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TANAFFOS

Association between Occupational Accidents and Sleep Apnea in Hospital Staff

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Background: Obstructive sleep apnea syndrome (OSAS) is a common disorder in which instability of the upper airways leads to a reduction or cessation of airflow during sleep. Sleep disorders such as OSAS increase the risk of occupational accidents and impaired work performance. Sleep deprivation during shift increases the risk of occupational accidents among health care employees. The purpose of this study was to determine the association between occupational injuries in hospital staff and the risk of sleep apnea.

Materials and Methods: This cross-sectional study was conducted on hospital staff of Masih Daneshvari Hospital in 2012. In this study, the hospital staff's (715) response to the Berlin questionnaire plus additional information including a history of an occupational accident, night shifts, less than four hours of night sleep, history of smoking, chronic disease and quality of sleep were assessed. Information obtained was analyzed using SPSS 15.

Results: In general, 27.6% reported a history of occupational accidents. The incidence of occupational accidents in the high-risk group for sleep apnea was significantly higher than the low-risk group (OR=2.736, CI=1.522-4.917, P=0.001). The results of logistic regression analysis also showed a statistically significant association between occupational accidents and risk of sleep apnea (OR = 2.247, CI = 1.194-4.231, P= 0.012).

Conclusion: This study showed that the incidence of occupational accidents in the hospital employees is strongly related to the probability of OSA. Therefore, special attention should be directed to respiratory sleep disorders in order to reduce occupational injuries at hospitals.

Key words: Sleep Apnea, Obstructive; Accidents, Occupational; Health Personnel

INTRODUCTION

Obstructive sleep apnea syndrome is a common disease. The results of studies carried out to assess the prevalence of OSA have indicated significant numbers in Iranians (1, 2). The disorder is a result of instability of the upper airways. This leads to the reduction or cessation of airflow through the nose and mouth during sleep. A number of studies have been carried out on the prevalence of OSAS in some professions such as drivers (3). Daytime sleepiness among employees of health care centers is important and should be taken seriously as they deal with peoples' lives. Moreover, health care staff working night shifts are most likely to suffer from drowsiness. Snoring may exacerbate the condition.

Sleep deprivation in health care staff may have adverse effects and result in an increase of procedural errors in patient care as well as occupational accidents (4). Epidemiological studies have focused on the role of work schedule in fatigue-related accidents and the importance of sleep disorders has been overlooked in this regard (5, 6). To accurately determine the prevalence of OSAS as a type of sleep disorder, polysomnography is required. Polysomnography is very time-consuming and costly. Therefore, it is impossible to proceed with polysomnography for all the staff. The Berlin questionnaire is a tool developed by international consensus among pulmonologists and family physicians. It is applied in community-based and clinical samples worldwide (4). In Iran, several studies have been carried out using the Berlin questionnaire in the general population (1, 2). However, this study is one of the few studies carried out to determine the risk and symptoms of OSA in health care employees using the Berlin questionnaire.

Several papers have shown that sleep disorders such as snoring and OSAS increase the risk of occupational accidents and impaired work performance (7-9). Occupational medicine specialists play a significant role in the diagnosis as well as treatment and can provide patients with necessary information. In addition, untreated OSAS increases the urgent need for special health care. It is associated with impaired job performance as well. As a result, its financial burden is significant and accounts for billions of dollars spent yearly (10). An efficient hospital employee requires concentration, alertness and wakefulness. Health care staff usually lack the required concentration, alertness and wakefulness because of night shifts. If a health care worker is categorized as high-risk in terms of OSAS that causes daytime sleepiness, this issue requires assessment. We assessed sleep apnea and sleepiness and its association with occupational accidents in our study.

MATERIALS AND METHODS

The study was carried out at the National Research Institute of Tuberculosis and Lung Diseases of Masih Daneshvari Hospital in 2012. In this cross-sectional study, the study population included the hospital staff.

