

ORIGINAL STUDY

Apnea-hypopnea index changes in correlation with body position during sleep in patients with obstructive sleep apnea syndrome

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ABSTRACT

BACKGROUND. Obstructive sleep apnea syndrome (OSAS) and snoring are common conditions caused by the obstruction of the upper airways. The aim of this study was to analyze the effect of body position on the apnea-hypopnea index (AHI) changes in patients with OSA syndrome.

MATERIAL AND METHODS. In this study patients with snoring and OSA syndrome were included. The endoscopic ENT examination was completed with rhinomanometry, computer tomography and polysomnography. Examined parameters were: apnea hypopnea index (AHI), oxygen saturation level, number of sleep apneic events, number and severity of the desaturations in correlation with body position. The results were summarized and statistically analyzed.

RESULTS. The presence of minor oropharyngeal modifications determines OSA of different degrees. Snoring is caused by the nasal obstruction. The polysomnographic results, AHI, saturation level are significantly correlated with the body position during sleep.

CONCLUSION. The evaluation of OSA syndrome causing modifications has an important role in the localization of the airway obstruction. To determine the appropriate treatment for OSA is essential to apply the correlation between desaturation level and AHI, in addition knowing the importance of body position during sleep.

KEYWORDS: sleep apnea, snoring, polysomnography

INTRODUCTION

Sleep is a moment of rest, of repose, when the individual becomes indifferent to the environment, and most of the physiological functions decline, particularly breathing, which becomes deeper and slower. During sleep, a number of respiratory disorders may occur. Among these, a particular pathology is represented by the obstructive sleep apnea syndrome. This can be classified into: central, obstructive and mixed type apnea syndrome^{1,2}.

Today, obstructive sleep apnea syndrome and snoring represent an increasingly frequent pathology^{1,2}. Obstructive sleep apnea occurs due to repeated obstructions of the pharyngeal airways. The walls of the

airways in patients with obstructive sleep apnea syndrome (OSAS) are collapsible due to the respiratory motions while sleeping. These patients' quality of life is severely affected.

Our aim was to point out the apnea-hypopnea index changes in patients with obstructive sleep apnea syndrome in correlation with body position during sleep^{3,4}.

MATERIAL AND METHODS

For the purposes of evaluation, we included in our study patients who were diagnosed with snoring and obstructive sleep apnea syndrome at the Galenus Med-

ical Center in Targu Mures. These patients were completely examined and their data were introduced into examination charts. Patients' evaluation protocol included nasopharyngolaryngeal endoscopic examination and flexible pharyngoscopy, rhinomanometry, imaging (computer tomography, magnetic resonance), carried out only when needed, as well as polysomnographic examinations.

We present a transversal retrospective clinical study which processes data from 132 patients. Our batch of patients was selected based on inclusion and exclusion criteria established at the beginning of data processing. The inclusion criteria were represented by the presence of sleep apnea (SA) and, respectively, SA recorded in both body positions during sleep (dorsal decubitus as well as ventral decubitus position). The exclusion criterion was the lack of data necessary for the inclusion criteria. The results were synthesized by drafting a registration abstract that featured the following parameters: the apnea-hypopnea index (AHI), the degree of oxygen desaturation, the number of nocturnal events, the number of desaturations and their degree in correlation with body position during sleep.

118 patients were included in the batch, out of which we have chosen, using a randomized method, a final batch of 20 patients for whom we processed the data.

Data analysis was performed by using the statistics software package IBM SPSS Statistics, version 20, and, respectively, Microsoft Office 2003.

RESULTS

Clinical data are in complete accordance with the polysomnographic ones. The minor modifications at the oropharyngeal level determine nocturnal events, while the existing nasal obstructive syndrome explains, subjectively, the presence of habitual snoring.

Analyzing the data obtained from 118 polysomnographic recordings, we have compared the AHI in the ventral decubitus position with the AHI in dorsal decubitus. We have established the fact that, although both positions had not been recorded in all 118 persons during sleep and despite the low number of cases presenting both positions in sleep, we have obtained a positive statistical difference in favour of the ventral decubitus position. The results presented in Table 1 show an AHI (apnea-hypopnea index) average of 36.56 registered in all 118 patients in the dorsal decubitus position and an AHI average of 15.49 in the ventral decubitus position during sleep. The above values have been compared with the One Sample Test statistical test. The results presented in Table 2 reveal a statistically significant difference between the AHI obtained in the two body positions during sleep ($p < 0.05$ with a degree of freedom of 19).

There was also a correlation between polysomnographic values during sleep and the degree of desaturation.

We have noticed an increased frequency of adopting the dorsal decubitus position in patients from the batch studied. The cause of this position is directly

Table 1
Dorsal and ventral decubitus AHI

	One-Sample Statistics			
	N	Mean	Std. Deviation	Std. Error Mean
Dorsal decubitus AHI	118	36.56	28.836	2.655
Ventral decubitus AHI	20	15.49	22.938	5.129

Table 2
Comparing AHI values in the two positions

	One-Sample Test $p < 0.05$				
	Test Value				
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
				Lower	Upper
Dorsal decubitus AHI	13.774	117	.000	36.564	31.31 41.82
Ventral decubitus AHI	3.020	19	.007	15.490	4.75 26.23

