Occurrence of Arterial Hypertension in Patients with sleep Apnoea Syndrome

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Original Article

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Abstract:

Introduction: Sleep apnoea syndrome (SAS) is a serious under-diagnosed chronic disease, which often coincides with arterial hypertension (AH). The U.S. Joint National Committee considers SAS to be the most common cause of secondary arterial hypertension.
Objective: To determine the incidence of arterial hypertension in patients diagnosed with SAS in an accredited sleep laboratory (ASL) in Bratislava in the years 2013-2022.
Methods: The monitored group consisted of 688 patients examined in an ASL in Bratislava who underwent an initial

examination (anamnesis, anthropometry, sleep questionnaire) and a diagnosis of sleep-disordered breathing (nocturnal polysomnography) in order to confirm or refute the diagnosis of OSAS.
Data collection also took place by using a copy of the patients' medical records (presence of AH). We used Microsoft Excel and statistical software SPSS, version 21.0 to process the obtained data. We considered the result to be statistically significant if $p \leq 0.05$.
Results: We demonstrated a statistically significant difference in the incidence of AH in patients with SAS compared to patients without SAS, i.e., there was a statistically significantly higher incidence of AH in patients with SAS compared to patients without SAS (39% vs. 17.5%; OR=3.0; $p<0.001$). We also demonstrated that the higher the AHI value in patients with SAS, the higher the incidence of AH ($p=0.002$; 95% CI 1.4 – 4.4). In addition, there was a 1.9 times higher risk of developing AH in patients with a moderate degree of SAS compared to patients with a mild degree of SAS ($p=0.014$) and up to a 2.8 times higher risk of developing AH in patients with a severe degree of SAS compared to patients with moderate SAS ($p<0.001$) regardless of BMI.
Conclusion: Due to the high coincidence (1/3) of arterial hypertension and sleep apnoea syndrome in the monitored group, it is necessary to focus on effective screening of SAS in high-risk persons as well as effective screening of SAS in persons with present AH.

Biography of the first author

In 2010, I completed the second degree of university education in the study program Public Health (PH), and in 2012, I took a rigorous exam in the study field of PH. In 2013, I defended my dissertation, and in 2018 I obtained a specialization in the specialized field of healthcare management and organization - Master of Public Health (MPH). Since July 2022 I have been acting as the head of the Institute of Health Protection at the Faculty of Public Health of the Slovak Medical University in Bratislava. Since November 2022, I have been acting as the vice-dean for educational activities at the Faculty of Public Health of the Slovak Medical University in Bratislava. I actively participate in domestic and foreign professional events. I participate in the pedagogical process, especially in the PH study program.

Introduction

Currently, the human population lives in deregulated environmental conditions that create the potential for an emergence and potentiation of several diseases of civilization. Thanks to massive scientific advancements, the state of knowledge in the field of disease prevention is vast; however, chronic diseases still represent a serious medical problem (1).

Chronic diseases are responsible for 41 million deaths annually, accounting for up to 74% of all deaths worldwide (2). Chronic diseases lead to premature mortality and worsening of disabilities. They represent a main cause of deterioration of the physical health of the population in all countries, which in turn has economic impacts. The biggest risk factor is human behavior based on an unhealthy lifestyle. The WHO claims that if the current situation is maintained, the annual mortality due to chronic diseases will increase to 55 million individuals per year by 2030 (3). Especially in low- and middle-income countries, chronic diseases account for up to ¾ of deaths, and approximately 13.5 million people die prematurely or before reaching the age of 70 (2). Currently, we can talk about a pandemic of chronic diseases, which not only have serious health consequences for the individual, but also for the family and the community. It also presents a burden on the healthcare system, which represents a challenge for the 21st century in terms of ensuring adequate healthcare. Education itself also has its justified place in the care of people with chronic diseases. This activity is considered to be a lifelong activity aimed at increasing the level of knowledge about diseases and acquiring the necessary skills (4).

According to the International Classification of Sleep Disorders (5), sleep apnoea syndrome (SAS) is the most common sleep-related breathing disorder. It is estimated that the majority of patients in Slovakia are not diagnosed, which increases the risk of many acute or chronic consequences of untreated OSAS, namely cardio-metabolic complications (AH, ischemic heart disease, cardiac arrhythmias, type II DM, metabolic syndrome, etc.), as well as other known negative effects causing endocrine, ophthalmological, haematological, hepatological, nephrological and sexual modifications.