The response of the hospital staff to the Berlin questionnaire prepared by the researchers regarding a history of an occupational accident, working night shifts, less than four hours of night sleep, history of smoking, chronic disease and sleep quality was analyzed. The standard Berlin questionnaire was translated and used. The questionnaire included 10 questions and consisted of three parts: The first part focused on snoring characteristics and the noticing of interruption of breathing during sleep by their family. The second part related to fatigue and sleepiness during the day or falling asleep while driving and the third part was devoted to a history of hypertension and BMI over 30. Cases that scored positive in two out of the three parts of the defined criteria in the questionnaire were considered high-risk for OSA (4)

Assessment of the quality of sleep included questions relating to difficulty falling asleep, difficulty staying asleep and waking up too early.

To evaluate the reliability and validity of the questionnaire prepared by the project researchers, the questionnaire was reviewed by several skilled professionals in the field. A pilot study was conducted one month prior to the start of the original study. After carrying out a pilot study and the completion of the questionnaire by 30 people, Cronbach's alpha was calculated to be 87%. The validity of the Farsi version of the Berlin questionnaire had formerly been approved by Amra et al. in 2013 (11). After assessment of validity and reliability of the questionnaire, during the annual periodic health examinations of the staff, those who were willing to participate in the research were asked to complete the questionnaire. The anonymous questionnaire was completed in presence of an expert. The respondents were reminded about the significance of accuracy in completing

the questionnaire. In the case of those who were unable to complete the questionnaire, the questionnaire was completed by an expert. A total of 715 persons completed the questionnaire (response rate of 89.4%) and the data obtained were statistically analyzed using SPSS 15 software (Microosft, IL, USA). The association between sleep apnea and the other studied risk factors and the incidence of occupational accidents were analyzed using the chi square test. Confounding variables were assessed by logistic regression analysis. The level of significance was set at 0.05. In this study, all ethical considerations listed in the Helsinki Agreement, including voluntary participation of respondents and obtaining respondent's informed consent, as well as confidentiality of information were followed. The study was approved by the ethics committee of Masih Daneshvari Hospital.

RESULTS

Out of 800 hospital employees who received the questionnaire, 715 completed the questionnaires. Of these 715 people, 449 (62.8%) and 246 (34.4%) were females and males, respectively; 20 (2.8%) did not report their gender. The mean age was reported to be 33.51 years (SD=7.65); 436 (61%) were 35-years-old or less and 259 (36.2%) were over 35-years-old; in 20 cases (2.8%), age was not reported. In terms of marital status, 442 (61.8%) were married and 273 (38.2%) were single; 29 (4.1%) were smokers and 686 (95.9%) were non-smokers or had quit smoking. As for educational level, 409 (57.2%) had BSc/BA or higher academic degrees. Whereas, 306 (42.8%) did not have BSc/BA. Out of 715, 191 (26.7%) reported a history of chronic disease. However, 522 (73%) had no history of chronic disease and two (0.3%) did not respond to this question; 406 (56.8%) worked the night shift and 309 (43.2%) had no experience of night shifts; 367 (51.3%) reported less than four hours of sleep at night during last week, and 348 (48.7%) had no history of night sleep less than four hours. In terms of sleep quality, 218 (30.5%) had difficulty falling asleep, 233 (32.6%) could not stay asleep and 301 (42.1%) woke up too early.

As for the probability of sleep apnea, 49 (6.9%) were reported to be highly probable and 666 (93.1%) fell under the category of the low-probability. Prevalence of snoring was reported to be 12.6% (90) and 87.4% of the participants (625) did not mention it. The mean BMI was 25.17 kg/ m^2 (SD =8.85).

Also, 197 (27.6%) reported a history of occupational accidents; 518 (72.4%) mentioned no history of occupational accidents.

The association between the risk of occupational accidents and sleep apnea and other probable factors is summarized in Table 1. The incidence of occupational accidents in those who were in the high-probability group in terms of sleep apnea (OR = 2.736, CI = 1.522-4.917, P= 0.001), those over 35 years old (OR = 1.575, CI = 1.123-2.208, P= 0.008), people with bachelors degree or higher educational level (OR = 1.474, CI = 1.051-2.067, P= 0.024), people with a history of chronic disease (OR=1.576, CI=1.102-2.254, P=0.012), those who had experienced night sleep less than 4 hours per week (OR=1.867, CI=1.334-2.612, P=0.000), those who had trouble falling asleep (OR=2.720, CI=1.925-3.844, P=0.000), those who had trouble staying asleep (OR=2.023, CI=1.439-2.844, P=0.000), those who had experienced problems due to waking up early (OR=2.171, CI=1.553-3.035, P=0.000) and in those who worked night shifts was significantly higher (OR=0.569, CI=0.409-0.792, P=0.001) (Table 1).

