The Relationship between Perceived Sleep Quality, Polysomnographic Measures and Depressive Symptoms in Chemically-Injured Veterans: A Pilot Study

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Objective: Sleep complaints are common among Iranian chemically-injured veterans. The growing body of research has investigated (in) equalities between such subjective complaints and objective sleep records. Moreover, sleep complaints are associated with depressive symptoms. Depressive symptoms, also, have been frequently reported in chemically-injured veterans. Therefore, the purpose of this pilot study was to investigate the relationship between perceived sleep quality, polysomnographic measures and depressive symptoms in Iranian veterans with chemical injuries.

Methods: In this pilot study, 35 Iranian veterans with chemical injuries complaining of a sleep problem were selected. Initially, participants were evaluated via all-night polysomnography, then, they completed the research questionnaires. Collected data were analyzed using Pearson correlation coefficients.

Results: Data analyses showed that there was no significant correlation between many of self-reposted variables and polysomnogaphic recordings, however, remarkable relationships were found between the Pittsburgh Sleep Quality Index and the Beck Depression Inventory scores.

Conclusion: The findings indicated that sleep complaints of chemically-injured veterans are not equivalent to objective sleep disturbances, however, these complaints are largely associated with level of depression. This study emphasizes the important role of mood in sleep evaluation. Further, the findings suggest using a combination of both subjective and objective measures for accurate assessment of sleep quality in Iranian veterans with chemical injuries (i.e., multimethod approach).

Keywords: *depression, polysomnography, sleep measures, veterans*

Chemically injured veterans experience a variety of physical and psychological sufferings; of which, sleep disorder is one of the most common complaints among them (1). According to research findings, these veterans report more sleep disturbances, in comparison with both the general population (2), and veterans with nonchemical injuries (3).

One of the growing areas of the study of sleep disorders is the investigation of (in)equalities between subjective measures (e.g. self-report instruments) and objective measures (e.g. laboratory methods such as polysomnography and actigraphy), as well as attempt to identify factors that can moderate or mediate such relationships. For example, the term of paradoxical insomnia which was previously called sleep state misperception, refers to the significant difference between the patients' perception of their sleep problems and data from objective sleep measurements. In other words, paradoxical insomnia is diagnosed when a patient complaints of difficulty initiating or maintaining sleep and no objective evidence of sleep disruption is found (4).

Some studies have reported significant differences between subjective and objective measures (5-8). In contrast, some other studies have found a significant association between objective sleep indices and patients' self-reports (9-12). Therefore, present evidence in this area is somewhat inconsistent. Furthermore, such similarities/differences can be largely disparate in various populations; therefore, the research results obtained with specific populations cannot be completely generalized to Iranian veterans with a chemical injury.

In addition, on the other hand, several studies have shown that there exists a significant relationship

between various sleep disorders and depressive symptoms (13-19). Also, depression is one common problem in persons with chronic respiratory problems (18, 19). And finally, the prevalence of depression in Iranian chemical warfare victims was found to be significantly higher than those who suffered from nonchemical injury (20).

Given the advanced arguments, this study aimed to investigate the relationship between perceived sleep quality and polysomnographic measures in Iranian veterans with a chemical injury. In addition, it was hypothesized that the level of self-reported depressive symptoms of Iranian chemically-injured veterans would be associated with the veterans' (mis)perceptions in their self-reported sleep problems.

Material and Methods

Participants

Thirty-five male patients were recruited from 71 consecutive Iranian veterans, chemically injured during Iran and Iraq warfare (1981-1989) complaining of a sleep problem, and attending and/or referred to a specialized sleep clinic in Baqiyatallah Hospital in Tehran from July 2011 to March 2012. The age range in the sample was 47 to 65 years (Mean: 53.1, SD: 7.3). Based on official medical records, all the participants were previously evaluated by the Iranian Veterans Medical Commission and approved to suffer from injuries induced by chemical warfare agents. None of the participants had a history of alcohol or substance/drug abuse. All of the participants did not take psychotropic medications and medications known to affect sleep, at least 3 months prior to the study. They had no history of the treatment sleep disorders.

