Romanian Journal of Rhinology, Vol. 2, No. 5, January - March 2012

ORIGINAL STUDY

The association of webbing index and obesity with the severity of obstructive sleep apnea syndrome and oxygen saturation

Adriana Neagos[1,2], Diana Duca[2], Gheorghe Muehlfay[1]
[1]Tg. Mures Emergency County Hospital, ENT Clinic, Tg. Mures
[2]GALENUS Private Medical Center, Tg. Mures

ABSTRACT

BACKGROUND. Sleep breathing disorders are characterized by apnea or hypopnea periods with or without pharyngeal obstruction, hypoventilation, hypoxemia, hypercapnia or acidosis. To apply a proper therapy much knowledge of somnology is needed. Sleep breathing disorders cause secondary pulmonary respiratory symptoms, which is why somnology has an interdisciplinary character. ENT pathology involvement in the etiology of obstructive sleep breathing disorders justifies this work.
MATERIAL AND METHODS. We performed a retrospective study on a group of 100 patients with obstructive sleep breathing disorders in which the main clinical manifestations, snoring, fatigue and daytime sleepiness, were correlated with results of the investigations performed (polysomnography, ENT clinical examination and laryngoscopy). Patients were divided into 3 groups, according to apnea-hypopnea index. Webbing index value for each group was correlated with the degree of desaturation and apnea-hypopnea index value in different body positions.
RESULTS. This correlation, based on the webbing value, showed that between it and the degree of desaturation is a significant correlation ($p < 0.0001$). There is a linear decrease in oxygen saturation in relation to the increase of webbing and apnea-hypopnea index.
CONCLUSIONS. This correlation is important in initiating treatment with CPAP mask, because in patients with high webbing needed pressure, hard to bear, preliminary surgical treatments are absolutely justified.
KEYWORDS: obstructive sleep apnea, webbing index, body mass index, sleep position, Müller Maneuver, CPAP therapy

INTRODUCTION

Sleep breathing disorders with total or partial obstruction of the upper airways is today the term for obstructive sleep apnea syndrome.

Increasing the concentration of CO_2 in the blood causes reflex breathing, followed by an awakening reaction called arousal, which produces a reduction in the depth of sleep, with fragmentation of the physiological sleep. Clinical consequences are: fatigue and daytime sleepiness, decrease of performance, impaired cardiopulmonary system.

Reduced airways caliber during sleep can have anatomical or functional causes.

The main cause in adults is the throat muscles collapse, a voluminous tongue, elongated soft palate which causes the narrowing of all segments of the pharynx during the supine position, along with a decrease in muscle tone which occurs during sleep[1,2]. This mechanism is favored by the hypertrophy of the tongue, the soft palate and the fatty tissue of the neck. Obstruction can also occur in the region of the nose or rhinopharynx, leading to mouth breathing and shortness of breath.

The main cause of childhood obstructive sleep apnea syndrome is the adenoid hypertrophy. The upper airway resistance syndrome (UARS) was included as a disease in the category of obstructive sleep breathing disorders. It is characterized by extended breathing pauses without affecting airflow. Due to the border between this syndrome and obstructive sleep apnea syndrome (OSAS), the first appeared as a concept in recent years[3,4]. Obstructive sleep apnea syndrome causes impaired quality of life, reduced

Corresponding author: Adriana Neagos
email: adriana.neagos@galenus.ro

alertness, daytime sleepiness, increased risk of emergent heart failure, hypertonia, increased risk of accidents.

This specific conditions prevalence in adults is determined by sex, weight and individual factors. The incidence is specific between 40 and 70 years of age. World statistics indicate the presence of apnea-hypopnea index (AHI) greater than 5/h at a rate of 9% in women and 24% in men, aged 30-60 years old. Statistically, only 2-4% of them have clinical symptoms. In patients with cardiovascular disease, the prevalence is 2-3 times higher. Categories of individual predisposing factors are: body mass index (BMI), cranio-facial modifications, smoking, alcohol consumption especially during the evening and pregnancy.

From the clinical point of view, patients present daytime fatigue, snoring and sleep apnea which may lead to daytime sleepiness[4,5,6]. Daytime sleepiness must be distinguished from daytime fatigue. Daytime sleepiness implies a reduction in activity controlled by the central nervous system (awakening, the degree of attention). Daytime fatigue consists in daily activities disturbances[2,6,7]. Daytime sleepiness is the result of poor sleep, requiring after a latency period a repose of the patient.

