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The impact of obstructive sleep apnea syndrome severity on physical performance and mental health. The use of SF-36 questionnaire in sleep apnea

K. KARKOULIAS, D. LYKOURAS*, F. SAMPSONAS*, K. KARAIVAZOGLOU[1], M. SARGIANOU, P. DRAKATOS, K. SPIROPOULOS, K. ASSIMAKOPOULOS[1]

Department of Pulmonology and [1]Department of Psychiatry, University Hospital of Patras, Rio, Patras, Greece

Abstract. – OBJECTIVES: Obstructive sleep apnea syndrome (OSAS) is a common disorder defined by repeated episodes of airflow cessation (apneas)leading to arterial hypoxemia and sleep disruption. OSAS has been associated with increased morbidity, mortality and diminished quality of life so far. This cross-sectional study aimed to assess the impact of OSAS on patients' Quality of Life, as measured by the Medical Outcomes Study Short Form-36 (SF-36).

PATIENTS AND METHODS: Two hundred and forty five subjects referred to the sleep laboratory and underwent full polysomnography overnight. Prior to sleep study onset, we registered height and weight, medical history, smoking habit, drug consumption. Afterwards, each patient completed the SF-36.

Eighty subjects not diagnosed with sleep apnea [apnea hypopnea index (AHI < 5)] were excluded. Therefore, 165 subjects (121 male and 44 female) remained.

RESULTS AND CONCLUSIONS: Statistical analysis revealed that in patients with respiratory disturbance index (RDI) ≥ 15, (n = 115), RDI was independently associated with lower performance in role limitations due to physical problems ($p = 0.005$). Additionally, RDI was the only factor associated with decreased vitality ($p = 0.014$) and mental health scores ($p = 0.047$). In the same patient subgroup, body mass index (BMI) and age were associated with poorer scores in physical functioning ($p < 0.001$ and $p = 0.003$, respectively). BMI was an independent clinical predictor of worse scores in bodily pain ($p = 0.006$) general health ($p = 0.006$), social functioning ($p = 0.025$) and role limitations due to emotional problems ($p = 0.004$).

Keywords:

OSAS, Quality of Life, SF-36, RDI, SpO_2.

Abbreviations

OSAS: Obstructive sleep apnea syndrome
AHI: Apnea hypopnea index
HRQOL: Health-related quality of life
QOL: Quality of life
SF-36: Medical outcomes study short form-36
BMI: Body mass index
RDI: Respiratory disturbance index

Introduction

Obstructive sleep apnea syndrome (OSAS) is a common disorder defined by the occurrence of repeated episodes of upper airway obstruction and airflow cessation (apneas) that normally lead to arterial hypoxemia and sleep disruption[1].

Clinical presentation of OSAS includes snoring, breathing pauses observed by the patient's bed partner, and daytime sleepiness, resulting in poor sleep quality. Patients usually present with excessive daytime sleepiness and tiredness, lack of concentration, memory impairment and frequently psychological disturbances. Furthermore, OSAS has been associated with many medical problems such as cardiovascular diseases and may co-exist with chronic obstructive pulmonary disease (COPD)[2,3]. Consequently, OSAS has been associated with workplace problems and motor vehicle accidents, resulting in diminished quality of life (QOL) and increased morbidity and mortality.

So far, many different tools have been utilized to measure quality of life in patients with OSAS. Four primary domains have been related to health-related quality of life (HRQOL) measure-

*Equally contributed Authors

Corresponding Author: Kostas Spiropoulos, MD; e-mail: spircos@upatras.gr

ment: physical and occupational function, psychological function, social interaction, and somatic sensation[4]. One of the most frequently used clinical questionnaires to assess HRQOL is the Medical Outcome Study's Short Form survey (SF-36)[5].

To date, little evidence is available regarding the influence of OSAS on the quality of life. Thus, in this cross-sectional study, we attempted to assess the impact of OSAS on the patient's quality of life, as evaluated by the SF-36 questionnaire.

Patients and Methods

Patients

This cross-sectional study consisted of 165 subjects (121 male, 44 female) out of the 245 originally referred for full polysomnography to the sleep laboratory of Patras University Hospital due to complaints ofsleep-related symptoms. Figure 1 illustrates the procedure of our study protocol.

Study protocol

Prior to the onset of sleep study, we registered data for each subject individually including height and weight in order to calculate body mass index (BMI), medical history, marital status, smoking habits, coffee and alcohol consumption, prescribed or over-the-counter drugs. Moreover, each patient completed a previously validated health questionnaire, the Medical Outcomes Study Short Form-36 (SF-36) with the aid of an experienced clinician.

