



## Sleep Quality among Patients with Mild Traumatic Brain Injury: A Cross-Sectional Study

Arash Mani<sup>1</sup>, Seyed Ali Dastgheib<sup>2\*</sup>, Asieh Chanor<sup>3</sup>, Hosseinali Khalili<sup>4</sup>, Laaya Ahmadzadeh<sup>5</sup>, Jamshid Ahmadi<sup>2</sup>

<sup>1</sup>Research Center for Psychiatry and Behavior Sciences and Community Based Psychiatric Care Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>2</sup>Substance Abuse Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>3</sup>Department of Psychiatry, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>4</sup>Shiraz Neuroscience Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>5</sup>Research Center for Psychiatry and Behavior Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

\*Corresponding author: Seyed Ali Dastgheib

Address: Substance Abuse Research Center, Shiraz University of Medical Sciences, Shiraz, Iran. Tel: +98-917-7203150; Fax: +98-71-36279319  
e-mail: adastgheib@sums.ac.ir

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### ► ABSTRACT

**Objective:** To evaluate and describe the sleep quality in seven subscales among the patients with mild traumatic brain injury (TBI) and compare it with normal patterns.

**Methods:** This cross-sectional study was conducted within a 6-month period from February to August 2014 in Shahid Rajaei trauma center of Shiraz. Participants were selected randomly from all adult (18-60 years of age) patients admitted during the study period with impression of mild TBI (GCS of more than 13). The patients' sleep quality and demographic characteristics were evaluated by Pittsburgh sleep quality index (PSQI) and self-report questionnaire, respectively. Results were compared with normal data, which extracted from the normative data of PSQI manual.

**Results:** Overall we included 60 patients with mild TBI with mean age of 36.2±13.4 years. All the patients had sleep disturbance. Among them there were 46 (76.7%) men and 14 (23.3%) women. The subjective sleep quality ( $p=0.01$ ), sleep latency ( $p=0.01$ ), habitual sleep efficiency ( $p=0.01$ ), sleep disturbance ( $p=0.01$ ), use of sleep medication ( $p=0.01$ ) and day time dysfunction ( $p=0.01$ ) were significantly impaired in patients with mild TBI when compared to normal values. There were no difference between men and women regarding the sleep quality. The sleep duration was comparable between the subjects and the normal values.

**Conclusion:** Patients with mild TBI have poor sleep quality which should be considered as one of the main factors in interventions after the injury and it might lead to better quality of life.

**Keywords:** Traumatic Brain Injury (TBI); Sleep quality; Pittsburgh sleep quality index (PSQI).

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## Introduction

**T**raumatic brain injury (TBI) is an alteration in brain function or other brain pathologies caused by an external pressure and is a major cause of mortality and morbidity worldwide [1,2]. TBI patients do not only suffer from physical disorder, but also encounter cognitive, emotional and interpersonal problems. Their common sign and symptoms are amnesia, personality changes, fatigue, confabulation, irritability, delayed verbal and motor response, emotional lability, disorientation, speech problems, impaired executive functioning and sustained attention [3-8].

Regardless of the severity of brain injury, patients experience difficulties in sleep and wakefulness. Surprisingly sleep problems are more prevalent in minor TBI patients than severe cases. Their complaints are usually insomnia (delayed sleep onset, poor sleep maintenance and inadequate sleep), fatigue, sleepiness, circadian rhythm disturbance, nightmares, obstructive sleep apnea and sleep walking [1,2,9,10-13]. Insomnia might become a chronic problem and could persist even three years after trauma [14].

The pathophysiology of sleep problem is probably due to trauma to brain areas responsible for sleep regulation with diffuse axonal injury and neuronal metabolic and microscopic anatomy changes; however, we should also consider that headache, dizziness, anxiety and depression are more predictive of insomnia than Glasgow Coma Scale score [14,15], and it seems that medical and psychiatric disorders caused by trauma and subsequent medications play an important role in sleep difficulties. On the other hand, patients with sleep disorder are more sensitive to pain and demand for more medication which triggers a vicious cycle [1]. It is supposed that low levels of CSF hypocretine-I might be responsible for sleep difficulties after TBI [14,16].

