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Determination of the Relationship between Severity of Obstructive Sleep Apnea and Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) patients are at increased risk of sleep-disorders. The concomitant occurrence of COPD and obstructive sleep apnea hypopnea syndrome (OSAHS) is named overlap syndrome. This study aimed to evaluate the severity of OSAHS in overlap syndrome patients.

Materials & Methods: This cross-sectional study was conducted on adult patients with forced expiratory volume in 1 second (FEV1%)/forced vital capacity<0.7 and obstructive sleep apnea. The patients with left-sided heart failure, cancer, or recent history of sedative or opioid use were excluded from the study. We collected all the data regarding patients' demographics, body mass index (BMI), neck and waist circumference, stage of COPD (according to Global Initiative for Chronic Obstructive Lung Disease 2012 classification), and polysomnography variables. One-way analysis of variance (ANOVA) was performed using SPSS, version 11.

Results: Forty patients (62.5% male) with mean age of 59.7±8.3 years participated in the study. Severity of obstructive sleep apnea was low, moderate, and severe in 23 (57.5%), 14 (35%), and 3 (7.5%) cases, respectively and there was no statistical relation between OSAHS and FEV1% (P=0.55).

Conclusion: This study showed that there was no significant correlation between apnea–hypopnea index and FEV1% predicted in overlap syndrome patients.

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Introduction

The prevalence rate of chronic obstructive pulmonary disease (COPD) is on a growing trend, such that it is the fourth major cause of mortality worldwide (1). Sleep-disordered breathing (mainly obstructive sleep apnea hypopnea syndrome [OSAHS]) and COPD are among the most common pulmonary diseases. There are a great number of patients suffering from both disorders at the same time, which is called overlap syndrome (2, 3). Patients with overlap syndrome are at a higher risk of morbidity and mortality in comparison to those with either COPD or OSAHS alone (4). This study aimed to identify the correlation between severity of OSAHS and anthropometric variables and forced expiratory volume in 1 second (FEV1%) predicted in patients with overlap syndrome.

Materials and Methods

This cross-sectional study was conducted on overlap syndrome patients in Sleep Laboratory

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of Imam Reza Hospital and Chronic Obstructive Pulmonary Disease Research Center of Mashhad University of Medical Sciences in 2015. Based on the study by Partida-Gaytán et al. (5), in which the frequencies of OSAH in eutrophic, obese, and extremely-obese adolescents were reported 0.8, 0.22, and 0.67 respectively, with a desired study power of 80% and statistical significance of 2.5%, the required sample size was calculated to be at least 40. Prior to the study, informed consent was obtained from all the patients or their guardians. The adult patients with FEV1%/forced vital capacity (FVC)<0.7, irreversible airflow obstr-uction, apnea–hypopnea index (AHI)>15 or 5, and excessive daytime sleepiness were included in the study. Participants with left-sided heart failure, cancer, or recent history of sedative or opioid use were excluded from the study.

We gathered all the date regarding patients' demographics, body mass index (BMI), neck and waist circumference, stage of COPD (according to Global Initiative for Chronic Obstructive Lung Disease 2012 classification), and polysom-nography variables. Afterwards, according to severity of OSAHS in terms of AHI, the patients were divided into three groups of low (AHI=5-15), moderate (AHI=16-30), and severe (AHI≥31).

Statistical analysis

The normality of data was checked by Kolmogorov-Smirnov test. Numerical data, including age, BMI, neck circumference, AHI, and waist circumference, was expressed as mean±standard deviation. One-way ANOVA (to compare the means of different subgroups) and partial correlation (to determine the correlation between the variables controlling the conf-ounders) were run using SPSS, version11. P-value less than 0.05 was considered statistically significant.

Results

Forty patients (62.5% male) with mean age of 59.7±8.3 years (age range: 46-82 years) and BMI of 40.51±4.55 kg/m^2 were enrolled in the study. Mean BMI of women was significantly greater than that of men (33.96±5.47 kg/m^2 vs. 28.87±5.29 kg/m^2; *P*=0.006). Partial correlation coefficient between AHI and BMI (controlling for gender) was not significant (r=-0.118, P=0.472). Severity of OSAH was low, moderate, and severe in 23 (57.5%), 14 (35%), and 3 (7.5%) cases, respectively. As determined by One-way ANOVA, There were no statistically significant differences between these three groups in terms of BMI, waist and neck circumference, and FEV1% (*P*=0.53, P=0.71, P=0.72, and P=0.55, respectively; Table 1).