Measures

Self-reports

In this study, the Pittsburgh Sleep Quality Index (PSQI) (9) an 8-item self-report questionnaire that consists of 7 components, was used for measurement of participants' subjective sleep quality. The psychometric properties of the Persian version of PSQI (PSQI-P) have been reported by Farrahi-Moghaddam, et al. (21). The level of depressive symptoms was assessed using of the Beck Depression Inventory-Second Edition (BDI-II) that is a 21-item self-report inventory (22). The Persian version of the BDI-II has satisfactory validity and reliability. (23). Higher BDI-II total scores indicate more severe depressive symptoms.

Polysomnography (PSG)

Standard all-night polysomnography was performed in order to obtain objective measurement of sleep. Briefly, polysomnography is an overnight test to evaluate sleep disorders via monitoring sleep stages, respiratory effort, oxygen saturation, heart rate, body position and limb movements (24). All polysomnographic measurements were performed between 11 pm to 6 am. For more detailed information about this protocol, see Loredo, et al. (25).

Procedure

The study protocol ethically was approved by the Board of Advanced Studies and Research of Baqiyatallah University of Medical Sciences in Tehran, which was responsible for the supervision of the current study. At the beginning of the study, the goals and procedures of the study were explained to participants and a written consent obtained from all of them, and they were informed about the purpose of the study, their right to either consent or refuse to participate, and to withdraw from the study at any point in time. Afterwards, participants' sleep was evaluated via polysomnography. Afterwards, participants completed the self-report questionnaires in the morning following the polysomnograpic recording night. After completing the data collection, appropriate therapeutic practices were carried out for all the participants .

Statistical analysis

Collected data were analyzed with SPSS software (SPSS V17.0, Chicago, IL, USA). To assess relationships between the research variables, Pearson product-moment correlation coefficients were performed. Analyses were run controlling for age, because it has been reported to be associated with both objective sleep disturbances.13,29 and subjective sleep estimations (12,27). The significance of 2-tailed tests were interpreted at $P < .05$.

Results

Descriptive statistics of the sample are shown in Table 1. According to the results, fourteen participants (40%) reported good sleep quality (total PSQI score < 5) and the rest of them (60%) expressed poor sleep quality (total PSQI score > 5). Also, 23 participants (66%) reported at least mild mood disturbance (BDI-II score < 11) and 33% of them (n = 10) showed moderate depression level (BDI-II score 21-30).

Correlation coefficients between research variables are depicted in Table 2. Data analyses showed that total sleep time in polysomnogaphic recordings and number of awakenings, St age 1, Stage 2 and Stage 3-4 did not correlate with any self-reported variables. Polysomnografic-recorded sleep efficiency was correlated with self-reported habitual sleep efficiency ($r = 0.33$, $P < 0.01$), subjective sleep quality ($r = 0.28$, $P < 0.01$), daytime dysfunction ($r = -0.42$ $P < 0.05$) as well as PSQI-P total score ($r = 0.23$, $P < 0.05$). Sleep onset latency, also, was negatively correlated with BDI-II total score ($r = -0.26$, $P < 0.01$), and REM percentage was positively correlated with BDI-II total score ($r = 0.28$, $P < 0.01$). Notwithstanding the lack of significant correlations between many of self-reposted variables and polysomnogaphic recordings, remarkable relationships were found between PSQI-P and BDI-II scores. PSQI-P total score was negatively correlated with BDI-II total score ($r = -0.36$, $P < 0.01$).

