Original Research

Motor Vehicle Accidents in Patients with Excessive Daytime Sleepiness

Arezu Najafi[1], Khosro Sadeghniiat-Haghighi[1], Ahmad Khajeh-Mehrizi[2], Ania Rahimi-Golkhandan[1]*

[1.] *Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran*
[2.] *Department of Internal Medicine, School of Medicine AND Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran*

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Abstract

Background and Objective: Excessive daytime sleepiness (EDS) is a common problem in patients referred to sleep clinics, which could result in adverse consequences in their personal and social activities including motor vehicle accidents (MVAs). Epworth Sleepiness Scale (ESS) and Multiple Sleep Latency Test (MSLT) are known methods for measuring EDS. In this study, we aimed to evaluate the relationship between EDS and MVAs.

Materials and Methods: Medical records of 144 patients (106 men) with EDS referred to Baharloo Sleep Clinic, Tehran, Iran, were assessed in this cross-sectional study. All participants filled out a questionnaire including demographic characteristics, ESS, and history of MVAs due to sleepiness in the last five years and underwent full-night polysomnography (PSG) and MSLT. Sleepiness was categorized to normal, moderate, or severe according to mean sleep latency (MSL) in MSLT.

Results: Patients with history of MVAs had a significantly less MSL and higher ESS scores than those without MVAs (6.6 ± 3.9 vs. 9.3 ± 6.5, P = 0.038; and 17.9 ± 4.4 vs. 15.6 ± 5.5, P = 0.030, respectively). MVAs were reported in 41.9%, 31.0%, and 16.1% of patients with severe, moderate, and normal sleepiness, respectively. There was a significant relationship between severity of sleepiness and history of MVAs (P = 0.020). Regression analysis showed that after adjustment for age and sex, ESS and MSL remained significantly different between patients with and without MVAs.

Conclusion: ESS score and MSL would help sleep clinicians to find high-risk patients for safety-sensitive jobs, the issue which should not be overlooked by them during visits in sleep clinic.

Keywords: Sleep; Traffic accidents; Sleep latency

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Introduction

Excessive daytime sleepiness (EDS) is a common complaint among patients referred to sleep clinics. Up to 36 percent of adults suffer from EDS (1-3). In general population, insufficient sleep at night is the most common reason for EDS, whereas narcolepsy, severe obstructive sleep apnea (OSA), and insomnia are the major causes of EDS in patients referring to sleep clinics.

EDS is accounted as a considerable issue for occupational and driving settings due to its serious consequences like motor vehicle accidents (MVAs) (4). Shift working, jet lag, and occupational exposure to some solvents and chemicals may result in EDS (5, 6). MVA is a main cause of mortality in many countries especially in Iran (7). According to the relevant studies, daytime sleepiness in commercial drivers plays an important role in MVAs (8). Furthermore, patients with narcolepsy have many difficulties in their daytime activities, so that they report more driving problems and car accidents than general population (9).

Epworth Sleepiness Scale (ESS) is a well-known questionnaire for measuring EDS (10). ESS is more reliable in sleep clinic settings, because the symptoms are reported honestly. However, in occupational settings, self-reported symptoms provide less reliable information. Patients in

* ***Corresponding author***: *A. Rahimi-Golkhandan, Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran*
Tel: +98 21 55677333, Fax: +98 21 55648189
Email: aniarahimi.g@gmail.com

such settings avoid reporting their symptoms in fear of losing their job (11-13).

Multiple Sleep Latency Test (MSLT) after overnight polysomnography (PSG) is used as an objective method for diagnosing the cause and severity of EDS. All patients with MSLT have to undergo a PSG in the night before to rule out common sleep problems leading to daytime sleepiness (14).

Limited information regarding association of EDS and mean sleep latency (MSL) with MVAs among patients referred to sleep clinic is available in the region. Furthermore, traffic accidents are considered as one of the main causes of premature mortality in Iran, about 17000 deaths per year (15). Sleep disorders also have an important role in the etiology of traffic accidents (16). Thus, in this study, we aimed to evaluate the severity of daytime sleepiness and self-reported MVAs due to sleepiness among patients referred to sleep clinic.

