



Using respiratory polygraphy in diagnosing obstructive sleep apnea – our experiences

Primena respiratorne poligrafije u dijagnostikovanju opstruktivnog poremećaja disanja tokom spavanja – naša iskustva

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Abstract

Background/Aim. Obstructive sleep apnea (OSA) involves repeated episodes of cessation of breathing that occur due to a decrease in pharyngeal muscle tone. This disorder is more common in men and represents a significant risk factor for serious cardiovascular and cerebrovascular events. The gold standard in the diagnosis of this disorder represents a polysomnography (PSG), which is technically a complex and multidisciplinary method. Respiratory polygraphy (RP) may constitute an adequate replacement for most uncomplicated cases of obstructive sleep apnea. The aim of the study was to examine the efficacy of using respiratory polygraphies in diagnosing of obstructive sleep apnea. **Me-**

thods. On all the patients with suspected obstructive sleep apnea, RP and a retrospective analysis of the obtained results were performed. **Results.** By completing our examination, we proved that there was a positive correlation between the results obtained by using RP and the predictors of obstructive sleep apnea such as the Epworth sleepiness scale (EPWORTH) score, neck circumference and body mass index. **Conclusion.** Respiratory polygraphy represents a cheaper and simpler replacement for PSG, especially with uncomplicated obstructive breathing disorders during sleep.

Key words:
sleep apnea syndrome; diagnostic techniques and procedures; respiratory function tests; risk factors.

Apstrakt

Uvod/Cilj. Opstruktivni poremećaj disanja tokom spavanja podrazumeva ponovljene epizode prestanka disanja koji nastaju zbog smanjenja tonusa mišića faringusa. Ovaj poremećaj češći je kod muškaraca i predstavlja značajan faktor rizika od ozbiljnih kardio- i cerebrovaskularnih događaja. Zlatni standard u postavljanju dijagnoze ovog poremećaja predstavlja polisomnografija (PSSG) koja je tehnički zahtevna i multidisciplinarna metoda. Respiratorna poligrafija (RP) može predstavljati adekvatnu zamenu kod većine nekomplikovanih slučajeva opstruktivne *sleep apneae*. Cilj rada bio je ispitati efikasnost primene RP u dijagnostikovanju opstruktivnog poremećaja disanja tokom sna. **Metodo-**

de. Kod svih ispitanika sa sumnjom na opstruktivni poremećaj disanja tokom sna, učinjena je respiratorna poligrafija i retrospektivna analiza dobijenih rezultata. **Rezultati.** Učinjenim ispitivanjem dokazali smo da postoji pozitivna korelacija između rezultata dobijenih RP prediktora kao što su *Epworth Sleepiness scale* (EPWORTA skor), obim vrata, indeks telesne mase. **Zaključak.** Respiratorna poligrafija predstavlja jeftiniju i jednostavniju zamenu za PSG naročito za nekomplikovane opstruktivne poremećaje disanja tokom sna.

Ključne reči:
apneja u snu, sindromi; dijagnostičke tehnike i procedure; respiratorna funkcija, testovi; faktori rizika.

Introduction

Obstructive sleep apnea (OSA) is regarded as continuing episodes of obstruction of upper airways which cause lowered saturation of blood with oxygen and interrupted sleep. More precisely, OSA implies more than five breathing abortions

and/or significant reduction of ventilation during one hour of sleeping. These episodes are quantified with the apnea/hypopnea index (AHI). Breathing disorder is the consequence of reduction muscle pharynx's tone and the cause of specific day-night symptoms which significantly decrease the quality of life and increase the risk of lethal cerebral and cardiovascular events^{1,2}.

In the general adult population, 4% of males and 2% of females have OSA.

Physical constitution and age are tightly connected with occurrence of OSA. Obese and middle aged people are more likely to have OSA, particularly patients with the body mass index over 35 kg/m², where incidence is between 7% and 11%³⁻⁵.

In this disorder, the main pathophysiological change consists of continuing episodes of hypoxemia which cause complex inflammatory mechanisms and accelerate pathological processes in organism, such as arteriosclerosis^{3,6,7}.

Interrupted sleep, intermittent hypoxia, systemic inflammation and chronically raised tone of sympathetic nerve system caused by OSA make many cardiovascular disorders, such as arterial hypertension, ischemic heart disease, congestive heart failure and disturbance of heart rhythm^{8,9}.