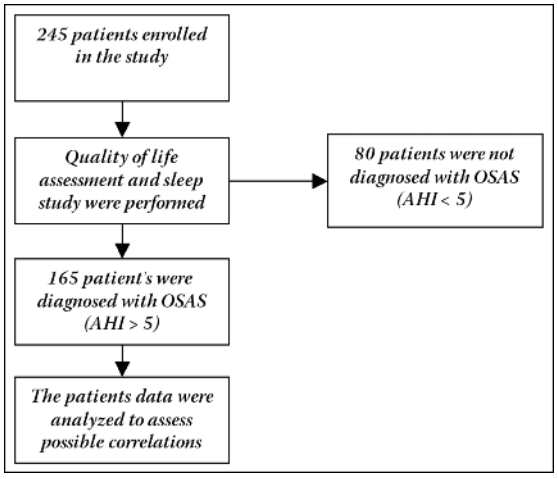

Figure 1. Study protocol procedure.

Quality of life assessment

HRQOL was assessed using the Short Form 36 Health Survey (SF-36), which is a self-reported, generic measure of HRQOL including eight multi-item scales (36 items) that evaluate the extent to which an individual's health limits his or her physical, emotional, and social well-being[6]. The SF-36 covers eight areas of HRQOL, namely physical functioning, role limitations due to physical problems, bodily pain, general health perception, vitality, social functioning, role limitations due to emotional problems, and mental health. Scores on each subscale range from 0 to 100, with higher scores indicating a better HRQOL. A Greek version of the SF-36 has been validated, and population-based normative data are now available[7].

Sleep study

Polysomnography was performed between 9:00 pm and 7:00 am. The sleep state was recorded with two channels of electroencephalogram (C3/A2 or C4/A1, O2/A1 or O1/A2), two channels of electrooculogram, and one channel of submental electromyogram. Breathing was assessed by monitoring chest wall and abdominal movements, and nasal and oral flows were monitored using thermisters. Arterial oxygen saturation was measured using an integrated pulse oximeter. Leg movements were monitored with two channels of electromyogram, and the ECG was recorded continuously. Sleep recordings were scored in 30-sec epochs and staged according to standard criteria[8]. Calculated variables included the respiratory disturbance index (RDI), and the degree of arterial oxygen desaturations.

Statistical analysis

Eighty subjects that were not diagnosed with OSAS (AHI < 5) were excluded from statistical analysis, although they presented with sleep-related symptoms. Data were analyzed using SPSS for Windows version 17.0, (SPSS Inc., Chicago, IL, USA). Descriptive statistics were generated for all variables. Multiple correlations of clinically significant variables were evaluated with logistic regression analysis. Spearman correlation coefficients were calculated for possible relations among continuous measures. All tests were two-tailed and statistical significance was set at $p < 0.05$.

Results

A hundred and sixty-five patients (121 male and 44 female) were included in this study. The

Table I. Demographic and clinical characteristics of the subjects.

Characterictics	
All patients (No, %)	165 (100%)
Age, years (mean, SD)	55.45 (13.9)
Sex (No, %)	
Male	121 (73.3%)
Female	44 (26.7%)
Marital status (No, %)	
Single	24 (14.5%)
Married	132 (80.1%)
Divorced	6 (3.6%)
Smoking, pack years (mean, SD)	19.5 (25.3)
Coffee consumption (No, %)	
None	34 (20.6%)
1-2 cups/day	94 (57.0%)
>2 cups/day	37 (22.4%)
Body Mass Index, BMI (mean, SD)	32.9 (6.8)
Average SpO_2 Desaturation (mean, SD)	6.1 (4.8)
AHI (mean, SD)	27.8 (21.5)

average age of the patients was 55.45 years old (SD = 13.9) and average BMI was 32.9 (6.8) kg/vm^2. The majority of patients were married males with a significant tobacco and coffee consumption history. The patients were also obese (BMI > 30), with a noteworthy average oxygen desaturation during sleep (6.1%) and increased AHI (27.8) The detailed demographic data of the study group are shown in Table I.

The scores of the SF-36 test are separated into 8 categories (physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems and mental health). The majority of patients exhibited diminished performance (below the average Greek population scores) in physical functioning (69.9% of subjects), bodily pain (62.1%), general health (76.7%), vitality (78.6%), social functioning (55.3%) and mental health (84.5%). The raw scores as well as the Norm-based scores for the age matched group are presented in Table II.

