Polysomnographic Characteristics of Patients with Chronic Insomnia

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We conducted this study to assess the usefulness of polysomnography (PSG) in patients referred to the sleep disorders center (SDC) with chronic insomnia. Sixty-seven patients with chronic insomnia who underwent overnight polysomnography were included in the study. Clinical diagnoses were reported using the second revision of the International Classifications of Sleep Disorders (ICSD). The mean age of the studied group was 43±1.5 years and males comprised 53.7%. In the whole group, sleep onset latency was 42.6±7.74 minutes, sleep efficiency 69.9±2.5 and arousal index was 18.8±1.8 per hour. Presumptive polysomnographic diagnoses were identified in 56 patients (83.6%). Sleep state misperception (SSM) represented 40.3% of the studied insomniacs and sleep disordered breathing (SDB) was detected in 25.4%. The present study illustrated the importance of PSG in the assessment of selected patients with chronic insomnia. It also demonstrated that high percentage of insomniacs have subjective insomnia. Finally, the prevalence of SDB is common among patients with chronic insomnia. Further studies are needed to explore the relation between insomnia and SDB and to delineate the clinical significance of the so-called SSM. **(Sleep and Hypnosis 2004;6(4):163-168)**

Key words: *insomnia, polysomnography, sleep-state misperception, alpha-delta sleep, sleep disordered breathing, apnea*

INTRODUCTION

Insomnia is usually defined as a complaint of difficulty initiating sleep, maintaining sleep, and/or non-restorative sleep that causes clinically significant distress or impairment in social, occupational or other important areas of functioning (1). The term insomnia is used to describe a wide range of alterations in the amount and type of sleep loss or perceived sleeplessness. The duration of patient's symptoms has important diagnostic implications. Transient insomnia, lasting only a few days, is often a result of acute stress or illness. Insomnia lasting longer than three weeks is considered chronic and usually has different causes (2). Some look to insomnia as a symptom of an underlying disorder rather than a disease on its own. Chronic insomnia is a complex, heterogeneous condition that can be secondary to an underlying medical, psychiatric, neurological, or substance abuse disorder. Or, it can be a syndrome in itself, in which case the diagnosis of primary insomnia is often made (3). In total, 55 of nosological

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entities listed in the International Classification of Sleep Disorders (ICSD) (4) can have insomnia as a symptom. Epidemiological research reveals that insomnia afflicts 10-30 percent of adult population (5,6).

Overnight polysomnography (PSG) is a standard tool in sleep medicine for evaluating sleep-related pathophysiology, sleep architecture and sleep integrity. However, the role of PSG in patients with insomnia has attracted unnecessary debate (7). Some etiologies underlying insomnia have specific pathophysiology detectable with PSG like sleep disordered breathing (SDB) and periodic limb movements (PLM). Other insomnias may manifest abnormal sleep architectural patterns like major depressive disorder and alpha-delta sleep that while recognizable are diagnostically non-specific (8,9). Finally, conditions like sleep state misperception (SSM) can be directly measured with PSG. Measures such as sleep onset latency (SOL), total sleep time (TST), arousal index, and sleep efficiency can be measured using PSG. Therefore, we feel that the role of PSG in the evaluation of some patients with chronic insomnia cannot be discarded completely.

A few studies addressed the usefulness of PSG in patients with chronic insomnia and limited number of studies looked into the prevalence of SDB and subjective insomnia in patients with chronic insomnia. We conducted this study to assess the usefulness of PSG in patients referred to the SDC with chronic insomnia.

MATERIALS AND METHODS:

In our practice, patients referred to the sleep disorders clinic with the complaint of insomnia are usually assessed clinically in the clinic and subsequently, appointments are made for PSG in the sleep disorders center (SDC) if certain criteria are present. Patient's visits were classified as patient-initiated or physician initiated. If the referral was physician initiated, the medical specialty of the referring physician was then sought.

Inclusion criteria:

In this study, we included 67 patients with chronic insomnia who underwent PSG in two sleep disorders centers, at King Khalid University Hospital (KKUH) and Specialized Medical Center Hospital (SMCH) in the period between January 2002 and June 2004.

For the sake of this study, chronic insomnia was defined as the complaint of difficulty initiating sleep, maintaining sleep, and/or non-restorative sleep for more than three months. All patients were assessed by psychiatrists before presenting to the SDC to rule out primary psychiatric disorders.

We followed the proposed criteria of the American Academy of Sleep Medicine (AASM) for performing PSG in patients with insomnia. Therefore, PSG was considered for referred patients with chronic insomnia if one of the following clinical conditions was present:

- Clinically suspected SDB or PLM
- When initial clinical diagnosis is uncertain
- Unsuccessful treatment
- Precipitous arousals occur with violent or injurious behavior.