Except the negative effect on brain and cardiovascular diseases, OSA makes already existing lung diseases such as bronchial asthma, chronic obstructive pulmonary diseases significant and deepens the respiratory insufficiency¹⁰.

OSA leaves serious consequences on the gastrointestinal tract and endocrine system which are manifested through the gastroesophageal reflux disease – GERD, and disturbance of liver and pancreatic functions¹¹.

The diagnosis of this disorder is based on the typical anamnestic data, results gathered from various questionnaires at the end and on the specific examination – recording respiratory acts during sleeping.

Initially, the hetero-anamnestic data, obtained from family members often has a crucial part in the diagnostic process of this disorder^{12,13}.

This way, many diagnostic procedures contribute to raising the number of diagnosed cases in real conditions by increasing the number of the diseased¹⁴.

The Epworth's sleepiness scale (ESS) is one of the most frequently used tests for estimating somnolence which consisted of 8 questions focused on problem intensity caused by interrupted sleep. Answers are graded with points from 0 to 3. According to this test, a score of 10 or more points is regarded as an indication for the examination¹⁵.

In order to verify a sleeping disorder, the standards require usage of polysomnography (PSG) with registering several vigilance and somnolence parameters (electroencephalogram, electrooculogram, electromyogram as well as cardio-respiratory (airflow, oximetry, effort, respiratory movement, etc.) and the visual parameters.

Polysomnography is technically complex and expensive, which makes it often an unavailable method. Because of its complicatedness, the need for a faster, simpler and less expensive method has aroused¹⁶.

Respiratory polygraphy (RP) is a technically simpler and much cheaper method which can play an important role in the diagnosis of obstructive sleep apnea.

The aim of the study was to show the efficiency of using RP in diagnosing obstructive sleep apnea and examine the correlation between apnea-hypopnea index (AHI) index obtained using RP and scoring achieved by using the ESS, body mass index and neck circumference, as well as risk factors for the existence of sleep apnea.

Methods

The examination included 61 patients, 52 men and 9 women, age from 30 to 76 years old, with suspicion of having a breathing sleep disorder. All of them completed the ESS test after the patients' history was gathered and physical examination performed. Everyone got their neck circumference measured as well as their body mass index calculated. After that, the patients who had positive anamnestic data and the result on the ESS of at least 10 did a RP. We conducted a retrospective analysis of the results.

Results

By analyzing the distribution of patients by sex and age, we found that among examined patients (52 men and 9 women) most of them were middle-aged and elderly men with average age of 59 years.

On further analysis, we performed an examination of the correlation of the AHI index and parameters which represent known risk factors, such as the ESS, neck circumference and body mass index.

The results obtained from the ESS were in a positive correlation with the AHI index acquired by RP ($p < 0.0001$; $R = 0.53$, $n = 61$) (Figure 1).

We found that the patients with the increased neck circumference had a higher AHI index ($p < 0.0001$; $r = 0.46$, $n = 49$). The correlation between the raised body mass index and the higher AHI index was: $p < 0.0001$; $r = 0.49$, $n = 61$ (Figures 2 and 3).

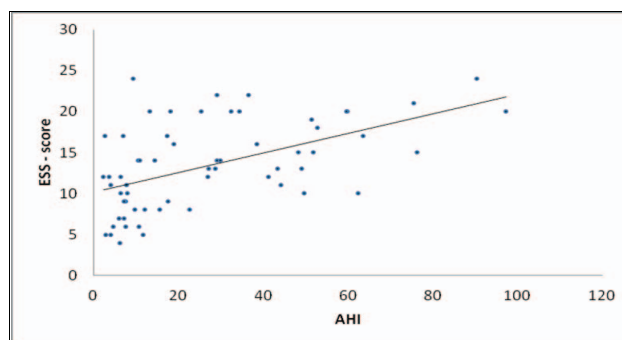


Fig. 1 – Correlation between the ESS score and AHI index.
ESS – Epworth sleepiness scale; AHI – apnea-hypopnea index.

