (IQR=11-19), respectively. Poor sleep was observed in 192 of 431 (44.5%) subjects. Multivariable analysis revealed that younger age [odds ratio (OR)=0.95, p=0.01], lower body mass (OR=0.86, p=0.01), lower serum high-density lipoprotein cholesterol (OR=0.95, p=0.02), and higher severity of depression (OR=2.1, p=0.0001) were predictors of poor sleep quality among men with ED.

Conclusion: Nearly half of the men with ED also suffer from poor sleep. Younger age, lean body mass, and severe depression were the main predictors of poor sleep quality among ED sufferers.

Keywords: Erectile dysfunction, sexual satisfaction, sleep quality

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Introduction

As an important pillar of good health, such as diet and exercise, sleep quality is hypothesized to be closely related to erectile function (1). Recent data obtained from large population-based surveys reveal the prevalence of poor sleep quality about 8.3% which is also associated with advanced age, female gender, smoking, the presence of cardiovascular diseases, respiratory diseases, anxiety, and depression (2-5). Sleep disorders and their association with erectile dysfunction (ED) are increasing topics of interest in recent studies (1,6-13). Data obtained from several studies with few human subjects who suffered from sleep dysfunction demonstrated that ED is frequent among men with sleep disorders (6-13). Furthermore, recent longitudinal studies have emphasized increased odds of ED in the future life of men with current sleep disturbances (3). In this manner, several conditions were proved to be associated with sleep dysfunction such as higher body mass index, advanced age, comorbid diseases such as diabetes, depression and, anxiety among men accompanied with erectile dysfunction (1,6-13).

Although, there are several studies indicating the higher prevalence of ED or worse outcomes by the means of erectile function among men who have sleep dysfunction, reverse association still needs to be clarified. In other words, "How much attention should be given to sleep quality in men complaining of ED?". Does the quality of sleep correlate with erectile function in patients with ED? Furthermore, determinants of the sleep quality among men complaining of erectile dysfunction are awaiting validation.

In this study, investigation of subjective sleep quality, the prevalence of poor sleeping, and the role of associated factors like body mass index, age, and comorbid diseases among men who were admitted with ED complaints to andrology clinics were aimed.

Materials and Methods

Subjects

We conducted a cross-sectional study among men who were admitted to andrology outpatient clinics with complaints of ED. Patients who had a stable heterosexual relationship in the last six months and who gave informed consent to participate in this questionnaire-based study were eligible. Subjects who had proven neurological disease or used psychotropic medications (antidepressants, sedatives, anxiolytics, and so on) were excluded from the study. The study design was approved by ethical review board of the Niğde Ömer Halisdemir University (no: 2019/33) and permission of the provincial health management office (2019-11/02). The study was conducted between November 2019 and November 2020 following institutional review board recommendations from 12 different training hospitals. Informed consent was obtained from all participants, and survey administration was conducted face-to-face by researchers in all participating centers.

Outcome Measures

Erectile function severity was measured by the International Index of Erectile Function (IIEF) and degree of sleep quality was measured using the Pittsburgh Sleep Quality Inventory (PSQI). The presence and degree of depression measured by the Beck Depression Inventory (BDI) were the main outcome measures of the current study. Validated versions of the three questionnaires were used (14-16).

Data Management

Demographic characteristics, BMI and waist circumference measurements, summary of the age-adjusted Charlson comorbidity index (AACCI) ratings, and serum measurements of fasting blood glucose (FBG), cholesterol total, LDL cholesterol, HDL cholesterol, triglycerides, and serum testosterone levels (as nanogram per dL) obtained from routine baseline initial evaluations were recorded (17). All recorded data were submitted by each participating author to a web-based data management program. The presence of ED was attributed to the subjects' ratings in the erectile function domain of the IIEF (below 21 points indicated ED). Scores in the BDI were interpreted as follows: 0-9, minimal level; 10-16, mild level; 17-29, moderate level; and 30-63, severe level of depression. The PSQI consists of 19 items (15 rated 0-3 and 4 open ended) that generate seven components of sleep as follows: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of medications for sleep, and daytime disturbance (14). The global PSQI score is calculated by the sum of all of the above components (14). We used the original version of this questionnaire, with 5 points or greater used as the global score cut-off for which to define poor sleep quality (14,18).