Discussion

In the present study, we examined patients with overlap syndrome to determine the correlation between AHI, anthropometric variables, and FEV1%. BMI and neck circumference were lower in the AHI severe group in comparison to the other groups, although this difference was not statistically significant. This finding was not in agreement with the results of former studies in which BMI increased with the

Table 1. Correlation between severity of obstructive sleep apnea–hypopnea syndrome (as determined by apnea–hypopnea index in overlap patients) and body mass index, anthropometric variables, and apnea–hypopnea index

	Obstructive sleep apnea–hypopnea syndrome severity	No.	Mean (standard deviation)	95% confidence interval (lower-upper bound)		P-value
Body mass index (kg/m^2)	Low	23	31.52 (6.44)	28.73	34.30	0.53
	Moderate	14	30.21 (5.27)	27.16	33.26	
	Severe	3	27.73 (2.66)	21.11	34.34	
	Total	40	30.77 (5.85)	28.90	32.65	
Waist circumference (cm)	Low	23	105.69 (15.38)	99.04	112.34	0.71
	Moderate	14	102.92 (8.39)	98.07	107.77	
	Severe	3	100.66 (1.52)	96.87	104.46	
	Total	40	104.35 (12.65)	100.30	108.39	
Neck circumference (cm)	Low	23	41.02 (4.84)	38.92	43.11	0.72
	Moderate	14	39.78 (4.11)	37.40	42.16	
	Severe	3	40.00 (5.29)	26.85	53.14	
	Total	40	40.51 (4.55)	39.05	41.96	
FEV1%* predicted	Low	23	67.47 (13.44)	61.66	73.29	0.55
	Moderate	14	61.78 (13.31)	54.09	69.47	
	Severe	3	75.33 (7.02)	57.88	92.78	
	Total	40	66.07 (13.34)	61.80	70.34	

*forced expiratory volume in 1 second

severity of obstructive sleep apnea (OSA). A study by Partida-Gaytán et al. showed that AHI raises 0.696 events/hour with each 1 kg/m^2 increase in BMI (5).

The mean BMIs of the patients with overlap syndrome were in the overweight range (mean BMI: 30.77 kg/m^2), which was slightly higher than our general population. A study by Mirzazadeh et al. demonstrated mean BMI of 26.5 kg/m^2 and 24.4 kg/m^2 in female and male Iranians, respectively (6).

In a study by Herer et al., mean BMIs in female and male OSAHS patients were 43.4 kg/m^2 and 36.3 kg/m^2, respectively (7). Chaouat et al. indicated that the patients with overlap syndrome were similar to those without COPD in terms of BMI (8). However, the BMIs of our patients with overlap syndrome were lower than those of the patients with pure OSAHS. To explain this finding we considered the fact that COPD is an inflammatory disorder, which can induce cachexia through releasing several inflammatory cytokines (e.g., TNF-α). Todorescu et al. (9) studied the prevalence of OSA in asthma patients and showed high risk of OSA with increase in asthma severity (OR=1.59; 95% CI 1.23-2.06). In the current study, the correlation between AHI classification and FEV1% was not statistically significant. The difference between pathophysiology of asthma and COPD can explain the discrepancy in results.

Due to the main limitation of our study, which is the absence of a control group of pure OSAHS patients (without COPD), we could not determine any probable differences in anthropometric variables. Furthermore, since we did not have data on upper airway anatomy (in the form of Mallampati or Friedman classifications), we could not study the association between upper airway size and FEV1% or AHI. It is recommended to replicate this study by using a larger cohort of overlap syndrome patients with a control group of OSAHS patients without COPD.

Conclusion

BMIs of our patients with overlap syndrome were lower than those of the participants of the previous studies. It is suggested to re-examine the role of BMI as a predictor of OSA in COPD patients. In addition, in our study, there was no significant relationship between AHI classification and FEV1% in our patients with overlap syndrome.

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Conflict of Interest

The authors declare no conflict of interest.

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