The occurrence of occupational accidents and possibility of sleep apnea and other possible factors were assessed via logistic regression analysis. The results of this analysis showed that even after adjusting for confounding factors, the association of occupational accidents and possibility of sleep apnea (OR=2.247, CI=1.194-4.231, P=0.012), educational level (OR=1.454, CI=1.005-2.104 , P=0.047), difficulty falling asleep (OR=2.063, CI=1.388-3.065, P=0.000) and waking up too early (OR=1.682, CI=1.139-2.484, P=0.009) seemed to be statistically significant (Table 2).

Table 1. Association of occupational accidents with probability of sleep apnea and other possible factors

	Job Accident				
	Yes N (%)	No N (%)	Crude P value	Crude OR*	Crude CI 95%*
Apnea Risk					
High probability	24(49%)	25(51%)	0.001	2.736	1.522-4.917
Low probability	173(26%)	493(74%)			
Age Group					
> 35	87(33.6%)	172(66.4%)	0.008	1.575	1.123-2.208
≤ 35	106(24.3%)	330(75.7%)			
Sex					
Male	57(23.2%)	189(76.8%)	0.052	0.701	0.490-1.004
Female	135(30.1%)	314(69.9%)			
Marital status					
Not married	69(25.3%)	204(74.7%)	0.284	0.830	0.590-1.168
Married	128(29%)	314(71%)			
Smoking status					
Yes	11(37.9%)	18(62.1%)	0.202	1.643	0.762-3.544
No	186(27.1%)	500(72.9%)			
Education group					
Graduate (or postgraduate student)	126(30.8%)	283(69.2%)	0.024	1.474	1.051-2.067
Under Graduate	71(23.2%)	235(76.8%)			
Chronic Disease History					
Yes	66(34.6%)	125(65.4%)	0.012	1.576	1.102-2.254
No	131(25.1%)	391(74.9%)			
Night Shifts					
Yes	92(22.7%)	314 (77.3%)	0.001	0.569	0.409-0.792
No	105(34%)	204 (66%)			
Night Sleep Less than 4 h.					
Yes	123(33.5%)	244 (66.5%)	0.000	1.867	1.334-2.612
No	74(21.3%)	274 (78.7%)			
Sleep Onset Problem					
Yes	91(41.7%)	127 (58.3%)	0.000	2.720	1.925-3.844
No	103(20.9%)	391 (79.1%)			
Sleep Continuation Problem					
Yes	87(37.3%)	146 (62.7%)	0.000	2.023	1.439-2.844
No	109(22.8%)	370 (77.2%)			
Early Wake-up					
Yes	109(36.2%)	192 (63.8%)	0.000	2.171	1.553-3.035
No	85(20.7%)	325 (79.3%)			

Table 2. Association of occupational accidents with possibility of sleep apnea and other possible factors using logistic regression analysis

	95% CI	OR	P value
Apnea risk	1.194-4.231	2.247	0.012
Age group	0.991-2.101	1.443	0.056
Education level	1.005-2.104	1.454	0.047
Chronic disease history	0.750-1.682	1.123	0.574
Night shifts	0.523-1.105	0.760	0.151
Night sleep less than 4 h.	0.839-1.826	1.237	0.283
Sleep onset problem	1.388-3.065	2.063	0.000
Sleep continuation problem	0.627-1.477	0.962	0.860
Early wake-up	1.139-2.484	1.682	0.009