For the otolaryngology physician, the anamnestic information about the associated pathology of patients with sleep breathing disorders is an essential diagnostic step. However, there is no history questionnaire widely accepted for these patients. This pathology might be considered when the following symptoms are encountered: outstanding daytime sleepiness, hypertonia, abnormal heart rhythm, breathing pauses noticed by the sleeping partner, intense and irregular snoring, impaired sexual performance, sleep restless, headache, dry mouth, nonspecific mental symptoms, attention disorders and decreased mental acuity.

Clinical examination of the upper respiratory tract includes examination of the nose and rhinopharynx, the soft palate (especially the retrovelar region), the oropharynx and the base of the tongue. Frequently increased adiposity, short neck, hypertrophy of the tongue, palate or tonsils, hyperplasia of lymphoid tissue are frequently involved in sleep breathing disorders. For an accurate diagnosis there are two possible paraclinic investigations: polygraphy and polysomnography. The respiratory polygraphy assesses heart rate, position during sleep, nasal respiratory flow, snoring intensity, oxygen saturation, while polysomnography also includes ECG, electrooculogram, electromyogram, electroencephalogram, sleep stages and leg movements.

Depending on the severity of symptoms, obstructive sleep apnea syndrome can be classified as: mild - daytime sleepiness or falling asleep with rare decline in attention while reading or watching TV, moderate - daytime sleepiness during the day, with decreased ability to focus during a conversation, severe - daytime sleepiness, falling asleep during daytime activities, drop-care capacity, falling asleep at the wheel.

Depending on the apnea-hypopnea index value (AHI), obstructive sleep apnea syndrome is classified by some authors into: mild AHI <15, moderate AHI >15 to 30, severe AHI >30.

Considering the above mentioned, making a correct diagnosis of obstructive sleep apnea syndrome involves a perfect correlation of data obtained by clinical examination and accurate medical history with data obtained by polygraphy or polysomnography.

In case of a patient with heavy snoring associated with periods of apnea and daytime sleepiness symptoms, polysomnography is absolutely necessary for a complete and correct diagnosis.

MATERIAL AND METHODS

Our team has made a retrospective study over a period of one year, between 2009 and 2010, on a sample of 100 patients sent to our service with suspected obstructive sleep apnea syndrome. On admission, they presented the following symptoms: daytime sleepiness, daytime fatigue, intense snoring, associated with decreased ability to concentrate.

In order to perform this study, we used existing endowment equipment in GALENUS Medical Center Tg. Mures - SOMNO-SCREEN polysomnography. Polysomnography is equipped with special channels for EEG - electroencephalography, EOG - electrooculography, ECG - electrocardiography, nasal flow, channel for oxygen saturation, abdominal activity, channel for measuring leg movements and channel for snoring (Figure 1).

Registration offers the possibility to evaluate polysomnography sleep parameters such as AHI index, RDI, oxygen saturation degree and snoring in all sleep positions. Also, it offers information about cardiovascular activity, blood pressure value and heart rate changes.

Limb movement is also recorded throughout the sleep. Awakening periods and arousals are shown in correlation with sleep stages. The sleep stages and sleep efficiency are reflected at the end of recording in the report. All these somnological parameters can be correlated with sleep stages, allowing an overview of its character.

Patients underwent endoscopic ENT examination, performed with rigid and flexible nasopharyngoscope, during specific Müller maneuvers to clarify the site of production of partial or total obstruction. Clinical examination was completed with polysomnography.

With the rigid optical 0° endoscope were examined the mouth, the size of the oropharyngeal isthmus, the palatine tonsils, the posterior pillars, respectively the soft palate size and the length of the uvula. Webbing index is given by the size and layout of posterior pillars and soft palate.

Nasal endoscopic examination, with the rigid endoscope, is used in order to diagnose a nasal pathology, such as: nasal septum deviation, chronic rhinitis, concha bullosa etc. and to assess any rhinopharyngeal modifications.

