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Original Article

Evaluation of sleep apnea prevalance among driving license applicants

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Abstract

Aim: This study aimed at evaluating the PSG results of the applicants of driving license by reference to the BMI, and investigating the accuracy of this cutoff value of BMI (33) on detecting the patients with OSAS among the applicants of driving license

Materials and Methods: Driving license applicants with a BMI <33 constituted the control group, with a BMI =33-36 constituted the group A and with a BMI >36 constituted the group B. The AHI levels of the groups were compared, and ROC analyzes were performed to detect accurate BMI values.

Results: Median AHI values did significantly differ among three groups (p<0.001). median AHI was statistically significantly higher in group A (median AHI: 12.5) and in group B (median AHI: 12.9) compared to the control group (median AHI: 2.4) (p<0.001). However, there was no significant difference between the median AHI of the group A and B (median AHI: 12.5 vs. 12.9) (p= 0.336). Additionally, 34 was found to be the cut-off value for BMI suggesting that AHI could be 15 and/or above; and 34.8 was found to be the cut-off value for BMI suggesting that AHI could be 30 and/or above.

Conclusion: Patients with a BMI over 33 had a greater AHI compared to the patients. Additionally, 34.8 value was found to be the cut-off value for BMI suggesting that AHI could be 30 and/or above.

Keywords: AHI; BMI; driving license; sleep apnea

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a common disease in general population that seriously reduces the quality of life. OSAS is defined as a clinical syndrome characterized by recurrent partial or complete airway obstruction episodes during sleep in the 3rd edition of International Classification of Sleep Disorders (1). Recurrent oxyhemoglobin desaturation and arousals occur because of upper airway collapse during sleep. This causes disruption in sleep structure and also results in adverse conditions such as daytime sleepiness, headache, cognitive dysfunction and reduced ability to concentrate (2). BMI rise has been showed to be associated with a significant increase in the prevalence of sleep apnea (3).

Because the symptom of daytime sleepiness might be a cause of traffic accidents, detecting the patients with OSAS among the applicants of driving license is crucial. For this purpose, Turkish official regulation (4) strictly requires a whole- night polysomnography (PSG) on the applicants of driving license with a BMI greater than 33. In this study, we aimed at evaluating the PSG results of the applicants of driving license by reference to the BMI, and investigating the accuracy of this cutoff value of BMI on detecting the patients with OSAS among the applicants of driving license.

MATERIALS and METHODS

This study was conducted in line with the dictates of the World Medical Association Declaration of Helsinki and approved by the local ethic committee. Among the driving license applicants, the individuals with a BMI <33 constituted the control group, the individuals with a BMI ≥33 constituted the study groups. The group A consisted of the individuals with a BMI between 33 and 36; and the group B consisted of the individuals with a BMI >36. Excluded from the study were the patients with any history of pulmonary or cardiac surgery and with a chronic obstructive pulmonary disease. All patients underwent whole- night PSG test and their results were evaluated. Patients diagnosed with moderate and severe apnea were re-titrated and treated with a proper PAP device. The AHI values of the groups were compared.

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Statistical Analysis

Results are presented as mean ± standard deviation median (min-max). The distribution pattern of the data was investigated using the Kolmogorov- Smirnov normality test. The age data did distribute normally, thus, compared using the one-way analysis of variance. AHI values did not distribute normally, thus compared using the Kruskal- Wallis test. Mann Whitney U test was used as the post hoc test for advanced comparisons of median AHI values between two groups. The gender distribution of the groups was compared using the Chi-square test. All statistical analysis was performed using SPSS 23 software for Windows (SPSS Inc., Chicago, IL, USA). A p-value under 0.05 was considered statistically significant. However, Bonferroni correction rule was taken into consideration for post hoc comparisons and it was considered significant when p-value was under 0.05/3=0.017.

RESULTS

A total of 103 patients were included in the study. The group A (driving license applicants with a BMI between 33 and 36) consisted of 24 individuals (20 males and 4 females, mean age: 46 ±17 years), the group B (driving license applicants with a BMI over 36) consisted of 26 individuals (20 males and 6 females, mean age: 42 ±15 years), and the control group consisted of 53 individuals (34 males and 19 females, mean age: 44 ±12 years). The groups were age (p= 0.55) and gender- matched (p= 0.17, X^2 =3.45).

The Kruskal Wallis test revealed that, median AHI values did significantly differ among three groups (p<0.001). The median AHI value was statistically significantly higher in group A (median AHI: 12.5) and in group B (median AHI: 12.9) compared to the control group (median AHI: 2.4), (p<0.001). However, there was no statistically significant difference between the median AHI values of the group A and B (median AHI: 12.5 vs 12.9) (p= 0.336).

BKI	Sensitivite	1- Spesifite
33,200	,950	,361
33,400	,900	,349
33,600	,850	,337
33,750	,850	,325
33,850	,850	,301
34,150	,750	,277
34,450	,700	,265
34,600	,650	,265
34,800	,650	,253
35,050	,600	,241
35,300	,600	,217

Figure 1. The sensitivity and 1 – specificity ranking resulting from the ROC analysis performed to determine the cut-off value suggesting that AHI could be 15 and above

Figure 1 presents the sensitivity and 1 – specificity ranking obtained from the ROC analysis performed to determine the cut-off value suggesting that AHI might be 15 and/or above. Accordingly, 34 value, which is between the two most ideal sensitivity and specificity values (sensitivity: 75-85%, specificity: 70-72%), was found to be the cut-off value for BMI suggesting that AHI could be 15 and/or above.