No specific instrument has been developed for assessing sleep in TBI patients but Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS) are two scales which are validated for this reason (2,17-20).

Unfortunately sleep disturbances are not routinely assessed and considered in patients with TBI patients and limited data is available about management of insomnia in TBI patients. Thus the purpose of the present study was to evaluate sleep quality in seven subscales in patients with mild TBI.

## Materials and Methods

### Study Population

This was a descriptive cross-sectional study conducted using random sampling method from patients admitted Shahid Rajaee Hospital, the major center of trauma in the south of Iran, affiliated to Shiraz University of Medical Sciences, From February to August 2014.

The patients were selected from those admitted to our center during the study period with TBI and had even hospital bed numbers. All the patients were between 18 and 60 years old, and had at least primary education, Glasgow Coma Scale score of at least 13, at least 24 hours of hospital stay, no history of previous TBI and no severe orthopedic injury. We excluded those with comorbidities, those with severe abdominopelvic injuries, those with orthopedic fractures, those with moderate and severe TBI, those with linguistic barriers and those who did not agree to participate in the study. The study protocol was approved by the institutional review board and medical ethics committee of Shiraz University of Medical Sciences. All the participants or their guardians provided their informed written consents before inclusion in the study. Participants had the right to withdraw from the study at any time and also were ensured of the confidentiality.

### Study Protocol

The patients were examined by attending physician and a through history and complete physical examination was performed before inclusion in the study, the demographic information and the positive findings were recorded in the data gathering form. We used the Pittsburgh Sleep Quality Index (PSQI) in order to determine the sleep quality in the patients included in the study. PSQI is a valid and reliable scale which quantifies the patients' sleep in 7 subscales such as 1) Subjective sleep quality 2) Sleep latency 3) Sleep duration 4) Habitual sleep efficiently 5) sleep disturbance 6) use sleep medication 7) daytime dysfunction and finally total score (17). Malek and coworkers (2011) reported that the PSQI have acceptable reliability and validity in Persian. According to their research on 150 non-clinical participants psychometric characteristics are between 0.78 and 0.83 for all subscales [18]. The PSQI has normative table in its manual and in that table the mean±SD of normal population is presented. In the present study, this score was used as normal group and the individuals' scores were compared with this score.

### Statistical Analysis

The collected data via PSQI among TBI patients were analyzed by statistical package for social sciences (SPSS Inc. Illinois, USA), version 16.0. To evaluate the data, descriptive statistics (mean±SD) and mean comparison test for one sample test were used; in this type of analysis, the mean of the present study is compared with the normative mean score to estimate any differences and independent sample t-test use to evaluate the difference between men and women. A *p*-value less than 0.05 were considered statistically significant.

## Results

Overall 60 patients fully filled the study criteria

and were included in the study. The mean age of the patients was  $36.2 \pm 13.36$  (ranging from 18 to 65 years). There were 46 (77.6%) and 14 (22.4%) women among the patients. Although our study was conducted during the first day of the being traumatized, prevalence of sleep disturbance was equal to 100%. In other words, all of the subjects encounter with one or more sleep disturbance in subscales. The demographic characteristics of the patients are summarized in Table 1.

**Table 1.** Baseline characteristics of the 60 patients with mild traumatic brain injury included in the study.

Variable	Value
Age (years)	$36.2 \pm 13.36$
<b>Gender</b>	
Men (%)	46 (76.7%)
Women (%)	14 (23.3%)
<b>Marital status</b>	
Single (%)	17 (28.3%)
Married (%)	43 (71.7%)

Comparison of sleep quality in seven subscales between TBI patients and normative data represented that the TBI patients had worse sleep quality compared to the references data; these differences were statistically significant except in sleep duration subscale in which there was no differences between two groups. Table 2 compares the sleep quality subscales in patients with mild TBI and normal data of original normative study of the PSQI. Comparing gender difference in all seven subscales of PSQI represented that there is no differences between men and women. Table 3 compares the sleep quality subscales in men and women with mild TBI.