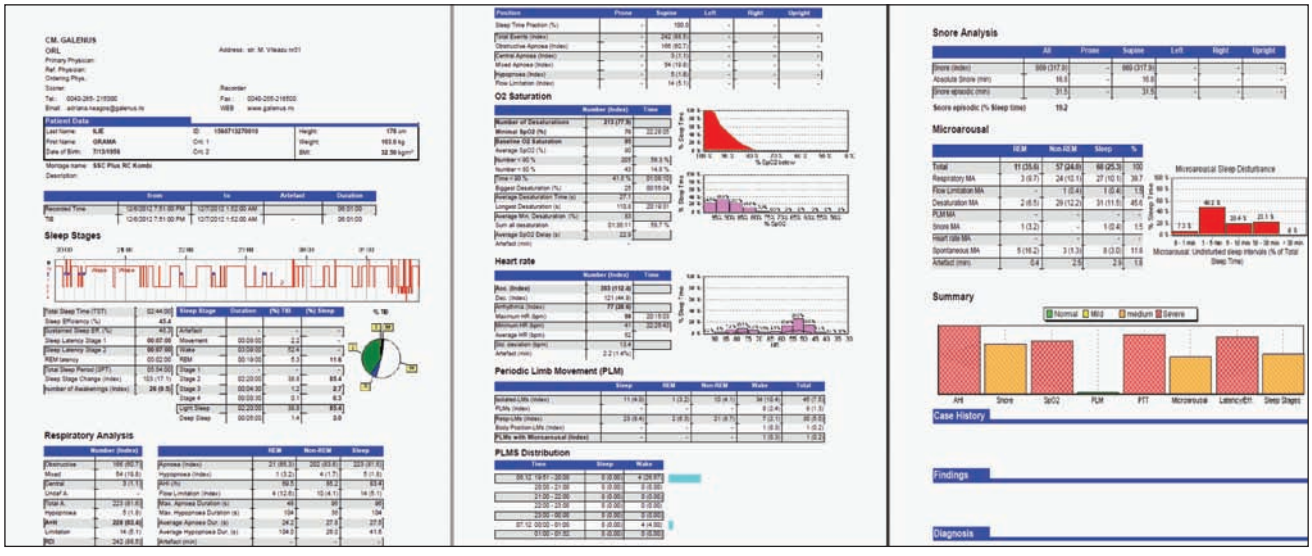

Figure 1 Polisomnography

For the examination and evaluation of the retrovelar region, the size of the posterior respiratory space and hypopharyngeal region, the flexible nasopharyngoscope can be used, while performing the Müller maneuver. Müller Maneuver involves performing a deep breath with the mouth and nose obstructed artificially, thus helping us determine the degree of the upper airway collapse, even if it has an orientative role. The data obtained by means of this maneuver are correlated with polysomnography in patients with obstructive sleep apnea syndrome.

The next step consisted in evaluating the clinical parameters like: webbing index, oxygen saturation, weight and body mass index (BMI).

Before polysomnography was performed, all patients had been asked to sign informed consent for admission and investigation and to complete a questionnaire, the Epworth Scale, which determines the degree of daytime sleepiness. Blood tests like: triglycerides, cholesterol, HDL and LDL cholesterol and blood glucose levels were performed in order to assess the metabolic status. Also, the abdominal diameter and blood pressure value were measured.

Patients were divided into 3 groups, depending on the AHI value as cited in the international literature: mild AHI <15, moderate AHI >15 to 30, severe AHI >30. Each group was subclassified according to the webbing index value (webbing <5 mm, webbing <10mm, webbing >10mm), the degree of desaturation (sat.O_2 <90%, 90% <sat.O_2 <95%, sat O_2 >95%) and sleep position (back, stomach, left side and right side).

The clinical results obtained by endoscopic examination were correlated with those of polysomnographic investigation. The purpose of these investigations is to demonstrate the possible linear correlation between these parameters and the existence of significant real dependencies between them.

RESULTS AND DISCUSSIONS

In our study group, the gender distribution was as follows: 83% male and 17% female. Our results correlate with the data found in the literature that show a predominance of respiratory pathology (such as obstructive sleep apnea syndrome) in males, the average age being 52 years old (Figure 2).