Polysomnography (PSG):

Sleep studies consisted of an all-night PSG that included four EEG placements (C1-A4, C2-A3, O1-A4, and O2-A3); muscle tone and leg movements by chin and leg EMG; eye movements by (electro-oculography) EOG; heart rate by EKG; oxygen saturation by finger pulse oximeter; chest and abdominal wall movements by thoracic and abdominal belts; air flow by thermistor and nasal prong pressure transducer; sleep position by position sensor; and snoring by microphone. PSG recording was performed using Alice® 4 diagnostic equipment from Respironics, Inc, Murrysville, Pennsylvania, USA.

Analysis and scoring of PSG data

Page-by-page analysis and scoring of the electronic raw data was done manually by the author in accordance with established criteria (10,11), to determine TIB, SOL (time from lights out to the first epoch of any stage of sleep), TST, sleep efficiency (TST/TIB x 100) and arousal index. The severity of SDB was expressed using the respiratory disturbances index (RDI).

Definitions of polysomnographic diagnoses:

Clinical diagnoses were reported using the second revision of the ICSD (4).

Obstructive sleep apnea (OSA): more than 5 obstructive apneas or hypopneas, greater than 10 seconds in duration, per hour of sleep followed by arousals or desaturation.

Cheyne-Stokes respiration (CSR): crescendo-decrescendo pattern of breathing with central apneas or hypopneas at the nadir.

Alpha-delta sleep (ADS): the polysomnographic finding of prominent alpha activity (8-13 Hz) occurring during slow wave sleep (<4 Hz) with no other polysomnographic abnormalities.

Sleep state misperception (SSM) (subjective insomnia): the compliant of insomnia without objective polysomnographic evidence of abnormalities in SOL, sleep architecture and sleep duration. It is also classified as subjective insomnia.

PLM: repetitive episodes of muscle contraction (0.5-5 seconds in duration) separated by an interval of typically 20-40 seconds followed by arousal or awakenings.

If PSG recording showed long SOL (> 30 minutes) and low sleep efficiency but no clear organic cause could be identified by PSG, a repeat PSG was done 1-2 weeks after the first study to control for the possibility of the "first-night effect" and the results of second study was used in the analysis. If no cause could be identified, the patient was labeled as idiopathic insomnia.

STATISTICAL ANALYSIS:

Data are expressed in the text and tables as mean ± standard error of the means (SEM) values. For continuous variable, t-test was used if the distribution was normal. When normality test failed, Mann-Whitney rank sum test was used. The chi-square test was used for comparison of proportions. Results were considered statistically significant at the p= 0.05 level. Standard statistical software (Sigma Stat, version 3; SPSS Chicago, Illinois, USA) was used for the analyses.

RESULTS:

During the study period, 67 patients with chronic insomnia underwent PSG. This represents 9.3% of the total performed PSGs during the study period. Only, thirteen (19.4%) visits were physician-initiated and the rest were patient-initiated. Among the physician-initiated visits, seven visits were from psychiatry, two from neurology, two from primary care and two from internal medicine. The mean age of the studied group was 43±1.5 years and males comprised 53.7%.

Figure 1 demonstrates the polysomnographic diagnoses of all patients. SSM (subjective insomnia) represented 40.3% of studied insomniacs. SDB, PLM, ADS and idiopathic insomnia represented 25.4%, 7.5%, 10.4% and 16.4%, respectively.

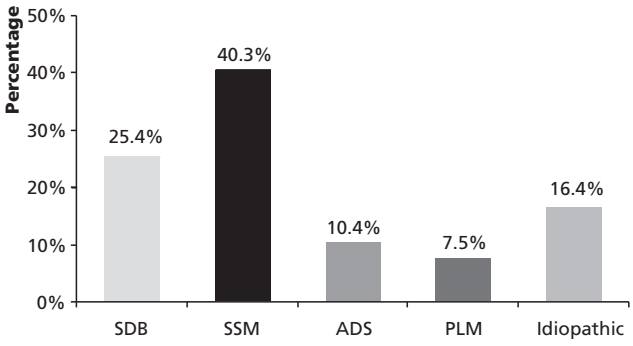

Figure 1. Polysomnographic diagnoses of insomniac patients. SDB: sleep disordered breathing; SSM: sleep state misperception; ADS: alpha-delta sleep; PLM: periodic limb movement.

Table 1. Demographic and polysomnographic characteristics of patients with insomnia.