Subgroup analysis using multivariate logistic regression (variables included in the analysis were age, gender, marital status, comorbidities, BMI, smoking and coffee consumption history, average SpO_2 desaturation and RDI) revealed that an RDI ≥ 15, was independently associated with lower performance in role limitations due to physical problems (our statistic results are thoroughly presented in Table III). Additionally, RDI was the only factor associated with diminished vitality and mental health scores, as shown in Table III. In the same patient subgroup, BMI and

Table II. Quality of Life (QOL) raw and norm-based scores and percentage of patients scoring below norm-based average.

SF-36 subscales	Raw scores Mean (SD)	Norm-based scores Mean (SD)	Percentage (%) of patients scoring below average
Physical functioning	64.6 (26.8)	43.7 (10.5)	69.9
Role limitations due to physical problems	69.4 (42.1)	47.3 (11.2)	38.8
Bodily pain	59.9 (29.0)	45.9 (9.2)	62.1
General health	50.6 (21.8)	42.8 (9.3)	76.7
Vitality	51.1 (17.9)	43.1 (8.0)	78.6
Social functioning	70.0 (26.9)	45.7 (9.6)	55.3
Role limitations due to emotional problems	65.1 (43.6)	45.5 (12.0)	42.7
Mental health	54.6 (16.8)	43.6 (7.9)	84.5

Table III. Aspects of Quality of Life compared for RDI, BMI, Average SpO_2 desaturation and Age.

Statistically important clinical parameters	RDI* p value, OR (95%CI)	BMI** p value, OR (95%CI)	Average SpO_2 desaturation p value, OR (95%CI)	Age p value, OR (95%CI)
SF-36 subscales				
Physical functioning	$p = 0.10$ OR = -0.18 95% CI = -039-0.35	$p < 0.001$# OR = -2.2 95% CI = -2.8-1.6	$p = 0.81$ OR = -0.90 95% CI = -0.65-0.83	$p = 0.003$# OR = -0.56 95% CI = -0.93-0.2
Role limitations due to physical problems	$p = 0.005$# OR = -0.89, 95% CI = -1.5-0.23	$p = 0.02$# OR = -1.42 95% CI = -2.63-0.21	$p = 0.23$ OR = 0.94 95% CI = -0.59-2.5	$p = 0.88$ OR = -0.58 95% CI = -0.81-0.7
Bodily pain	$p = 0.33$ OR = -1.18 95% CI = -2.0-0.34	$p = 0.006$ OR = -1.18 95% CI = -2.-0.34	$p = 0.27$ OR = 0.6, 95% CI = -2.63-0.21	$p = 0.5$ OR = -0.18 95% CI = -0.7-0.34
General health	$p = 0.86$ OR = -0.2 95% CI = -0.26-0.22	$p = 0.006$# OR = -0.93, 95% CI = -1.58-0.27	$p = 0.27$ OR = 0.47, 95% CI = -0.36-1.3	$p = 0.47$ OR = -0.14 95% CI = -0.56-0.26
Vitality	$p = 0.014$# OR = -0.27 95% CI = -0.47-0.06	$p = 0.19$ OR = -0.38, 95% CI = -0.96-0.20	$p = 0.77$ OR = -0.28, 95% CI = -0.45-1.2	$p = 0.51$ OR = -0.12, 95% CI = -0.24-0.48
Social functioning	$p = 0.25$ OR = 0.17 95% CI = -0.13-0.48	$p = 0.025$# OR = -0.97 95% CI = -1.82-0.12	$p = 0.89$ OR = 0.07 95% CI = -0.99-0.15	$p = 0.71$ OR = -0.10 95% CI = -0.63-0.43
Role limitations due to emotional problems	$p = 0.35$ OR = -0.22 95% CI = -0.66-0.23	$p = 0.004$# OR = -1.84 95% CI = -3.09-0.6	$p = 0.88$, OR = -0.11, 95% CI = -1.6-1.46	$p = 0.07$ OR = -0.72 95% CI = -1.5-0.05
Mental health	$p = 0.047$# OR = -0.20 95% CI = -0.41-0.01	$p = 0.9$ OR = 0.06 95% CI = -0.93-0.17	$p = 0.52$ OR = 0.65 95% CI = -1.38-2.7	$P = 0.37$ OR = -0.34 95% CI = -1.1-0.41