Regarding the apnea-hypopnea index correlation with the webbing index value, it can be said that the webbing index below 5 mm is encountered to a

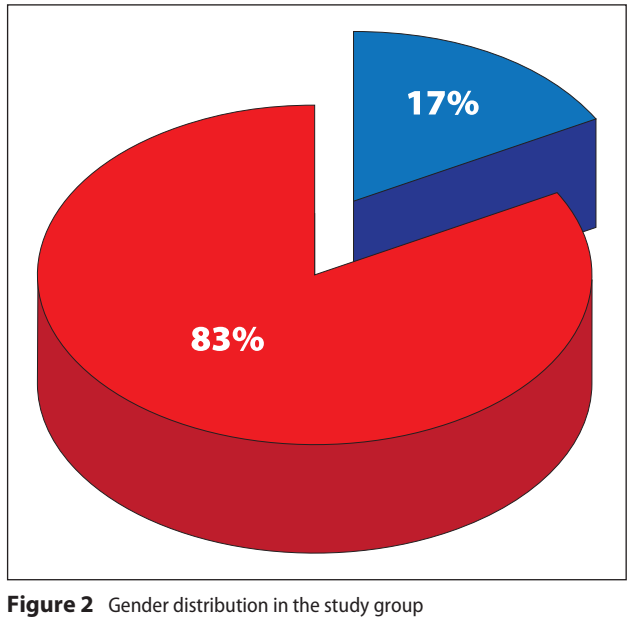

Figure 2 Gender distribution in the study group

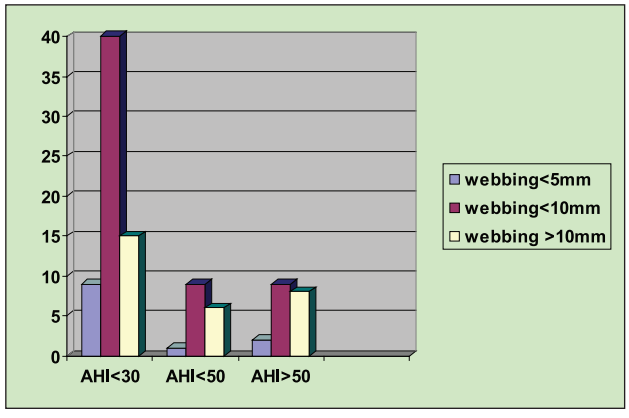

Figure 3 Webbing Index correlation with Apnea-Hypopnea Index value

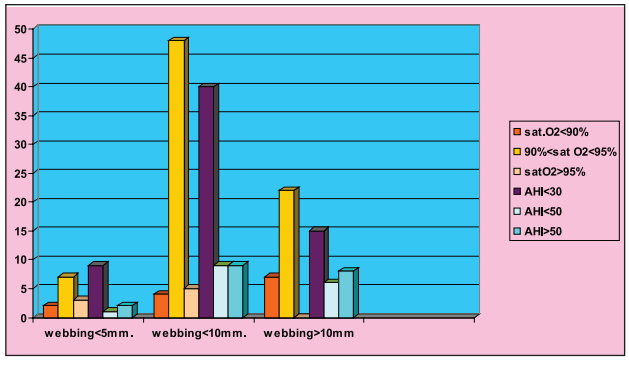

Figure 4 The correlation of desaturation degree with webbing index and Apnea-Hypopnea Index

greater extent in patients with mild apnea. The webbing index over 5 mm but less than 10 mm is more frequently encountered in patients with mild apnea, the percentage being considerably higher than in those with moderate and severe apnea. Webbing index over 10 mm, although found in a higher percentage in patients with mild apnea syndrome, shows a decrease in those with moderate apnea, followed by a further increase in percentage in patients with severe apnea.

Statistics demonstrate an absence of perfect correlation between apnea and the increasing of the webbing index value (Figure 3), but there is still a specific index over 5 mm and below 10 mm webbing for mild and moderate apnea. Performing a correlation between the degree of desaturation index value, webbing and apnea-hypopnea index, it can be said that there is a perfect correlation of these three elements and also a statistically significant interdependence ($p<0.0001$) (Figure 4).

Trying to establish a possible correlation between BMI, weight value, the apnea - hypopnea index value in different positions (back, stomach, right side and left side), our statistics show the impossibility of carrying out an exact correlation between these parameters (Table 1). These results explain that there is no significant correlation between BMI, AHI and the various positions during sleep. Thus, the connections between these parameters might be explained by the involvement of other predisposing factors.