Methodology

The monitored group consisted of 688 patients who were examined in an ASL due to the presence of one or some of the following day or night symptoms of SAS (excessive daytime fatigue, snoring, feeling of suffocation, sleep pressure during normal activities, or microsleep when driving a motor vehicle, feeling of unrefreshing sleep). The data collection took place in the form of a transcript from the medical records of patients examined in the years 2013-2022 at an ASL in Bratislava. We focused on collecting the following data from patients' initial examinations (basic characteristics - gender, age, associated diseases - arterial hypertension), data from the nocturnal polysomnographic examination - SAS unconfirmed and SAS diagnosed (determination of severity based on the apnoea-hypopnoea index (AHI), (ICSD, 2013). We considered a patient to have AH if they received the diagnosis of AH, an ICD code listed in the medical documentation. We processed the obtained data in a database in the Microsoft Excel program and then statistically evaluated them in the SPSS program, version 22. We set the level of statistical significance at $p \leq 0.05$.

Results

The monitored group consisted of 688 patients, of which a significant part was men (n=623; 90.6%) and 65 (9.4%) were women. In our group, most of the examined men were in the age categories: 30 to 39 years - 184 men (29.5%), 40 to 49 years - 195 men (31.3%), and 50 to 59 years - 125 men (20.1%). Most of the examined women were in the 40-49-year-old age category, 13 women (20%), and the least were in the 20-24-year-old category, where only one woman (1.5%) was examined (Table 1).

From the monitored set of men (n=623), SAS was not confirmed in 87 men, and we con-

Table 1 Age structure of examined patients based on gender (n=688)

		MEN n= 623	**WOMEN** n= 65
		n (%)	n (%)
AGE CATEGORIES	20-24 years old	5 (0,8%)	1 (1,5%)
	25-29 years old	22 (3,5%)	3 (4,6%)
	30-39 years old	184 (29,5%)	12 (18,5%)
	40-49 years old	195 (31,3%)	13 (20%)
	50-59 years old	125 (20,1%)	12 (18,5%)
	60-65 years old	59 (9,5%)	12 (18,5%)
	65+ years old	33 (5,3%)	12 (18,5%)
	TOTAL (n=688)	**623**	**65**

Table 2 Absence or presence of SAS based on severity and gender (n=688)

		MEN n= 623	**WOMEN** n= 65
		n (%)	n (%)
severity of **SAS**	SAS not diagnosed	87 (14%)	16 (24,6%)
	mild degree of SAS	129 (20,7%)	20 (30,8%)
	moderate degree of SAS	127 (20,4%)	14 (21,5%)
	severe degree of SAS	280 (44,9%)	15 (23,1%)
	TOTAL (n=688)	**623**	**65**

Table 3 Set of patients diagnosed with SAS according to severity with present AH based on gender (n=228)

		MEN with SAS and AH n= 208	**WOMEN with SAS and AH** n= 20
		n (%)	n (%)
severity of **SAS**	mild degree of SAS	31 (14,9%)	5 (25%)
	moderate degree of SAS	46 (22,1%)	7 (35%)
	severe degree of SAS	131 (63%)	8 (40%)
	TOTAL (n=228)	**208**	**20**

firmed SAS in 536 men. Mild SAS was found in 129 men, moderate SAS in 127 men and severe SAS in 280 men.

From the monitored group of women (n=65), SAS was not confirmed in 16 women, and we confirmed SAS in 49 women. A mild degree of SAS was detected in 20 women, a moderate degree of SAS in 14 women and a severe degree of SAS in 15 women (Table 2).

From the total group of 688 patients, 228 patients (31.5%) were diagnosed with SAS and arterial hypertension, of which 208 were men and 20 were women. The age specificity of SAS (40 to 60 years old) was also confirmed in the group of patients diagnosed with SAS and with arterial hypertension, where the highest number of men were in the age group 40 to 49 years old - 57 men (27.4%), in the age group 50 to 59 years old - 60 men (28.8%) and in the age group 60 to 65 years old - 32 men (15.4%). The group of women diagnosed with SAS and with the presence of AH in the age group 40 to 49 years consisted of 4 women, the age group 50 to 59 years consisted of 4 women, the age group 60 to 65 years consisted of 4 women, and the age group 65 and over consisted of 8 women.

In the group of men diagnosed with SAS and with present AH, 31 men had a mild degree of SAS, 46 men had a moderate degree of SAS and 131 men had a severe degree of SAS. In the group of women diagnosed with SAS and with the presence of AH, 5 women had a mild degree of SAS, 7 women had a moderate degree of SAS and 8 women had a severe degree of SAS (Table 3).

In the group of patients diagnosed with SAS (n=585), we recorded 228 cases of arterial hypertension. In the group of patients with undiagnosed SAS (n=103), we recorded only 18 cases of arterial hypertension. We demonstrated a statistically significant difference in the incidence of AH in patients with SAS compared to patients without SAS, i.e., there was a statistically significantly higher incidence of AH in patients with SAS compared to patients without

SAS (39% vs. 17.5%; OR=3.0; p<0.001). Using multivariate logistic regression, we demonstrated that the severity of SAS based on AHI affects the presence or absence of AH. We found that the higher the AHI value in patients with SAS, the higher the incidence of AH (CI=1.4 – 4.4; p=0.002).