Figure 2 presents the sensitivity and 1 – specificity ranking obtained from the ROC analysis performed to determine the cut-off value suggesting that AHI might be 30 and/or above. Accordingly, 34.8 value, which is between the two most ideal sensitivity and specificity values (sensitivity: 82%, specificity: 73%), was found to be the cut-off value for BMI suggesting that AHI could be 30 and/or above.

BKI	Sensitivite	1- Spesifite
34,450	,909	,283
34,600	,818	,283
34,800	,818	,272
35,050	,727	,261
35,300	,727	,239
35,500	,727	,228
35,650	,727	,217
35,850	,727	,207
36,050	,727	,196
36,550	,636	,185
37,050	,636	,174
37,150	,636	,163

Figure 2. The sensitivity and 1 – specificity ranking resulting from the ROC analysis performed to determine the cut-off value suggesting that AHI could be 30 and above

DISCUSSION

According to the Disease Control and Prevention Center 2016 data, one of the most important causes of death in the world is motor vehicle accidents. Sleepiness during driving session is closely related to motor vehicle accidents. The rate of sleep-related traffic accidents has been reported between 3% and 33% in studies conducted in various countries in recent years (5-9).

Patients with OSAS might have significant daytime-sleepiness, as an important risk factor for motor vehicle accidents and according to the prior literature, patients diagnosed with OSAS are more likely to be involved in traffic accidents than in normal population(10). Moreover, obesity is known as one of the most important risk factors for OSAS, and the prevalence of OSAS increases as the prevalence of obesity increases (11).

In various studies, the risk of traffic accidents in OSAS has been more closely associated with daytime sleepiness rather than apnea hypopnea index (AHI), the objective parameter for measuring the severity of sleep- disordered breathing (12-15). However, in studies conducted by Terán-Santos et al. and Mulgrew et al., AHI was found to be a better predictor factor for assessment of traffic accident risk in OSAS patients than the Epworth Sleepiness Scale (ESS), which is a subjective test for evaluating OSAS(10, 16). In our study, we aimed to investigate the importance

of the level of BMI on predicting the presence of OSA, in association with the AHI. Our results suggested that, the patients with a BMI over 33 have an increased risk of having OSAS. However, as BMI increases, the prevalence of OSAS may also increase. Because the median AHI levels did not significantly differ between the patients with a BMI =33-36 and the patients with BMI>36, we performed two different ROC analyzes, considering BMI as a predictor of the level of AHI.

In a study conducted by Howard et al. excessive daytime sleepiness, sleep disordered breathing and obesity prevalence were found to be higher in commercial vehicle drivers (17). In another study Pack et al. showed that OSAS prevalence in commercial vehicle drivers was 28.2%(18). Accordingly, in a study including 282 commercial vehicle drivers in Turkey, performances of obese drivers were significantly poor in simulator vision test(19).

In studies conducted in patients with OSAS, an increase in the severity of disease was found to be associated with weight gain and BMI increase (20). Peppard et al. showed that a 10% change in BMI caused a 30% change in AHI, which is the major marker indicating the severity of sleep apnea (21).

The European Union Directive on driving license was updated in 2014, accordingly, untreated moderate to severe OSAS with excessive daytime sleepiness leads to driving inabilities (22,23). The European Driving License Regulatory Commission Working Group agreed that when OSAS has been treated successfully by any effective therapy, and in the case of this treatment method is CPAP, with a compliance 4 hour per night for at least 1 month, drivers could be considered as safe drivers (24). Like European Union countries, the individuals with moderate or severe OSAS with excessive daytime sleepiness cannot receive a driving license without a sufficient treatment in Turkey. Considering the prevalence of OSAS in the community, the number of PSG tests that are required to make diagnosis of OSAS might be obviously high. In this study, we aimed to reveal the correct AHI value that will really cause OSAS leading to driving inabilities, thus, to reduce the unnecessary workload and cost- burden of sleep laboratories by eliminating unnecessary PSG requests. According to our statistical analysis, the cut-off value required in the Turkish official regulation (4) should be revised (BMI=34.8 for AHI>30), to avoid the overwork load and financial burden of unnecessary tests.

The gold standard test for the diagnosis of OSAS is PSG test with at least seven or more channels including electrooculogram, electromyogram, electrocardiogram and respiratory channels. Given the limited number of sleep centers in Turkey, PSG is not easily accessible test and every unnecessary test causes a serious burden on public health sources Therefore, preventing unnecessary tests with some legal regulations is crucial. According to the current regulation (4), all driver candidates with a BMI of 33 and above are directed to sleep centers for PSG test. However, it causes an overwork load in sleep centers. Based on the prior literature, the current cut-off value of BMI>33 seems not related to any scientific basis, and our study could be a scientific mainstay for future updates of the Turkish official regulation. Additionally, despite effective OSAS treatment, daytime sleepiness can continue in cases of psychiatric disorders such as chronic insomnia, central sleep apnea syndrome, narcolepsy, depression and use of some medications, which have side effects. This point also should be taken in consideration in the treatment and evaluation of driver candidates (25).

CONCLUSION

In conclusion, the patients with a BMI over 33 had a greater AHI compared to the patients. Additionally, 34.8 value was found to be the cut-off value for BMI suggesting that AHI could be 30 and/or above. However, for an absolute requirement of any legal regulation, further multicenter and prospective studies conducted on larger groups are needed.

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: All procedures performed in this study were in accordance with the ethical standards of local ethical committee of Giresun University.

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