Demographic, anthropometric, and metabolic characteristics of obstructive sleep apnea patients from Romania before the COVID-19 pandemic

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Abstract. Obstructive sleep apnea (OSA) syndrome is one of the major pathologies of modern life, with multiple etiologies intertwining: the increase in life expectancy, facial and dental changes, metabolic syndrome, and others. The current diagnosis is based on sleep studies, flexible endoscopy, imaging studies and a complete differential diagnosis from other possible pathologies. We present a retrospective study of 80 cases with OSA managed in 2019 prior to the beginning of the COVID-19 pandemic. We analyzed various demographic, anthropometric and metabolic data recorded in our study group. Some of the results, such as high levels of cholesterol and triglycerides, were consistent with worldwide literature. However, regarding the anthropometric data, we underline a general decrease in height in the Romanian population. In addition, demographic data have changed in the last decade due to the work immigration in the European Union. This data will be used in a future analysis for comparison with variables recorded from cases with OSA during the COVID-19 pandemic. Current cases with OSA are not a priority for healthcare systems, and patients avoid referral to a specialist as much as possible.

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Introduction

There is an increasing incidence and prevalence of cases of obstructive sleep apnea (OSA) syndrome worldwide. More than 1 billion individuals are affected in developed countries, as well as in middle- and low-income countries, regardless of the northern or southern hemisphere (1). The most common tool used for the assessment and management of OSA is the apnea-hypopnea frequency per hour index (AHI). Nonetheless, newer tools, such as heart rate variability (HRV) or oximetry and peripheral arterial tonometry (PAT) are available (2). OSA has systemic influence triggering or exacerbating cardiovascular disease, a fact underlined by the correlation between the cardio-ankle vascular index (CAVI), a measure of arterial stiffness, and OSA severity (3). Metabolic syndrome and obesity are strongly associated with OSA, and current guidelines recommend targeting a normal body mass index (BMI) before attempting any other treatment modalities (4). For the nasal obstruction component in OSA syndrome, performing a complete flexible endoscopy and imaging studies in order to exclude allergic rhinitis or tumors should be considered (5). The first line of treatment in OSA is continuous positive airway pressure (CPAP) treatment, with a clear impact on the prevention of cardiovascular risk (6). The increasing incidence of OSA in the pediatric population, due to major lifestyle changes with access to unhealthy food and decrease in physical activity, is even more alarming (7). Surgery should represent the last line in the treatment of OSA, procedures ranging from turbinate reduction to uvulopalatopharyngoplasty and maxillomandibular advancement (8). The new situation of the COVID-19 pandemic brought to attention other aspects of using CPAP and the risk of increasing air droplets and aerosols in sleep medicine practice (9). Although the awareness of the general population towards OSA and treatment modalities have increased, patients with OSA still present an impaired quality of socio-professional life (10).

The goal of the present study was to obtain and analyze the data of patients with OSA recorded before the beginning of the COVID-19 pandemic, and use these data in a future study during and after the end of the pandemic.

Patients and methods

A retrospective study was conducted of cases of OSA, diagnosed before the beginning of the COVID-19 pandemic, in order to analyze the demographic, anthropometric and metabolic characteristics correlated with the severity of OSA.

Study population. We gathered a study group of 80 adult male patients with the following inclusion criteria: body mass index (BMI) ≥24, associated major OSA symptoms, snoring and presenting an AHI ≥5. This retrospective study was performed at the 'Galenus' Medical Center, Targu Mures, Romania, on records dating from January to December 2019, prior to the beginning of the Covid-19 pandemic. Patients already diagnosed with OSA under treatment, pregnant women, and patients with carcinomas were not included in the study group. For more consistent statistical data we did not include the very few female patients addressing to our clinic. All patients signed a written consent for medical procedures and scientific analysis of their data in accordance with the Declaration of Helsinki. The study was supervised and approved by the Ethics Committee of the 'Galenus' Medical Center (Targu Mures, Romania).

Diagnostic procedures. According to our objectives, we queried our database for variables recorded with metabolic blood tests, anthropometric measurements, and polysomnography.

Polysomnography. We use a 6-h protocol for recording data during physiological sleep using the SOMNOscreen™ Plus (SOMNOmedics GmbH). The sleep study gathered data from electroencephalography (EEG), electromyography, electrooculography, pulse oximetry, heart rate, thorax movement and abdominal wall movement. OSA is defined as the stop of respiration for at least 10 sec and maintaining respiratory effort. The reduction in airflow below 50% for more than 10 sec and a decrease in O_2 saturation with 3% defines hypopnea. AHI index was obtained by dividing the number of sleep-related events to the number of sleep hours. Respiratory disturbance index (RDI) was automatically obtained from the polysomnography device.