Statistical Analysis

We anticipated to enroll at least 270 subjects in the study due on the sample size estimation summary obtained from a G*Power analysis with a power value of 80% and an alpha error probability of 5.0%. The latest version of PASW (IBM, Armonk, NY, USA) was used for statistical analysis. A reliability analysis of the PSQI scores of our cohort was performed. We used the chi-square test and non-parametric tests. Binomial logistic regression for dichotomous outcomes and stepwise hierarchical linear regression for the measured variables. P-values of .05 or lower were considered significant, while p-values of .01 indicated strong correlations in the correlation analysis.

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Results

Among the 431 eligible subjects, the median age was 51 [interquartile range (IQR)=43-59]. The demographic characteristics of the subjects are depicted in Table 1. During the initial physical examination, palpable Peyronie's plaque and benign scrotal pathologies were noted in 5 (1.0%) and 8 (1.8%) patients, respectively. Sixty-two (14.6%) patients had taken a previous medication for ED in the last 6 months, which included tadalafil, sildenafil, and intra-cavernous injection therapy (10.7%, 3.0%, and 0.5%, respectively).

Among participants, the mean IIEF erectile function score was 14.3±6.5. The distribution of subjects according to categories of erectile function in IIEF was as follows: 108 (26%) with severe ED, 142 (33%) with moderate ED, 139 (32%) with mild-to-moderate ED, 34 (7.0%) with mild ED, and no ED in 8 (2.0%). The mean BDI score of the subjects was 13.9±8.1. We noticed a moderate to severe degree of depression in 147 (34%) subjects in our cohort. The distribution of the depression categories was as follows: 32%, minimal; 34%, mild; 30%, moderate; and 4.0%, severe. The mean global PSQI score in our cohort was 4.7±2.9. Reliability analysis among the seven components of the PSQI questionnaire revealed a high level of consistency (Cronbach's alpha=0.66). We observed that 192 of 431 (44.5%) responders in our cohort were poor sleepers. The distribution of variables between the good and poor sleepers is shown in Table 2.

Table 1. Demographic characteristics of the participants						
Age	<40	40–49	50–59	60–69	>70	
	13%	30%	34%	18%	5%	
Graduation	Primary School	High School	University	Master, PhD etc.		
	28%	43%	28%	1%		
Count of children	0	1	2	3	4	>5
	10%	13%	34%	%24	9%	10%
Smoking status	No	Yes				
	56%	44%				
Alcohol consumption	No	Yes				
	88%	12%				
AACCI	0	1	2	3	4	>5
	33%	27%	20%	10%	6%	4%
Main co-morbid diseases	DM	CAD	PVD	COPD	CTD	Peptic Ulcer
	25%	8%	3%	3%	2%	1%

Table 2. Differences between good and poor sleepers			
	Good sleepers n=233	Poor sleepers n=192	p-value
Age	52.9±11.6	48.6±10.8	0.0001
BMI (kg/m²)	28.3±3.9	27,5±4.0	0.04
WC (cm)	92.4±11.3	94.4±13.9	0.18
AACCI score	1.5±1.6	1.3±1.5	0.10
FBG level	117.7±57.3	118.6±63.7	0.87
Total-Cholesterol level	199.2±42.3	195.6±48.1	0.42
LDL-C level	127.4±82.5	118.7±48.2	0.22
HDL-C level	47.6±15.1	44.2±12.7	0.01
Triglycerides	165.1±99.4	193.4±147.4	0.02
Serum Testosterone level (ng/dL)	301.0±224.5	307.2±233.4	0.78
Erectile function (IIEF)	15.3±6.1	13.1±6.7	0.001
Orgasmic function (IIEF)	5.4±2.7	5.3±3.1	0.59
Sexual desire (IIEF)	5.6±1.9	5.5±2.1	0.70
Sexual satisfaction (IIEF)	6.5±3.2	5.8±3.4	0.02
Overall satisfaction (IIEF)	5.0±2.0	4.5±2.0	0.01
Depression score (BDI)	11.2±6.2	17.1±8.8	0.0001

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Correlation Analysis

We noticed correlations between the EF scores of the subjects and their AACCI scores (Spearman's Rho=-0.20), FBG (Spearman's Rho=-0.15), BDI scores (Spearman's Rho=-0.19), and PSQI scores (Spearman's Rho=-0.14). The means of the sexual satisfaction IIEF domain and the overall satisfaction scores of our cohort were correlated with the global PSQI scores (Spearman's Rho=-0.11 and Spearman's Rho=-0.11). Additionally, the global PSQI scores of the patients were correlated with their BDI scores (Spearman's Rho=0.42), age (Spearman's Rho=-0.17), degree of graduation (Spearman's Rho=0.19), consumption of alcohol (Spearman's Rho=0.20), and serum HDL levels (Spearman's Rho=-0.14). Finally, the BDI scores of the patients were correlated with age (Spearman's Rho=-0.13). We noticed a higher estimate of coincidence between the presence of poor sleep quality (global PSQI score ≥5) and moderate to severe depression (according to their BDI scores) in our cohort [odds ratio (OR)=3.4 (95% confidence interval (CI) 2.2-5.3), p=0.0001].