CONCLUSIONS

Respiratory pathology represented by obstructive sleep apnea syndrome is frequently encountered in ENT practice and not only. It remains undiagnosed in many cases. The degree of apnea value is given by the apnea-hypopnea index and the degree of resistance RDI. The study performed on a group of patients with obstructive respiratory sleep pathology showed a correlation between the value of webbing index and mild and moderate apnea and not a specificity of this index for severe apnea. Our results have great practical value, since in such cases the application of radiofrequency or laser-types treatments is indicated.

The Webbing Index is considered useful in evaluating the soft palate status and in choosing the right indication for minimally invasive treatment methods. There is a perfect correlation between the webbing index value and the degree of desaturation, which makes possible to interpret how this index level can influence sleep apnea. This is why we have to solve this

Table 1
Correlation between apnea-hypopnea index value and body position

Apnea on back position	Hypopnea on back position
7 8 21 77 p=0.0739 (NS, to limits)	11 4 47 51 p=0.1203 (NS)
Apnea on stomach position	Hypopnea on stomach position
15 0 93 5 p=0.8253 (NS)	15 0 98 0 p cannot be calculated
Apnea on left position	Hypopnea on left position
15 0 70 28 p=0.0388 (S)	15 0 82 16 p=0.1966 (NS)
Apnea on right position	Hypopnea on right position
10 5 46 52 p=0.2518 (NS)	14 1 66 32 p=0.0790 (NS, to limits)

For all cases: The first BMI <= 26, apnea < 5;The second BMI <= 26, apnea >=5;The third BMI > 26, apnea < 5;The fourth BMI > 26, apnea > 5;NS- insignificant; S-significant

type of pathology before the application of positive pressure CPAP therapy. Regarding the involvement of the weight index and the position during sleep, there seems to be no statistical relationship between these elements, which makes us think of the involvement of other factors that influence the degree of sleep apnea in different positions.

All our findings are important to accurately assess patients with obstructive respiratory pathology of sleep before establishing the therapeutic strategy.

REFERENCES

1. Teerapraipruk B., Chirakalwasan N., Simon R., Hirunwiwatkul P., Jaimchariyatam N., Desudchit T., Charakorn N., Wanlapakorn C. - Clinical and polysomnographic data of positional sleep apnea and its predictors. Sleep Breath. 2011 Dec.
2. Oksenberg A., Silverberg D.S., Arons E., Radwan H. - Positional vs non-positional obstructive sleep apnea patients: anthropomorphic, nocturnal polysomnographic, and multiple sleep latency test data. Chest, 1997 Sep;112(3):629-39.
3. Oksenberg A., Khamaysi I., Silverberg D.S., Tarasiuk A. - Association of body position with severity of apneic events in patients with severe non-positional obstructive sleep apnea. Chest, 2000 Oct;118(4):1018-24.
4. Sundaram S., Bridgman S.A., Lim J., Lasserson T.J. - Surgery for obstructive sleep apnoea. Cochrane Database Syst Rev., 2005 Oct 19;(4):CD001004.
5. Dempsey J.A., Skatrud J.B., Jacques A.J., Ewanowski S.J., Woodson B.T., Hanson P.R., Goodman B. - Anatomic determinants of sleep-disordered breathing across the spectrum of clinical and nonclinical male subjects. Chest., 2002 Sep;122(3):840-51.
6. Valencia-Flores M., Orea A., Castano V.A., Resendiz M., Rosales M, Rebollar V., Santiago V., Gallegos J., Campos R.M., Gonzalez J., Oseguera J., Garcıa-Ramos G., Bliwise D.L. - Prevalence of Sleep Apnea andElectrocardiographic Disturbances in MorbidlyObese Patients, Eur Arch Otorhinolaryngol, 2008;265:105–113.
7. Wang1 J., Xian H., Licis A., Deych E., Ding J., McLeland J., Toedebusch C., Li T., Duntley S., Shannon W. - Measuring the impact of apnea and obesity oncircadian activity patterns using functional linear modeling of actigraphy data, Wang et al. Journal of Circadian Rhythms, 2011;9:11.