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Brief communication

Self-reported levels of sleepiness among subjects with insomnia

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Abstract

Objectives: To determine the prevalence of sleepiness in a cohort of insomnia subjects. We evaluated if differential levels of subjective sleepiness predict systematic differences in the polysomnographic characteristics of these subjects.

Background: Insomnia is prevalent among the adult population. While it has been speculated that sleepiness may be an important daytime consequence of insomnia, this has not been demonstrated.

Methods: Sixty-two subjects with complaints of insomnia for at least 6 months were polysomnographically evaluated. Subjects were asked to self-report their level of sleepiness based on their experiences for the previous 7 days. Subjects were divided into three groups based on their level of sleepiness. Sleepiness was determined using the excessive daytime sleepiness scale of the Sleep/Wake Activity Inventory (SWAI-EDS).

Results: Twenty-two percent of insomnia subjects were found to be sleepy on the EDS scale of the SWAI. The level of sleepiness was also found to predict difficulty initiating sleep both on the nocturnal scale of the SWAI, and on nocturnal polysomnography.

Conclusions: This study established a base rate of sleepiness among a cohort of insomnia subjects. It also demonstrated a wide spectrum of sleepiness/alertness among subjects with insomnia. Differential levels of sleepiness were found to predict nocturnal sleep latencies.

Keywords: Insomnia; Sleep/wake activity inventory; Excessive daytime sleepiness; Hyperalertness

1. Introduction

Insomnia is one of the most pervasive problems affecting the adult population. For the majority of people, sleep difficulty is associated with daytime stress and is reversible. However, for some patients, insomnia becomes a chronic experience. Chronic insomnia has been found not only to be of clinical significance, but also a risk factor for absenteeism [1], and medical and behavioral complications [2]. From a clinical perspective, it is important to determine whether patients with insomnia experience daytime consequences as a result of their sleep difficulties. Among these, insomniacs frequently report memory problems, difficulties concentrating, and limitations in their ability to enjoy relationships [3]. Many of the daytime consequences are attributed to the effects of sleep loss secondary to insomnia. While it has been speculated that sleepiness may be an important daytime consequence of insomnia, this

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has not been demonstrated. Clinical studies utilizing the multiple sleep latency test (MSLT) have failed to corroborate a heightened propensity to fall asleep among these patients [4–7]. In fact, the results of these studies have shown evidence of longer than average sleep latencies among most insomniacs, which has been hypothesized to represent a state of hyperalertness [5].

From a methodological perspective, the MSLT may not be the ideal tool in assessing sleepiness among insomniacs. Asking patients with insomnia to try to fall asleep (on repeated occasions across the day as the MSLT requires) may only rekindle the difficulties these individuals experience when they go to bed at night. Relevant to this limitation is Hauri's observation that patients experience great difficulty falling asleep when 'trying too hard to sleep' [8]. In contrast, Hauri has noted that these patients often fall asleep easily when they are distracted during activities such as watching TV or during other sedentary activities [8].

The Sleep/Wake Activity Inventory (SWAI) is a self-report measure of sleepiness that is easy to complete and has been shown to be sensitive to differential levels of sleepiness [9]. The sleepiness factor of the SWAI has been shown to be useful in evaluating sleepiness among college students [10–12], clinic populations [13,14], and epidemiological studies [15,16]. The items included in the sleepiness factor of the SWAI inquire about the propensity to fall asleep while engaged in activities of daily living (i.e. when riding as a passenger, while visiting with friends, during a conversation, etc.). In this context, the SWAI enables the assessment of the propensity to fall asleep among people with insomnia without subjecting them to the instruction 'try to fall asleep'. The currently validated sleepiness factor of the SWAI consists of nine statements each followed by a 1–9 semi-continuous scale. Subjects are asked to circle, for each item, the number which most closely describes them over the previous 7 days. A score is derived by the addition of the subject's ratings. Clinical experience indicates that low scores ($\leq$50) are indicative of a high propensity to fall asleep [17].

The SWAI also contains a scale which assesses nocturnal sleep (NS). Subjects rate three items which ask specifically about difficulties with nocturnal sleep onset. The NS scale was initially derived and validated among clinic populations [9], and more recently in a representative community sample [16]. The values on the nocturnal sleep scale range from 3 to 27 with lower scores indicating greater difficulty with falling asleep.

The purpose of this study was to determine the prevalence of sleepiness in a group of consecutive subjects with complaints of insomnia. We evaluated whether differential levels of sleepiness, as determined by the SWAI, are reflective of systematic differences in the polysomnographic characteristics among these subjects. The study also evaluated the scores of the nocturnal sleep scale of the SWAI in these subjects.