Multivariable analysis: In our multinomial logistic regression analysis, the BMI of the subjects significantly predicted the presence of ED (OR=1.2, p=0.03). Poor sleep quality was predicted by age (OR=0.95, p=0.01), waist circumference (OR=1.04, p=0.03), BMI (OR=0.86, p=0.01), serum HDL level (OR=0.95, p=0.02), BDI (OR=2.1, p=0.0001), and IIEF score (OR=0.89, p=0.03). The level of serum testosterone (OR=1.002, p=0.01) and global PSQI score (OR=1.45, p=0.0001) of the enrolled subjects were predictors for the presence of depression.

Finally, a path analysis using hierarchical linear regression was applied. Our results with path analysis using the erectile function score of the subjects as the dependent outcome variable, are depicted in Figure 1. Our model demonstrates that the erectile function of subjects is predicted by a score of comorbidity index and depression level, while sleep quality and depression level of the subjects are in relation with bidirectional way.

Discussion

We evaluated the prevalence and contribution of poor sleep quality in men with ED in a hospital setting. Poor sleep according to questionnaire-based evaluations has been observed in nearly half of the men having ED. Poor sleepers were younger, had lower BMI values, had more severe ED and had poor satisfaction with intercourse and more depression compared with men who had good sleep quality. However, erectile function predicted by sleep quality in the unadjusted model along with depression levels and BMI values of the ED sufferers were the predictors of sleep quality in our final model.

Subjective sleep quality in the current study was measured using a self-reported questionnaire (PSQI), which is accepted as the

most useful tool in both clinical and non-clinical settings (18). The results of the internal consistency level of the questionnaire were in accordance with the previously reported results and support the higher internal reliability of the questionnaire components (18-20). The prevalence of poor sleep quality among our study subjects was higher than that reported in the general population (2-5,21-23). The mean global score of our study subjects was also higher than that previously reported in the general population of Shanghai (5). The prevalence of sleep quality measured by the same tool among ED sufferers has been evaluated previously in a Chinese study, and they found slightly higher prevalence rates (24). We noticed that in our study, the cut-off level to define poor sleep quality in the PSQI was lower and the mean age of the participating ED sufferers was higher than that in the Chinese study, which might have contributed to the difference. Furthermore, previous surveys demonstrated a higher prevalence of ED among sleep disorders, and a higher incidence of ED in longitudinal studies among patients with poor sleep quality (2-7,13,25-27). Our study results contribute to the literature by describing the presence of a reverse association.

Our study clarifies that sleep quality is predicted by erectile function, and poor sleep quality is related to lower BMI, lower serum HDL level, younger age, higher WC, and severe depression. The adjusted hierarchical model in our study emphasizes the severity of depression and lean body mass among men with ED as the main predictors of sleep quality. Previous surveys conducted in the general population have demonstrated that sleep disturbance is predicted by older age, smoking, lower educational level, more comorbid diseases, higher anxiety,
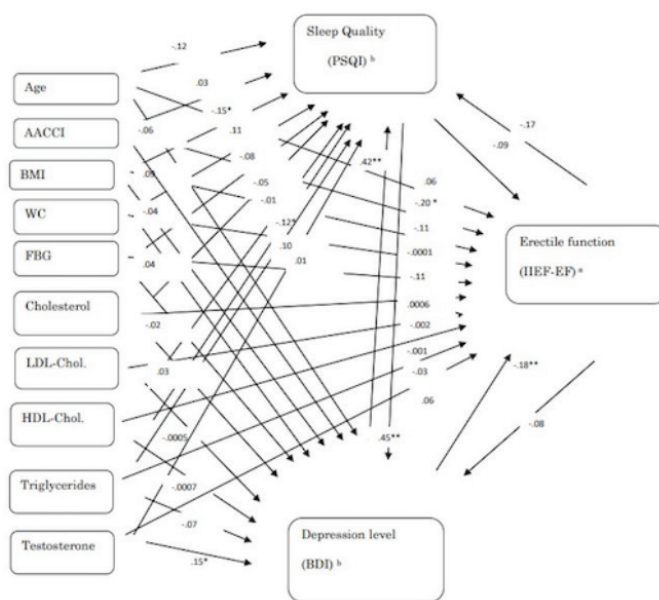
Figure 1. Results of path analysis