## Discussion

The main goal of the current study was to describe sleep quality among TBI patients admitted in a Level I trauma center. All the patients were visited according to the study protocol and their sleep quality was evaluated. Sleep quality is one of the main features of mental health which might be affected by TBI. We found that patients with mild TBI suffer from low sleep quality when compared to normal subjects. Several studies have evaluated the sleep quality in patients with mild TBI. They have reported that the prevalence of sleep disturbance is about 30-80% in patients with TBI. The wide range being reported in these studies is because of methodological differences between these studies [13,16,21-23].

In the current study, all sixty subjects had PSQI score  $>5$ ; this indicates that all of them had a degree of sleep difficulty. Similar to previous studies, TBI is associated with an increased risk of sleep disorders; however the higher prevalence could be due to methodological difference as we tested our admitted patients just few days after TBI when they did not have enough time to cope with stress while other studies evaluated the patients few months or years after trauma. Another issue is that our patients had mild TBI (GCS  $>13$ ) and as mentioned before, sleep problems are more prevalent in minor TBI cases. We could not find any difference between men and women regarding sleep parameters but due to the significant difference between the number of participants in the two groups, this data is not reliable.

In previous studies, the most common sleep disorder after TBI was insomnia followed by hypersomnia and obstructive sleep apnea [10] and

**Table 2.** Mean differences between patients with mild traumatic brain injury and normal subjects in sleep quality scale.

Sleep quality scale scoring	TBI <sup>a</sup>	Normal	p value
Subjective sleep quality	$2.25 \pm 0.57$	$0.6 \pm 0.54$	0.01
Sleep latency	$3.9 \pm 1.09$	$0.4 \pm 0.54$	0.01
Sleep duration	$0.73 \pm 0.95$	$0.8 \pm 0.44$	0.59
Habitual sleep efficiency	$0.4 \pm 0.71$	0±0	0.01
Sleep disturbance	$2.15 \pm 0.36$	$1.4 \pm 0.54$	0.01
Use sleep medication	$2.05 \pm 0.69$	0±0	0.01
Day time dysfunction	$2.08 \pm 0.56$	$1.2 \pm 0.54$	0.01
Total score	$13.61 \pm 3.49$	$4.4 \pm 0.54$	0.01

<sup>a</sup>TBI: Traumatic brain injury

**Table 3.** Comparing the sleep quality between men and women with mild traumatic brain injury.

Sleep quality scale scoring	Men (n=46)	Women (n=14)	p value
Subjective sleep quality	$2.19 \pm 0.54$	$2.42 \pm 0.65$	0.18
Sleep latency	$3.8 \pm 1.1$	$4.2 \pm 1.06$	0.19
Sleep duration	$0.72 \pm 0.98$	$0.78 \pm 0.89$	0.81
Habitual sleep efficiency	$0.46 \pm 0.75$	$0.21 \pm 0.57$	0.27
Sleep disturbance	$2.13 \pm 0.34$	$2.21 \pm 0.42$	0.45
Use sleep medication	$2.02 \pm 0.57$	$2.28 \pm 0.46$	0.57
Day time dysfunction	$2.02 \pm 0.57$	$2.28 \pm 0.46$	0.12
Total score	$13.4 \pm 3.4$	$14.35 \pm 3.8$	0.37

one research showed most problems in falling asleep and staying asleep [13]. In a control study, one year after head trauma 44% of patients had PSQI score >5 and TBI, compared to healthy group, had significant differences in five items of PSQI including sleep latency, sleep disturbance, day time dysfunction, subjective sleep quality and use sleep medication [21]. Just like this study, our patients had significant problems in those five items with the most prominent one being sleep disturbance item. The best items in our patients were sleep duration and sleep efficiency which again confirms previous data.

We note some limitations as our study was limited to a single trauma center and we tested patients in the first days of trauma. This may affect the study results in a negative way because patients do not have enough time for adaptation within first days of trauma. Thus future studies should be multicenter including larger study population and a longer period after the trauma.

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In conclusion, Sleep disturbance is a common ignored problem in patients with mild TBI that should be considered in any assessment and treatment planning.

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