Materials and Methods

Patients: A total of 144 patients with chief complaint of EDS referred to Baharloo Hospital, Tehran, Iran, from 2005 to 2017, were enrolled in this cross-sectional study. Patients routinely filled out a questionnaires including demographic characteristics, past history of MVAs in the last five years due to sleepiness, and ESS. All patients underwent MSLT after overnight PSG. Patients under age of 18 years old, those taking stimulants or sedatives, and those who were not willing to participate or perform MSLT were excluded from our study. Written consent was obtained from all the subjects.

Epworth sleepiness scale (ESS): ESS is a validated 8-item questionnaire for subjective evaluation of daytime sleepiness. Each question of ESS has a score from 0-3 according to the severity of sleepiness in different situations. Score $\geq$ 10 was categorized as EDS. For the purpose of the study, we used the Persian validated version of ESS (10).

Polysomnography (PSG): All patients underwent PSG as the gold standard test for various sleep disorders, especially OSA. Several body systems were monitored during PSG containing electroencephalography (EEG), electrooculography (EOG), electrocardiography (ECG), and electromyography (EMG). Respiratory Disturbance Index (RDI) was used as an indicator of OSA. RDI equal or greater than 30 was categorized as severe OSA (17).

Multiple sleep latency test (MSLT): The MSLT is known as the gold standard test to evaluate daytime sleepiness. This test consists of four or five naps done at 2-hour intervals. For assessing the occurrence of rapid eye movement (REM) sleep, nap was terminated after 15 minutes from the first epoch of sleep.

Two main results of this test are MSL and numbers of naps with sleep onset REM periods (SOREMPs) (17).

The severity of sleepiness was classified according to MSL as follows: a) normal sleepiness, MSL > 10 minutes; b) moderate sleepiness, 5 minutes $\leq$ MSL $\leq$ 10 minutes; and c) severe sleepiness, MSL < 5 minutes (18).

Statistical analysis: All measurements are presented as mean ± standard deviation (SD) or frequency and percentage. Mann–Whitney U test was used for comparing continuous variables. Chi-square test was performed to compare sex distribution between subjects with and without MVAs. Binary logistic regression analysis was performed for controlling the effect of age and sex on the relationship between the MVAs and MSL as well as between MVAs and ESS. The Cochran-Armitage trend test was used to determine the relationship between MSL and MVAs across the MSL groups. P-value < 0.050 was considered statistically significant. SPSS software (version 22, IBM Corporation, Armonk, NY, USA) was used for statistical analysis.

Results

106 (73.6%) patients were men (Table 1). A total of 80 motor vehicle crashes was reported by 36 subjects (25%) in the last 5 years due to sleepiness.

Table 1. Characteristics of studied patients with and without motor vehicle accidents (MVAs)

Variable	Total	Patients with MVAs (n = 36)	Patients without MVAs (n = 108)	P-value
Age (year)	37.8 ± 12.3	39.4 ± 11.8	37.2 ± 12.6	0.366
Sex (men)	106 (73.6)	29 (80.0)	77 (71.0)	0.328
RDI	14.2 ± 19.6 (Median: 8.5)	15.0 ± 17.7	14.4 ± 20.8	0.902
MSL (minute)	8.5 ± 6.0	6.6 ± 3.9	9.3 ± 6.5	0.038
ESS	16.1 ± 5.4	17.9 ± 4.4	15.6 ± 5.5	0.030

These values are represented as mean ± standard deviation (SD) or number (percent)
RDI: Respiratory disturbance index; MSL: Mean sleep latency; ESS: Epworth sleepiness scale; MVA: Motor vehicle accidents

There was a significant difference of MSL between patients with and without MVAs ($P = 0.038$). After adjustment for age and sex in logistic regression, MSL remained a statistically significant factor on MVAs ($P = 0.035$). Patients were divided into three groups based on their physiological sleepiness measured by MSL. The frequency of MVAs in 3 groups is showed in figure 1. MVAs were reported in 41.9%, 31.0%, and 16.1% of patients with severe, moderate, and normal sleepiness, respectively.