*p-value of <0.05, **p-value <0.01, ªHigher score indicates better outcome, ᵇHigher score indicates worse outcome

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and depression (2,4,5). Cross-sectional studies investigating interactions between erectile functions and sleep disorders revealed an association between sleep disturbances and ED, perceived stress, and depression (2,7,26,28). To understand the type of interrelation, our study revealed consistent findings with the study by Seehuus et al. that concluded an association between sleep disturbance and ED (3). We found a depression-dependent relationship between sleep quality and erectile function, which was independent of a previous survey. In a previous study, Seehuus and Pigeon (3) demonstrated a relationship between erectile function and insomnia severity, rather than sleep quality. In this regard, we conclude that the tools used to evaluate sleep disturbance (sleep quality *vs.* insomnia severity) and the differences in the populations studied may play roles in this issue.

Our study findings regarding the correlation between ED and age were concordant with those of Cheng et al.'s (24) study; however, our findings were in contrast to the findings of Martin et al. (27). In the study by Martin et al. (27), the independent interrelation of sleep disturbance with erectile function was demonstrated only in older men (ages >65 years old) (27). However, in the latter study, obstructive sleep problems were evaluated methodologically, which is different from our study (27). Our findings support a depression-dependent relationship between ED and subjective sleep quality in relatively younger patients. In this context, we conclude that the knot untier of this complex interrelation appears to be age. Age-dependent mediators, such as depression, exist in younger populations with poor sleep quality, as well as endothelial risk factors that manifest as obstructive sleep problems and insomnia in relatively older men with ED.

In our study subjects, ED predicted only the BMI of men in the multivariate model. The quality of erectile function was hierarchically related to sleep quality, depression, and the quantity of comorbid diseases after regression analysis. Current knowledge in the literature about the possible role of sleep disorders in the etiopathogenesis of ED is limited. A clinical study performed in a small population demonstrated lower serum melatonin levels in patients with ED than in those without non-ED patients, as well as an association with ED severity (29). The preventive role of melatonin on the morphological changes in erectile tissue induced by diabetes and chronic ischemia has also been clarified in a few preclinical studies (30,31). There are also clinical studies reporting improvements in erectile function with the treatment of accompanying obstructive sleep disorders alone (9-12,32). With the current findings, we are still far from making a precise conclusion. However, our study clarifies that comorbid diseases and accompanying depression should be considered when considering sleep disorders as a risk factors for ED.

Study Limitations

Ongoing concerns about the use of the PSQI as a diagnostic tool to differentiate between good and poor sleepers and the lack of objective sleep measurements via methods such as polysomnography are limitations of the current study. The lack of health- and sex-related quality of life measurements in our study subjects is another limitation. The recruitment period of the study overlapped with the first wave of the COVID-19 pandemic. As we had already established our study protocol prospectively, we had not performed any of the COVID-19 tests. However, subjects the study had no proven COVID-19 infection while they could admit us for their erectile difficulty. However, we cannot ignore either the effects of asymptomatic COVID-19 infection or the acute traumatic effects of a pandemic on the psychological health of the study subjects, which might be rendered as a limitation theoretically.

Conclusion

We revealed the frequency of poor sleep and determinants of sleep quality among patients with ED. A considerable number of subjects were poor sleepers within the representative sample of men with ED. The quality of sleep correlated with erectile function among patients with ED. Poor sleep quality was more frequent in younger men, and lean body mass among ED sufferers, and was associated with worse satisfaction, erectile function, and depression. Depression is central to the interrelation between sleep dysfunction and erectile dysfunction. Longitudinal and multidisciplinary studies are required on this topic.

Ethics

Ethics Committee Approval: The study design was approved by ethical review board of the Niğde Ömer Halisdemir University (no: 2019/33) and permission of the provincial health management office (2019-11/02).

Informed Consent: Informed consent was obtained from all participants.

Peer Review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.C., Concept: A.C., İ.O.K., K.E.A., Design: A.C., İ.O.K., K.E.A., Data Collection or Processing: A.C., İ.O.K., M.B.D., Ö.Y., A.B., Ü.G., E.H., Y.K., T.T., H.İ.Ç., B.Ş., Analysis or Interpretation: A.C., B.Ş., Literature Search: A.C., Writing: A.C.

Conflict of Interest: No conflict of interest was declared by the authors.

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