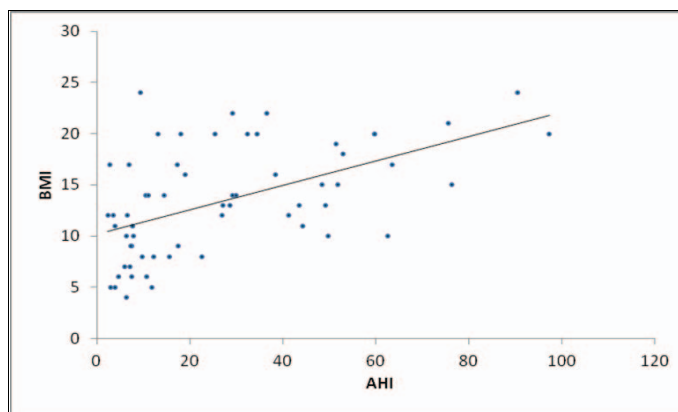


Fig. 2 – Correlation between the BMI and AHI index.
BMI – body mass index in kg/m^2 ; AHI – apnea-hypopnea index.

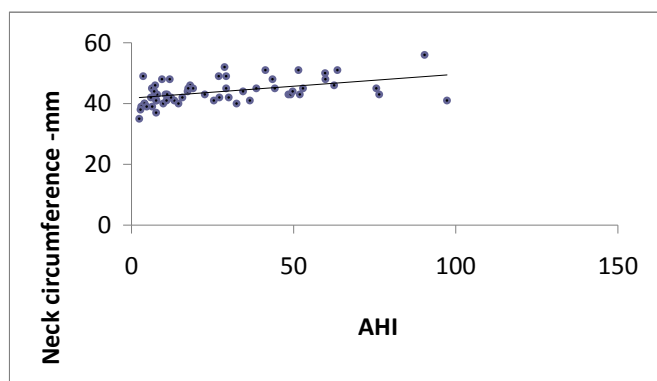


Fig. 3 – Correlation between neck circumference and AHI index.
AHI – apnea-hypopnea index.

Discussion

Verification of obstructive sleep apnea is the most important step in the process of diagnosis and successful treatment. Although PSG is recommended as a “gold standard”, there is a growing interest in the alternative diagnostic methods that could quickly and easily give the same or similar data.

In support of this fact is an increasingly frequent application of RP, especially in the pediatric population¹⁷.

Besides accepting RP by the clinician, a need for the new diagnostic methods has been recognized by the relevant world organizations.

Based on the number of measured variables, the American Academy of Sleep Medicine (AASM) classified the sleep study into four main types out of which the three of them can be performed with the portable monitoring¹⁸.

Despite the fact that the portable devices measured the same parameters as PSG, there are authors who believe that the portable monitoring has variable sensitivity and specificity for OSA.

These attitudes largely result in the lack of research on this type of devices¹⁹.

The existence of conflicting opinions did not reduce the interest for RP. Consequently, numerous studies confirmed the compatibility of the AHI index obtained after PSG and RP.

In one big study, Iber et al.²⁰ showed that portable devices displayed a very low degree of failure in diagnosing apnea.

Other studies proved the acceptable sensitivity and specificity of portable devices with a very low percentage of falsely positive results (about 3%)²¹.

In a randomized study, Campbell and Neill²² pointed that a portable diagnosis without supervision was proven to be an adequate PSG alternative.

This knowledge encouraged us to perform our study whose aim was to examine the effectiveness of RP in the diagnosis of OSA.

The results we obtained mostly confirmed well-known views on the possibilities of RP.

The population of our examinees had the typical demographic characteristics of people with obstructive sleep apnea, having been largely made up of elderly and middle-aged men, which is consistent with previous findings.

By examining the correlation between the results obtained by the ESS and the AHI index determined by RP, we demonstrated a positive correlation between these two parameters. In other words, the higher the score on the test, the higher the AHI index.

We examined the relationship between the neck circumference and AHI index and we also got a positive correlation.

Similarly happened when we compared the value of body mass index with the AHI index obtained by RP because

we proved a positive correlation between these two parameters. The greater body mass index was associated with the higher index of AHI.

Our results showed that there was no inferiority of RP compared to PSG in diagnosing the obstructive disorders of breathing during sleep.

Of course, our conclusions, and the conclusions of other authors are primarily related to OSA in conditions where there are no significant comorbidities^{23,24}.

Conclusion

Although PSG is the "gold standard" in the diagnosis of obstructive sleep apnea, RP can be an adequate substitute especially when it comes to the obstructive disorders.

The significance of this method is even greater if we take into account the fact that RP is significantly more favorable financially, technically simpler and therefore more accessible for wider use.

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