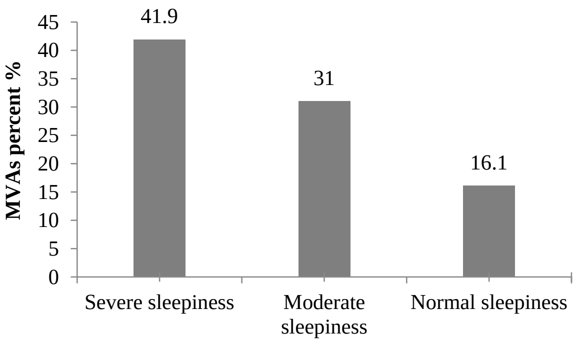

Figure 1. Motor vehicle accidents (MVAs) frequency in study participants in terms of daytime sleepiness

The Cochran-Armitage trend test showed a significant relationship between severity of sleepiness and history of MVAs ($P = 0.020$). After adjustment for age and sex and correction for the presence of OSA, subjects with severe sleepiness had an almost four-fold [odds ratio (OR) = 3.75, 95% confidence interval (CI) = 1.10-12.30] and two-fold (OR = 2.31, 95% CI = 0.69-7.70) risk of MVAs compared to participants with normal and moderate sleepiness, respectively

ESS score in patients with a history of MVAs was significantly higher than those without MVAs ($P = 0.030$). After adjustment for age and sex, ESS difference remained statistically significant between patients with and without MVAs ($P = 0.039$). RDI and ESS had a weak relationship in our study ($r = 0.150$, $P = 0.068$). There was a negative insignificant correlation between ESS and MSL ($r = -0.185$, $P = 0.057$).

Discussion

The current study indicates that with increasing daytime sleepiness, chance of MVAs rises significantly. Participants' MSL in MSLT was also correlated with increased risk of self-reported MVAs. Driver sleepiness is one of the major causes of MVAs in different studies (19). In our study, ESS score was significantly higher in patients with MVAs. Some studies on commercial drivers did not find any relationship between ESS and MVAs (7). Commercial drivers may not respond honestly to ESS because of the risk of losing their jobs (20). As in the current study, the participants were not referred for occupational health evaluation to receive health license, ESS scores may be more reliable and have more accuracy than occupational settings. Subjective reports in sleep clinic settings are more honest and compatible to objective tools.

If a comprehensive electronic health system setting could be available, health reports of drivers can be sent by physician in-charge to driver health authorities in case of lack of objective data like PSG.

In our study, participants with decreased MSL had more MVAs. We had a significant relationship between three groups of MSL and MVAs. Consistent with Drake et al. study (4), the rate of MVAs in patients with severe sleepiness was greater than two other groups with moderate and normal sleepiness.

The frequency of accidents may be underestimated, because some of the patients may refuse to drive due to their fear of having MVA because of severe sleepiness.

MSL and ESS had a negative relationship in this study, although the association was not statistically significant. MSL decreases when ESS score is rising. Similar studies also reported negative correlation between ESS score and MSL (21). ESS and Apnea–Hypopnea Index (AHI) had a weak relationship in the current study. In other studies, no correlation between ESS and AHI was reported (22). Because of more accidents reported in patients with EDS and narcolepsy (9), using some objective methods seems to be necessary.

History of accidents was first asked in a yes/no question; and if the participant answered yes, then the number, type, and time of accidents were also inquired. The past five-year history of accidents was considered, which may be subject to recall bias. We did not have details of participants' accidents such as type of vehicle and duration of driving experience before accident. External validity in sleep clinic patients is also limited.

Conclusion

ESS as a subjective and MSL as an objective measure could help clinicians to find high-risk patients for safety-sensitive tasks and jobs such as driving. Patients with lower MSL may be unfit for safety-sensitive jobs and they should be warned by medical evaluation team, thus finding association between MSL and traffic accidents would be helpful in aforementioned subjects.

Conflict of Interests

Authors have no conflict of interests.

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