There were 228 patients in the group of patients diagnosed with SAS and AH - in the group of patients with a mild degree of SAS based on AHI (n=36), in the group with a moderate degree of SAS (n=53) and in the group with a severe degree of SAS (n=139).

We found a 1.9 times higher risk of developing AH in patients with a moderate degree of SAS compared to patients with a mild degree of SAS (p=0.014) and a 2.8 times higher risk of developing arterial hypertension in patients with a severe degree of SAS compared to patients with moderate SAS (p<0.001) regardless of BMI.

Discussion

Sleep apnoea syndrome is a serious chronic disease with an increasing trend of occurrence mainly in the productive part of the population, especially in men. Currently, it is known that SAS is a significant risk factor for the onset and development of many chronic diseases, e.g., arterial hypertension (6). Especially in patients with untreated sleep apnoea syndrome there are frequent pauses in breathing during sleep or too shallow breathing. These pathophysiological changes are characterized by a drop in blood pressure, especially in stage I non-REM sleep. In stage II non-REM sleep there is an increase in blood pressure values, and the most significant increase in blood pressure values is in stage III non-REM sleep, in the so-called hyperventilation phase. These pathophysiological changes caused by sleep-disordered breathing first lead to an increase in blood pressure values during sleep, and later these values also increase during the day. In our work, we confirmed a statistically significant difference in the occurrence of AH in patients with SAS compared to patients without SAS, i.e., there was a statistically significantly higher incidence of AH in patients with SAS compared to patients without SAS (39% vs. 17.5%; OR=3.0; p<0.001). The results of our work are in agreement with the results of many relevant professional studies (7, 8, 9). In their study, Floras et al. also found a higher incidence of arterial hypertension in patients diagnosed with SAS compared to the group of patients with undiagnosed SAS (88% vs. 12%) (7). Ahmad et al. report in their study that up to 83% of patients diagnosed with SAS also have present AH (8). Studies by Pascale et al. and Ahmad et al. report the prevalence of arterial hypertension in patients diagnosed with SAS at the level of 83%, while in the given study the diagnosis of SAS was defined by the presence of an AHI of more than 10 pauses in breathing per hour of sleep based on the result of nocturnal polysomnography, which is considered the gold standard in the diagnosis of sleep-disordered breathing. If the criteria of the last valid International Classification of Sleep Disorders (AHI > 5 pauses per hour of sleep) were used in the given study, the percentage of patients diagnosed with SAS and present AH would be significantly higher in the monitored group (9). With increasing AHI in patients with untreated SAS, i.e., with the increasing number of apnoea/hypopnoea episodes per hour of sleep, there are more frequent and more serious pathophysiological changes during sleep that negatively affect blood pressure values, i.e., lead to the development of arterial hypertension. The incidence of AH increased statistically significantly depending on the severity of SAS based on AHI (24.2% vs. 37.8% vs. 47.1%, p<0.001). The results of our work are in agreement with the results of several relevant studies (10, 11). In their study, Steinhorst et al. described the effect of the severity of SAS on the occurrence of AH, while the criterion for establishing the diagnosis of SAS was carrying out a polysomnography and having more than 10 pauses or shallow breaths per hour of sleep. They also found a statistically significant difference in the incidence of arterial hypertension in SAS patients with AHI>10 per hour of sleep compared to patients with AHI<10 per hour of sleep (60.6% vs. 39.4%, p=0.07). SAS patients with AHI>10 per hour of sleep had significantly higher systolic and diastolic blood pressure during the 24-hour measurement compared to patients with AHI<10 per hour of sleep (155,5 ± 19,6 mmHg vs. 145,5 ± 24,1 mmHg, p=0,02 ; 89± 13,7 mmHg vs. 87,2 ± 15,1 mmHg, p=0,04). In the given group of patients with SAS and AH, there was a higher incidence of associated diseases, which was also reflected in the higher use of medications (10).

Conclusion

Due to the consumerist way of life with the distinct feature of an unhealthy lifestyle, which can be observed worldwide, there is a significant increase in many chronic diseases that require enormous financial costs for screening, diagnosis and, last but not least, lifelong pharmacological treatment with frequent incapacity for work, which negatively affects the quality of life of these patients.

From the point of view of public health, it is necessary to focus on the effective management of SAS (targeted screening, timely diagnosis, effective treatment and dispensary of patients), as the incidence of arterial hypertension increases with the increasing severity of SAS in untreated patients.

In addition to the most effective therapy for SAS of moderate severity or a severe degree, a positive pressure device - CPAP treatment, it is necessary to focus on non-pharmacological treatment of SAS, specifically by modifying one's lifestyle with a reduction in body weight. Many clinical studies with a long-term follow-up show that a complex modification of one's lifestyle based on modification of nutrition and eating habits, regular physical activity and cognitive-behavioral training or other types of psychological coaching have a definite positive effect on one's health and quality of life (12).

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