Subgroup analysis using multivariate logistic regression (variables included in the analysis were age, gender, marital status, comorbidities, BMI, smoking and coffee consumption history, average SpO_2 desaturation and RDI) revealed that in patients with RDI ≥15, (n = 115), RDI was independently associated with lower performance in role limitations due to physical problems ($p = 0.005$, OR = -0.886, 95% CI = -1.5-0.227). Additionally, RDI was the only factor that was associated with lower vitality ($p = 0.014$, OR =- 0.265, 95% CI = -0.474-0.055) and mental health scores ($p = 0.047$, OR =-0.203, 95% CI = -0.412-0.006). In the same patient subgroup, BMI and age were associated with poorer scores in physical functioning ($p < 0.001$, OR =-2.2. 95% CI =-2.8-1.6 and $p = 0.003$, OR = -0.561, 95% CI = -0.928-0.195, respectively). BMI was an independent clinical predictor of worse scores in bodily pain ($p = 0.006$, OR = -1.179, 95% CI =-2.017-0.341), general health (p = 0.006, OR = -0.925, 95% CI =-1.581-0.268), social functioning (p = 0.025, OR= -0.969, 95% CI = -1.816-0.122), role limitations due to emotional problems ($p = 0.004$, OR = -1.844, 95% CI = -3.09-0.599) and role limitations due to physical problems ($p = 0.02$, OR= -1.42, 95% CI = -2.63-0.21)

RDI*: Respiratory Disturbance Index, BMI**: Body Mass Index, #= Statistically Significant

age were associated with poorer scores in physical functioning. Also in this subgroup, BMI was an independent clinical predictor of worse scores in bodily pain, general health, social functioning and role limitations due to emotional problems.

Discussion

The effects of OSAS on the quality of life (QOL) have already been reported in the literature[9]. Excessive daytime sleepiness and altered

circadian rhythms may negatively affect the ability to learn, to work, and to function socially; thus, QOL is directly worsened. The aim of this study was to evaluate the impact of the severity of OSAS on QOL[10].

Although quality of life has been recognized as an important parameter in OSAS patient evaluation, an association between AHIor oxygen desaturation and most of the quality of life measures has not been achieved yet. The AHI and the average SpO_2 desaturation were selected as polysomnographic variables indicative of OSAS. To determine the effect of the severity of quality of life, the AHI and SpO_2 desaturation during sleep were correlated with each domain of the SF-36. In a preparatory longitudinal cohort study of several health-status measures, the SF-36 had the best reliability, validity, and responsiveness for patients with OSAS[11,12]. Block et al[13] found that hypoxemia was associated with worse performance on a wider spectrum of neuropsychological functioning than our data showed. In contrast, Findley et al[14] noted only impairment in verbal memory. The underlying mechanism responsible for neuropsychological deficits associated with OSAS is yet to be determined. Nocturnal hypoxemia is a commonly proposed causative factor[15], in line with our findings at least in those persons with moderate to severe OSAS. Perhaps, the most parsimonious explanation is that both hypoxemia and the consequences of sleep fragmentation are responsible for the adverse effects of OSAS on neuropsychological function[16], and that their relative impact depends on the severity of OSAS degree of hypoxemia and the affected individual.

During apnea or hypopnea episodes, blood oxygen saturation (SpO_2) can drop to dangerously low levels, resulting in increased respiratory effort and arousals from sleep to resume breathing. Recurrent hypoxemia and fragmented sleep are, therefore, significant consequences of the disorder[17]. Although the relationship between oxygen desaturation and quality of life is still uncertain, it is possible that severe oxygen desaturation during sleep plays a substantial role in the development of neuropsychological disorders and a diminished quality of life. OSAS patients with hypoxemia have been shown to be more cognitively impaired than others without hypoxemia. However, the impact of OSAS on neuropsychological function is not clear yet. More studies are needed in order to overcome the conflicting results of recent studies and provide more convincing data on this topic[18].

In large series regarding the association between OSAS and QOL, high levels of sleep apnea index (RDI > 30) were associated with reduction in physical functioning, general health perception, mental health, vitality and social functioning[19]. Our study is in accordance with these findings,suggesting that QOL is inversely proportional to OSAS severity. Our study was designed in order to take into consideration other factors such as presence of illness (such as diabetes mellitus and hypertension), BMI, marital status, smoking and coffee habits, medication use, daily habits or social factors that might have influenced the results, despite other previous studies.

It is, therefore, important for physicians and other healthcare practitioners to be aware of the potential impact of OSAS on physical functioning, vitality and mental health of these patients in order to improve diagnostic sensitivity and specificity, and to provide appropriate treatment. Future studies are required in order to define these OSAS-related disturbances, the relationship between the disease severity and the level of impairment and the correlation between the test's results and significant day-to-day social and occupational functional impairment.

Conclusions

Numerous investigations have already demonstrated the diminished quality of life in patients with OSAS. Further characterization of impairment, particularly in these OSAS patients, will provide a better understanding of the problem. Patients with OSAS commonly report disturbances in cognitive and psychological function and general quality of life, increased rates of obesity, hypertension, diabetes mellitus, cardiovascular disease, medication abuse, and related psychosocial complications present the potential aetiologies that might explain the impairments noted[20,21].

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