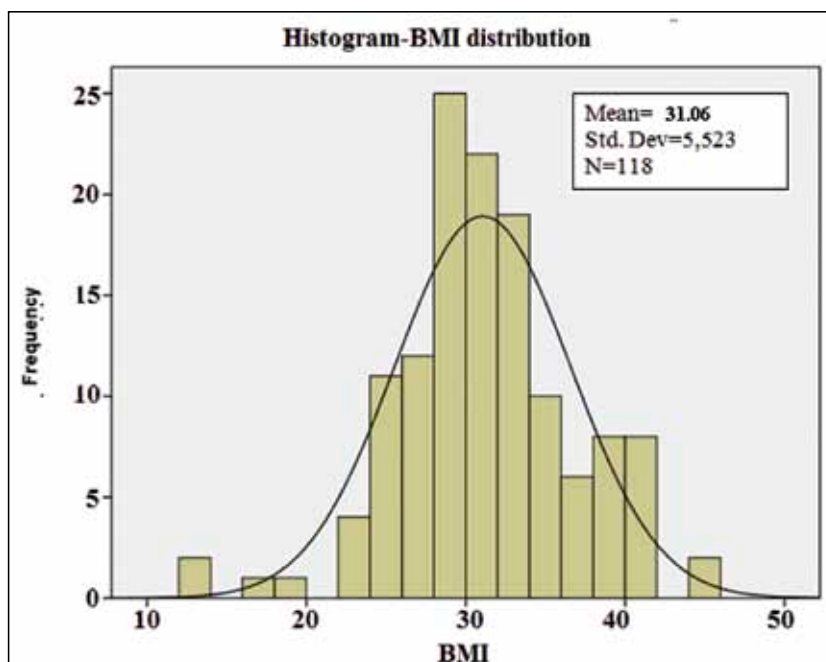


Figure 1 BMI distribution in the batch studied

linked to the BMI (body mass index), which has been found to have increased values.

We have analyzed BMI values in patients using the well-known formula: body weight (kilograms) divided by height (meters squared) (Figure 1). Analyzing the bar graph, we notice that the average value of the BMI from the batch studied (the initial batch of 118 persons) was 31.06, with a minimum value of 13 and a maximum of 44. An increased frequency was found between 29-40 BMI values. The standard deviation was 5.5.

In order to have a more rigorous check of the results and to exclude certain errors caused by the large difference in the number of persons adopting only one body position during sleep, we have excluded the patients who did not present both body positions during sleep. Thus, a batch of 20 persons was constituted, in whom the AHI in the dorsal decubitus position was recorded with AHI_A, and respectively, the AHI obtained in the ventral decubitus position was recorded with AHI_B (Tables 3, Table 4).

The data of these 20 patients were compared by applying the One Sample Test. The result of the test revealed a significant statistical difference between the degrees of AHI in both body positions adopted by the patients during polysomnographic monitoring.

The average of apnea phenomena in the dorsal decubitus position was 32.6, while in ventral decubitus it was 15.5.

Considering the results of the statistical data analysis, we can state that body positioning during sleep significantly influences the degree of sleep apnea.

The severity of the disease, the increase in oxygen

desaturations and the decrease in the quality of life are significantly influenced by the habitual body position that patients adopt during sleep.

DISCUSSIONS

As evidenced by our study, the body position adopted during sleep influences the AHI changes during sleep. Thus, the phenomena of nocturnal apnea-hypopnea increase in the dorsal decubitus position and are significantly decreased in ventral decubitus. These phenomena determine frequent changes of position during sleep, and therefore the appearance of a restless sleep⁵⁻⁷. However, we have noticed that the number of patients adopting exclusively the ventral position or both positions is smaller than of those who adopt the dorsal position.

The primary cause of adopting the supine position during sleep in patients with obstructive sleep apnea syndrome is predominantly related to obesity. This statement is sustained by previous studies showing that blood parameters changes are in direct relation to the body mass index and AHI values, respectively^{7,8}.

The increase in BMI is directly correlated with the AHI value and, respectively, with body position during sleep. This increase might have metabolic causes^{9,10}. Obesity and the metabolic syndrome lead to the development of cardiovascular diseases, such as arterial hypertension, which can also influence body position during sleep. Patients can present sleep disordered breathing due to respiratory distress and reduction of the thoracic cage¹⁰⁻¹².

Table 3
Comparing AHI values in patients from the studied batch according to body position during sleep (n=20)
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
AHI_A dorsal decubitus	20	32.60	24.003	5.367
AHI_B ventral decubitus	20	15.50	22.855	5.111

Table 4
The results of the statistical test used in order to compare AHI values in patients from the studied batch according to body position during sleep (n=20)
One-Sample Test

	Test Value					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
AHI_A dorsal decubitus	6.074	19	.000	32.600	21.37	43.83
AHI_B ventral decubitus	3.033	19	.007	15.500	4.80	26.20

CONCLUSIONS

Evaluating the rhino-pharyngeal pathological changes that may generate obstructive respiratory sleep pathology is important in establishing the location where the airway obstruction occurs, and has implications even for the degree of desaturation that occurs during sleep. It is essential to know that there exists a perfect correlation between the degree of desaturation and the value of the apnea index, as well as between the position adopted during sleep and the value of the apnea-hypopnea index, before introducing complex treatments, such as CPAP.

Therefore, multidisciplinary evaluation of these patients, as well as specialized treatments, is important in order to obtain a positive outcome regarding the quality of life. The recommendation of adopting the ventral position during sleep constitutes an element of therapeutic conduct.

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