Relationship between Sleep Quality, Polysomnographic

Table 1: Descriptive statistics of the sample (*n* = 35)

Measures	Variables	Mean ± SD
PSG	1. age (years)	46 ± 7.21
	2. Total Sleep Time (Min)	328.6 ± 56.91
	3. Sleep Onset Latency (Min)	40.2 ± 14.09
	4. Sleep Efficiency(%)	68.5 ± 8.63
	5. Number of Awakenings	6.34 ± 1.27
	6. Stage 1 (%)	10.5 ± 3.14
	7. Stage 2 (%)	54.7 ± 7.21
	8. Stages 3- 4 (%)	15.2 ± 4.01
	9. REM (%)	19.6 ± 3.84
PSQI Components	10. Subjective Sleep Quality	0.57 ± 2.8
	11. Sleep Latency	0.76 ± 2.03
	12. Sleep Duration	0.71 ± 1.1
	13. Habitual Sleep Efficiency	1.03 ± 0.58
	14. Sleep Disturbances	0.98 ± 2.67
	15. Use of Sleep Medications	1.15 ± 1.01
	16. Daytime Dysfunction	1.33 ± 1.24
	17. Total Score	8.22 ± 2.07
BDI-II	18. Total Score	19.06 ± 4.73

Table 2: Correlation coefficients between research variables

Measures	Variables	TST (*min*)	SOL (*min*)	SE	NA	Stage 1 (%)	Stage 2 (%)	Stage 3-4 (%)	REM (%)	SSQ	SL	SD	HSE	Dis.	USM	DD	PSQ Total Score	BDI-II Total Score
PSG	TST (*min*)	-	0.09	0.02	-0.11	0.07	0.03	0.08	0.08	0.04	-0.13	0.06	-0.06	0.16	-0.05	-0.14	0.09	0.11
	SOL (*min*)		-	0.10	0.07	0.02	0.06	0.04	0.15	0.12	0.09	0.11	0.07	0.12	0.16	0.09	-0.13	-0.26**
	SE (%)			-	0.04	0.10	0.04	0.05	0.03	0.28**	0.04	0.02	0.33**	-0.05	-0.11	-0.42**	0.23*	-0.06
	NA				-	0.03	0.04	0.09	0.04	-0.02	0.12	0.04	0.09	0.09	0.03	0.08	-0.04	0.09
	Stage 1 (%)					-	0.08	0. 13	0.13	0.07	-0.06	0.03	0.07	0.01	0.05	0.12	0.08	0.04
	Stage 2 (%)						-	0.02	0.03	-0.06	0.03	0.08	-0.04	0.13	0.11	-0.05	0.03	0.03
	Stages 3- 4 (%)							-	0.07	-0.04	0.11	0.13	0.09	-0.07	0.04	0.09	-0.02	-0.06
	REM (%)								-	0.11	-0.07	0.02	0.03	0.04	-0.07	0.04	-0.07	0.28**
PSQI Components	SSQ									-	0.15	0.11	0.09	-0.07	-0.14	-0.16	0.24*	-0.41**
	SL										-	0.12	0.14	0.13	0.17	0.12	0.32**	0.34**
	SD											-	0.13	-0.08	-0.12	0.17	0.23*	-0.07
	HSE												-	0.14	-0.09	0.18	0.26**	-0.16
	Dis.													-	0.16	0.16	0.33**	0.39**
	USM														-	0.13	0.17	0.44**
	DD															-	0.28**	0.38**
	Total Score																-	- 0.36**
BDI-II	Total Score																	-

* = *P* < 0/05; ** = *P* < 0/01. PSG = Polysomnography; TST = Total Sleep Time; SOL = Sleep Onset Latency; SE = Sleep Efficiency; NA = Number of Awakenings; REM, Rapid Eye Movement; PSQI, the Pittsburgh Sleep Quality Index, SSQ = Subjective Sleep Quality; SL = Sleep Latency; SD = Sleep Duration; HSE = Habitual Sleep Efficiency; Dis. = Sleep Disturbances; USM = Use of Sleep Medications; DD = Daytime Dysfunction; BDI-II, the Beck Depression Inventory-Second Edition.

Also, BDI-II score was associated with five of the PSQI-P component scores, as following: subjective sleep quality (r = -0.41, P < 0.01), sleep latency (r = 0.34, P < 0.01), sleep disturbances (r = 0.39, P < 0.01), use of sleep medications (r = 0.44, P < 0.01), and daytime dysfunction (r = 0.38, P < 0.01), Two PSQI-P subscales, the habitual sleep efficiency and the sleep duration, however did not significantly correlate with BDI-II total scores.