2. Materials and methods

Ninety-two consecutive subjects with insomnia for at least 6 months were evaluated for this study. Telephone interviews were conducted as an initial screen in order to establish the subjects' complaint, sleep schedule, health status, and history of drug and alcohol consumption. Subjects were required to report difficulty initiating sleep (sleep latency of at least 30 min) and/or difficulty maintaining sleep (total sleep time of 6.5 out of 8 h time in bed) on 4 out of 7 nights per week. They had to report regular nocturnal sleep schedules with no evidence of circadian sleep difficulties. The subjects reported in this study were being screened for various psychopharmacological studies. Subjects signed an informed consent and were paid for their participation. All subjects completed a medical and psychiatric evaluation followed by a physical examination and urine toxicology analysis. All clinical evaluations and physical examinations were completed by a Board Certified Physician in Sleep Disorders Medicine (L.R. or P.G.). Thirty subjects were excluded from participation (medical problems ($n = 11$), sleep disorders ($n = 5$), psychiatric problems, and/or drug and alcohol problems ($n = 14$)). The remaining subjects were considered to have a diagnosis of psychophysiological insomnia. Participating subjects ($n = 62$) were in good health, had no history of a major psychiatric illness, and were free of evidence of drug/alcohol abuse.

Subjects agreed not to drink caffeine or alcohol after 17:00 h on the evening of the polysomnographic (PSG) recording. Subjects arrived at the laboratory at

21:00 h (±1.5 h). They completed the SWAI, were prepared for the PSG recording, and spent 8 h in bed. The subjects' sleep in the laboratory was scheduled to match their habitual sleep schedule. Thus, the bed times ranged from 22:00 h (the earliest) to 24:00 h (the latest). In all cases, the nocturnal polysomnograpy lasted for 8 h. The PSG hook up included the standard central and occipital electroencephalograms, electrooculogram, submental electromyogram (EMG), electrocardiogram recorded with a V5 lead, respiratory flow recorded with nasal-oral thermistor, and left tibialis EMG. All recordings were scored for sleep stages according to the standards of Rechtschaffen and Kales [18]. Scoring was completed by technicians who were blinded to the participants' complaints.

Subjects were divided into three groups based on their SWAI-EDS scores. The groupings were determined from previous data available on the SWAI. These groupings were intended to capture those people with clinically significant sleepiness (i.e. MSLT $\leq$ 5 min) [9], subjects with no self-reported evidence of systematic difficulties with EDS, and those subjects who systematically denied any experiences of EDS. Group 1 had SWAI-EDS scores of $\leq$50, consistent with excessive daytime sleepiness [17]. Group 2 was derived from subjects with SWAI-EDS scores of $>50 \leq 65$, which is the most prevalent range of scores among subjects free from systematic symptoms of EDS. Group 3 represented the most extreme scores on the SWAI-EDS scale. Scores of >65 were entered into this group. To score >65 on the SWAI-EDS scale, subjects had to systematically deny any propensity to fall asleep on all of the items included in the scale.

Comparison of the group's sleep characteristics were run using one-way analysis of variance (ANOVA) on SYSTAT for the MacIntosh, version 5.2.1 (SYSTAT Inc., Evanston, IL). Where appropriate, the data underwent log transformation to normalize the variability of the data. Tukey's post-hocs were utilized where suitable.

3. Results

Age was comparable across the groups (group 1, 63.8 ± 9.3; group 2, 54.1 ± 16.8; group 3, 55.9 ± 16.8 years; range 18–-81 years, n.s.). Of the 62 subjects (32 males, 30 females, n.s.), 14 subjects were in group 1, 19 subjects were in group 2, and group 3 had 29 subjects. The PSG data showed no differences in sleep efficiency between the groups. Latency to stage 1 was significantly shorter in group 1 (14.9 ± 20.0 mins) when compared to group 3 (36.1 ± 44.7 min, df = 2, 59; $F = 3.2$, $P < 0.05$, see Table 1). The latency to stage 1 for group 2 (19.8 ± 16.8 min) was intermediate and not significantly different from groups 1 or 3. Latency to persistent sleep (PS) yielded similar results with the latency being significantly shorter in group 1 (27.1 ± 26.1 min) than in group 3 (53.3 ± 42.9 min, df = 2, 59; $F = 3.2$, $P < 0.05$, see Table 1) Group 2's latency to PS was 34.6 ± 31 min. Latency to stage 2 was significantly shorter in group 1 (23.3 ± 25.1 min) than in group 3 (48.3 ± 44.0 min, df = 2, 59; $F = 3.2$, $P < 0.05$). The latency to stage 2 in group 2 was intermediate (34.0 ± 24.9 min) and was not different from groups 1 or 3. The latency to stage REM (group 1, 68.5 ± 26.6; group 2, 98.6 ± 59.0;