Anthropometric measures. We recorded the height (cm) and weight (kg) of the subjects, neck circumference (cm) at the level of the cricothyroid membrane, abdominal circumference (cm) at the level of the umbilicus with the patient in an erect position. Thus, we were able to calculate the body mass index (BMI) for each subject.

Metabolic characteristics. Blood tests were performed in the morning after the sleep study ended. We recorded serum concentration of HDL (mg/dl), cholesterol (mg/dl), triglycerides (mg/dl) and testosterone (nmol/l) using ARCHITECT *ci*4100 (Abbott).

Statistical analysis. The patients were divided into 3 subgroups according to the AHI: subjects with snoring and AHI <15 were considered low severity patients; subjects with snoring and AHI between 15 and 30 were medium severity patients; and subjects with AHI >30 were considered to be high severity patients.

The data were analyzed using GraphPad Prism 7.01. The threshold for statistical significance was 0.05. The descriptive statistics for contiguous variables are presented as mean ± [standard deviation (SD)]. Other data were analyzed using the Kruskal-Wallis test. For the linear regression analysis, AHI was defined as a dependent variable, in order to evaluate the correlation between OSA severity and the characteristics studied for each of the 3 subgroups.

Results

The low severity subgroup (Subgroup 1) included 14 cases with a mean age of 51.71 (±14.84 SD) years. The second subgroup of medium severity (Subgroup 2) included 14 cases with a mean age 49.07±10.52 years. The third subgroup of high severity (Subgroup 3) included 52 cases with a mean age of 45.75±11.36 years. There were no statistical differences between the three subgroups regarding age. All cases presented snoring, OSA symptoms and BMI >24 (kg/m^2). When comparing the BMI for Subgroup 1, which was 28.41±4.172, for Subgroup 2, which was 31.61±4.317 and for Subgroup 3, which was 34.75±5.335, P=0.0005 was obtained, a significant difference.

Table I summarizes the anthropometric and metabolic characteristics of the study groups. RDI was significantly different between the three subgroups (P<0.0001). RDI was calculated as the number of apnea events/h plus the number of hypopnea events/h plus the number of respiratory-effort-related arousals (RERAs) per hour of sleep.

Variables recorded for Subgroup 3 were significantly higher regarding the abdominal and neck circumference.

Unfortunately, we could not correlate the AHI index with the values recorded for testosterone, HDL cholesterol, total cholesterol, and triglycerides.

We discovered a significant correlation between the level of triglycerides (mg/dl) and AHI in the low severity Subgroup 1 (R^2=0.3752, P=0.0199; Fig. 1).

In the case of Subgroup 3 with severe OSA, we discovered a correlation between the AHI and abdominal circumference (cm) (R^2=0.0766, P=0.0469; Fig. 2) and between OSA (AHI) and the RDI (R^2=0.23, P=0.0003; Fig. 3).

Discussion

In Romania, we recorded a low addressability of females towards sleep clinics, mainly due to socio-cultural background and the fact that males develop the clinical background for obstructive sleep apnea (OSA) (11). Metabolic syndrome is one of the factors that aggravates the symptoms of OSA. However, due to our small study group, we could not correlate plasmatic levels of cholesterol with OSA severity in the subgroups (12). Currently, we have observed an increase in BMI values due to life style changes and a decrease in height in the general population (13). Moreover, OSA cases tend to be associated also with laryngopharyngeal reflux (14). There is also an increased number of cases associated with thyroid

Table I. Anthropometric and metabolic characteristics of the 3 study subgroups with OSA.

Parameters	Abdomen circumference (cm)	Neck circumference (cm)	RDI	Testosterone (nmol/l)	HDL (mg/dl)	Cholesterol (mg/dl)	Triglycerides (mg/dl)	AHI
5≥ AHI <15 Subgroup 1 (n=14)	118.9 (27.76)	41.64 (2.925)	78.14 (33.93)	39.97 (23.27)	42.59 (8.585)	196.4 (28.43)	95.5 (27.79)	9.04 (2.37)
15≥ AHI <30 Subgroup 2 (n=14)	128.9 (17.63)	43.36 (2.951)	141.5 (62.29)	22.49 (19.62)	47.14 (8.486)	208.5 (32.83)	147.9 (69.83)	21.69 (4.29)
AHI >30 Subgroup 3 (n=52)	138.3 (23.34)	45.46 (4.07)	221.6 (133)	40.26 (25.26)	42.6 (8.284)	214.9 (36.99)	164.9 (106.4)	64.28 (19.58)
P-values	0.0125	0.003	<0.0001	0.6382	0.1118	0.2363	0.0752	0.10

Subgroup 1, low severity subgroup; Subgroup 2, medium severity subgroup; Subgroup 3, high severity subgroup. Data are expressed as mean (SD). P<0.05, significant difference. OSA, obstructive sleep apnea; AHI, apnea-hypopnea frequency per hour index; RDI, respiratory disturbance index; HDL, high-density lipoprotein.