Discussion

The current study showed that although there were some correlations between self-reported sleep quality (PSQI-P scores) and objective reports of sleep (polysomnographic outputs), among Iranian veterans suffering from chemically-induced injuries, no large associations have been found between them. Therefore, these findings support previous findings asserting that sleep complaints are not equivalent to objective sleep disturbances.

In spite of the lack of correspondence between objective and subjective sleep measures in the present study, sleep complaints of the participants (PSQI-P scores) were significantly associated with their depression levels (BDI-II scores). Accordingly, it can be concluded that such disparities are largely rooted in psychological factors involved in patients' perceptions of their sleep problems. For example, some studies have identified personality characteristics as determinant factors in these inequalities (28, 29).

Based on the research literature, depression is one of the most important psychological variables among a variety of other psychological factors in explaining disparity between subjective and objective sleep problems. For example, Quera-Salva, et al. (30) indicated that higher scores on anxiety and depression scales correlate with more frequent complaints of nocturnal sleep disturbances. Argyropoulos, et al. (31), also found a significant discrepancy between objective and subjective sleep reports of patients with depression before medical treatment. Tsuchiyama, et al. (27), studying 23 patients with depression, have indicated that although the subjective total sleep time showed a moderate correlation with the objective total sleep time, the degree of discrepancy between subjective and objective reports of sleep was significantly correlated with severity of depression (30). Rotenberg, et al. (32), also, have shown that the degree of wrong sleep estimation in depressed patients is larger than in healthy subjects.

Considering the relation between depression level and patients' subjective perception of sleep and objective sleep disturbances, it can be argued that participants' sleep complaints can be largely affected by particular styles of information processing related to their mood (e.g. cognitive biases), rather than objective sleep disturbance. According to the Beck's cognitive approach, depressive mood is associated with negative thoughts, cognitive biases and distortions in the patient's interpretations of the self, the world and the future (33). Argyropoulos, et al. (31) have suggested that the partial discrepancy between subjective and objective sleep measures indicates that a cognitive element is combined with the biological element to produce the sleep problems reported by depressed patients.

An important unintended finding of the present pilot study refers to the positive association between REM percentage and self-reported depression levels (BDI-II total scores). This result is consistent with various studies have shown that the amount of REM sleep in depressed patients is higher than in normal population (15,16,34,35). Moreover, the depression level is associated with the reported use of sleep medications. This finding, also, is consistent with several previous studies showing that higher levels of depression and anxiety are associated with increased use of sleep medication (30,36,37,38).

Limitation

The main limitation of this study is its small sample size. Also, all participants were male, however, previous studies have shown that there are gender differences in sleep disorders (26,39) and in the degree of correspondence between subjective and objective sleep quality (12). Additionally, a nonrandom sample was recruited in this pilot study. Thus, it would be most prudent to not extrapolate the findings of this pilot study. Furthermore, only one self-report measure (i.e. PSQI-P) was used to assess participants' sleep perception, as well as, one questionnaire (i.e. BDI-II) was administered to assess their depression levels. Finally, because of several unwanted constraints in implementation of this study, some important variables, such as psychological factors, especially, personality characteristics, and physiological factors, especially, objective respiratory events during sleep, were not measured/included and controlled, which represent another notable limitation of this pilot study.

Conclusion

The current pilot study show promise for increasing insight about the sleep complaints of chemically injured veterans, by postulating several possible paths to be addressed in future studies. In sum, the findings emphasize that sleep problems represent a multidimensional (e.g. psychological, physiological) domain of inquiry. Therefore, a concomitant use of objective and subjective sleep measures could provide more valid and reliable information in order to gain a more comprehensive and accurate understanding of the patient's sleep health (41). Therefore, as a practical suggestion of the present pilot study, authors recommend using the multimethod approach to assessment of sleep problem, especially in Iranian veterans suffering from chemical injuries. For more

information about multimethod approach, see Diener and Eid's book (42).

Acknowledgements

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