Table 1
The polysomnographic characteristics of the subjects[a]

	Group 1 (SWAI-EDS score ≤50)	Group 2 (SWAI-EDS score >50 ≤ 65)	Group 3 (SWAI-EDS score >65)
Sleep efficiency	75.6 (11.3)	80.0 (9.3)	75.9 (10.5)
Stage 1%	19.7 (15.6)	22.3 (11.6)	20.7 (12.3)
Stage 2%	57.0 (14.2)	53.7 (11.1)	53.5 (13.0)
Stage 3/4%	7.2 (8.7)	6.4 (8.4)	6.9 (9.1)
Stage REM%	16.1 (5.5)	17.7 (7.3)	19.2 (5.3)
Latency to stage 1	14.9 (20.0)	19.8 (16.8)	36.1 (44.7)*
Latency to PS	27.1 (26.1)	34.6 (31.0)	53.3 (42.9)*
Latency to stage 2	23.3 (25.1)	34.0 (24.9)	48.3 (44.0)*

[a] Means (standard deviations). *$P < 0.05$ vs. group 1.

group 3, 93.8 ± 41.0 min, n.s.) as well as the sleep architecture did not differ between the groups. The scores for the nocturnal sleep scale of the SWAI showed that both groups 1 and 2 had comparable scores (18.1 ± 5.9 and 24.5 ± 5.0, respectively) and these were significantly higher than group 3 (14.3 ± 3.8, df = 2, 56; $F = 5.7$, $P < 0.01$). The lower scores found in group 3 on the SWAI-NS scale are consistent with a greater degree of difficulty initiating sleep in this group of subjects [9].

4. Discussion

This study found a wide range of scores on the EDS scale of the SWAI. Twenty-two percent of insomnia subjects reported difficulties with excessive daytime sleepiness (i.e. SWAI-EDS scores ≤ 50). Previous reports quantifying the level of daytime sleepiness among people with insomnia have reported longer latencies on the MSLT when compared to control populations [5]. However, no previous report has commented on the specific prevalence of MSLT scores of ≤5 min, which would be consistent with 'pathological sleepiness'. This study, using a validated self-report measure, established a base rate of sleepiness among a cohort of insomnia subjects. It should be acknowledged that while the SWAI was validated among sleep-disordered populations using MSLT data, most of the patients had chief complaints of snoring and/or EDS [9]. Thus, it is possible that when insomniacs are tested in the laboratory they may experience a paradoxical response to the instruction of trying to fall asleep. This paradoxical response would be independent from their self-reported level of sleepiness. As Hauri has previously noted, patients with insomnia are more likely to experience great difficulty falling asleep when 'trying too hard to sleep' [8]. In this case, the MSLT protocol may yield an equivocal measure of sleepiness for these individuals. It would be desirable to establish further correlates of self-reported sleepiness among insomniacs to further confirm the validity of these reports. In any case, the results of this study demonstrated differential nocturnal sleep latencies on the polysomnographic evaluation based on self-reported levels of sleepiness among a cohort of insomnia subjects.

An additional dimension to the results of this study is related to the spectrum of sleepiness scores documented among subjects with insomnia. A relatively high number of subjects had SWAI-EDS scores of >65. In fact, 47% of insomnia subjects fell into this category. Such a high rate of scores on the EDS scale of the SWAI is dramatically higher than the 15% of comparable scores found among patients evaluated for sleep-disordered breathing. These results would seem to suggest that the scores on the EDS scale of the SWAI are capable of capturing the full spectrum of sleepiness-alertness. Furthermore, high scores on the SWAI are likely to be correlated with other measures of hyperalertness. For example, Bonnet and Arand have shown that insomniacs, in addition to their characteristic increase in sleep latency, also have increased metabolic rate, body temperature, tension and confusion, and personality disturbance [19]. It would be of interest to corroborate our findings and correlate them to the variables suggested by Bonnet. If these findings are corroborated in the laboratory, they would further confirm the notion that some subjects with insomnia experience a state of hyperalertness.

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