DISCUSSION

The results of this study showed that the prevalence of occupational accidents in hospital employees was 27.6%. In a study by Vaz et al., 59% of the hospital staff reported a history of one or two occupational injuries; whereas, 14% had a history of more than two occupational accidents (12). In our study, the prevalence of high-risk groups in terms of the sleep apnea was reported to be 6.9%. However, in the Iranian society and by means of the same questionnaire used in our study (Berlin), the prevalence in high-risk groups was reported to be 4.98% and in another study it was reported to be 27.3% (1, 2). The difference between the results of our study and those of the previous studies carried out in Iran can be attributed to the fact that unlike the previous studies, our study aimed at a particular occupation. In our study, occupational injuries occurred more in high-probability groups in terms of the risk of

having sleep apnea. This association was also confirmed in a study conducted on nurses and physicians in a university hospital by Soylu et al (13). In their study, 28.8% reported a history of snoring (13); whereas in our study 12.6% reported a history of snoring. In a study by Ulfberg et al., the risk of occupational accidents in men suffering from heavy snoring was two times higher and it was found to be increased by 50% in men with OSAS. However, the risk of incidence of occupational accidents in women with heavy snoring and OSAS was three times higher (14).

In Iran, the association between occupational accidents and the probability of sleep apnea has also been determined by the Berlin sleep questionnaire among other occupations such as drivers (15). It is necessary to increase public knowledge on this issue and physicians should be trained on the importance of alertness and should be informed on measures to help them prevent harm to themselves as well as to others (16). According to our study, other factors affecting the incidence of occupational accidents included age, level of education, history of chronic disease, night sleep less than four hours and some sleep disorders. Occupational accidents occurred more in the age group over 35 years, as compared to a younger age group of below 35. This result may be due to low energy and fatigue in older age groups (17). Research has shown that the history of occupational accidents in people with different characteristics such as different levels of education is different since the definition of the word is different (18). In our study, the risk of occupational accidents in people with higher levels of education was reported to be significantly higher.

The relation between the occurrence of occupational accidents and sleep disorders has been confirmed in other studies as well. Akerstedt et al. showed a relative risk (RR) of fatal occupational accidents of 1.89 times in patients with sleep problems (19). In the recent study and as reported by Uehli et al, short night sleep was associated with the incidence of occupational accidents (20). According to the results of our study, there was a relation between age and the risk of occupational accidents. This result was confirmed by Uehli et al, as well (20). The association between the incidence of occupational accidents and the history of chronic disease can also be attributed to fatigue, a major cause of occupational injuries, (17) occurring as a result of chronic disease (21). In addition, some studies have also shown the relation between chronic diseases such as chronic obstructive pulmonary disease and the risk of OSA (22). According to this, the higher incidence rate of occupational injuries in patients suffering from chronic diseases may be due to higher probability of OSAS.

Suzuki et al. showed that there was a direct correlation between the risk of occupational accidents and night shifts (5). However, the results of our study were quite the opposite as those with a history of night shift reported fewer occupational accidents. The difference may be attributed to the fact that our study included all the hospital staff including physicians, nurses, cleaners, etc.; while Suzuki et al. included only nurses. Compared to other occupational groups in health care systems, nurses' daily workload is almost the same as their night workload. However, in other occupational groups night workload may be less than daily workload and this may reduce the incidence of occupational accidents.

In general, studies have shown that sleep disorders impose heavy costs on the society both directly and indirectly (23). Economic loss due to untreated OSA is around billions of dollars per year, and therefore requires special attention (10). After adjusting for the confounding factors, the association between the risk of occupational accidents and sleep apnea, level of education, difficulty in falling asleep and waking up early indicates the importance of such factors (especially the risk of sleep apnea that showed the highest odds ratio) in the occurrence of occupational accidents. Special attention should be paid to these risk factors in order to prevent the incidence of occupational injuries. Larger studies focusing on these possible risk factors are recommended.

One of the limitations of this study was that by using the Berlin questionnaire, it was not possible to determine

whether or not the respondent was affected by sleep apnea. In this research, we determined the risk of incidence of occupational accidents in relation with the risk of sleep apnea since accurate diagnostic methods such as polysomnography for such a large sample size are too costly.

CONCLUSION

The results of this study showed that the incidence of occupational accidents in hospital employees is strongly associated with the risk of OSA, and other factors such as other sleep disorders are involved as well. Paying special attention to sleep disorders such as OSA may be an important step in reducing injuries from occupational accidents in hospital staff.

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