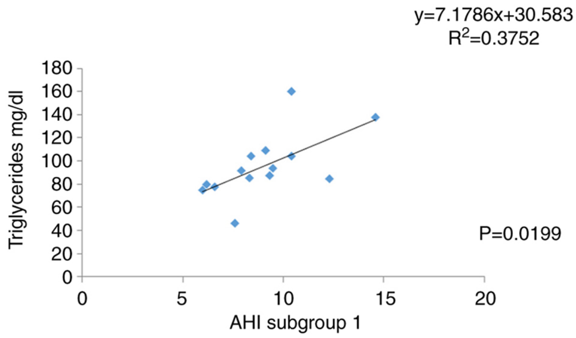

Figure 1. Pearson correlation of triglyceride levels (mg/dl) and AHI in the low severity OSA Subgroup 1. OSA, obstructive sleep apnea; AHI, apnea-hypopnea frequency per hour index.

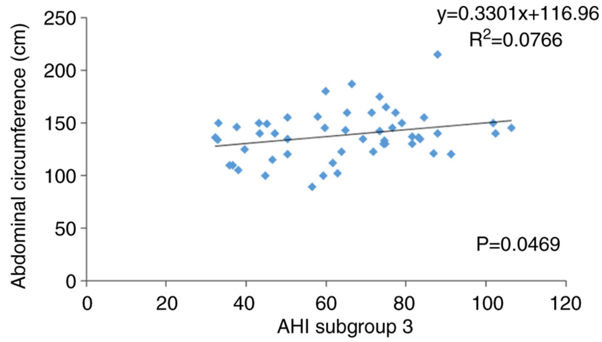

Figure 2. Pearson correlation of abdominal circumference (cm) and AHI in the severe OSA Subgroup 3. OSA, obstructive sleep apnea; AHI, apnea-hypopnea frequency per hour index.

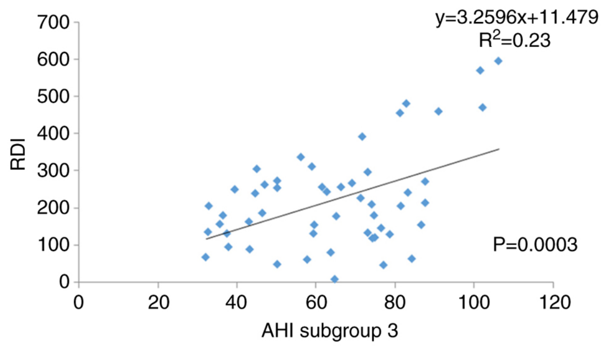

Figure 3. Pearson correlation between RDI and AHI in severe OSA Subgroup 3. OSA, obstructive sleep apnea; AHI, apnea-hypopnea frequency per hour index; RDI, respiratory disturbance index.

pathology and OSA (15). One aspect of our study is that we eliminated the few female patients we had from our study group for a more consistent statistical power. A future goal of our research could include analysis of the influence of female hormonal changes on OSA aggravation (16,17). Our data are consistent with other studies in developing countries such as Iran regarding body mass index (BMI) over 35 kg/m^2, age over 50 years, neck circumference over 43 cm in men, and OSA patients worldwide face increased risks due to the COVID-19 pandemic (18). The COVID-19 pandemic has limited the access of patients with OSA to healthcare services and this has diminished their quality of life (19). Cases with OSA should be recommended to undergo vaccination against SARSCov2 with priority (20).

Conclusion. In conclusion, our data regarding demographic, anthropometric and metabolic characteristics of OSA patients are consistent with literature reviews. However, there are some aspects specific to our country. The current data set was obtained prior to the unfolding of the COVID-19 pandemic, and we plan to use them as reference for a future comparative study regarding OSA challenges during the pandemic.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authors' contributions

AN and AC contributed substantially to the conception and design of the study, the acquisition, analysis, and interpretation of the data, and were involved in the drafting of the manuscript. DV and MD contributed substantially to the analysis and interpretation of the data and were involved in the drafting of the manuscript. RC contributed substantially to the interpretation of the data and was involved in the critical revisions of the manuscript for important intellectual content. AN, AC and RC were responsible for confirming the authenticity of all raw data. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors read and approved the final version of the manuscript for publication.

Ethics approval and consent to participate

The study followed the international regulations in accordance with the Declaration of Helsinki. The study was approved by the Ethics Committee of Galenus Medical Center (no. 20210105). Patient informed consent for publication of the data/images associated with the manuscript was obtained.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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