	All group (n=67)	SDB (n=17)	SSM (n=27)	ADS (n=7)	PLM (n=5)	Idiopathic (n=11)
Age	43.0 ± 1.5	45.9 ± 3.4	41.8 ± 2.1	38.4 ± 3.2	41.6 ± 6.0	45.2 ± 4.6
Males (%)	53.7%	58.8%	44%	71.4%	60%	54.5%
TIB (minutes)	370.3 ± 10.1	292.1 ± 27.3	400.3 ± 8.6	383.6 ± 29.5	387.7 ± 17.5	401.2 ± 10.2
TST (minutes)	264.98 ± 12.9	220.9 ± 26.5	325.0 ± 13.5	310.9 ± 32.8	248.6 ± 39.9	164.0 ± 26.8
SOL (minutes)	42.6 ± 7.74	37.7 ± 7.1	29.2 ± 4.9	24.5 ± 7.6	27.4 ± 23.2	103.1 ± 39.5
TST/TIB %	69.9 ± 2.5	71.1 ± 3.6	80.0 ± 2.5	79.6 ± 4.4	62.8 ± 7.7	40.2 ± 6.7
Stage1 % (TST)	14.6 ± 1.2	12.9 ± 1.5	12.6 ± 1.6	10.1 ± 1.02	23.5 ± 4.4	21.0 ± 4.9
Stage2 % (TST)	59.6 ± 2.04	66.4 ± 4.5	55.3 ± 2.8	62.7 ± 5.6	60.0 ± 4.3	57.3 ± 6.2
Deep sleep % (TST)	8.6 ± 1.3	7.2 ± 1.8	11.0 ± 2.3	7.0 ± 4.4	4.4 ± 2.6	5.5 ± 2.8
REM sleep % (TST)	14.7 ± 1.2	8.9 ± 2.1	19.5 ± 1.8	15.3 ± 2.6	11.7 ± 4.4	11.9 ± 3.8
RDI	8.1 ± 2.1	15.6 ± 2.9	3.5 ± 0.8	1.7 ± 0.6	2.2 ± 1.1	4.8 ± 5.1
Arousal index	18.8 ± 1.8	27.4 ± 4.1	10.5 ± 1.2	9.7 ± 1.1	14.9 ± 1.9	23.7 ± 8.9

SDB: sleep disordered breathing; SSM: sleep state misperception; ADS: alpha-delta sleep; PLM: periodic limb movement; TIB: time in bed; TST: total sleep time; SOL: sleep onset latency; RDI: Respiratory disturbances index.

Table 2. Comparison between patients with subjective insomnia (SSM) and patients with objective insomnia.

	SSM (n=27)	Non-SSM (n=40)	p-value
Age (years)	41.8 ± 2.1	43.8 ± 2.1	NS
Males	44%	62.5%	NS
TIB (minutes)	400.3 ± 8.6	350.1 ± 15.2	0.01
TST (minutes)	325.0 ± 13.5	224.5 ± 16.8	<0.001
SOL (minutes)	29.2 ± 4.9	52.1 ± 12.4	NS
TST/TIB %	80.0 ± 2.5	63.1 ± 3.5	0.001
S1 % (TST)	12.6 ± 1.6	15.9 ± 1.7	NS
S2 % (TST)	55.3 ± 2.8	62.4 ± 2.7	NS
Deep sleep % (TST)	11.0 ± 2.3	7.02 ± 1.4	0.02
REM sleep % (TST)	19.5 ± 1.8	11.5 ± 1.4	<0.001
RDI	3.5 ± 0.8	11.1 ± 3.3	NS
Arousal index	10.5 ± 1.2	21.6 ± 2.8	<0.001

SSM: sleep state misperception; TIB: time in bed; TST: total sleep time; SOL: sleep onset latency; RDI: Respiratory disturbances index.

Table 1 demonstrates the demographic and polysomnographic characteristics of the whole group and subgroups with different diagnoses. Presumptive polysomnographic diagnoses were identified in 56 patients (83.6%). Patients in whom no clear cause could be identified were labeled as idiopathic insomnia.

In the whole group, SOL was 42.6±7.74 minutes, sleep efficiency 69.9±2.5 and arousal index was 18.8±1.8 per hour. The idiopathic group had the worst parameters with SOL of 103.1±39.5 minutes; sleep efficiency of 40.2±6.7; and arousal index of 23.7±8.9 per hour. In the SDB group, one patient had CSR causing frequent arousals and awakenings. The rest of the group had OSA. RDI of this group was 15.6±2.9 events/hour.

Table 2 compares patients with subjective insomnia (SSM) to the rest of the group. Females were more than males in the SSM group while males were more in the non-SSM group. TST, sleep efficiency, deep sleep, and REM sleep were significantly more in the SSM group. On the other hand, SOL and arousal index were significantly less in the SSM group. In general, polysomnographic data in the SSM group were within normal limits.

DİSCUSSİON

Although the diagnosis of insomnia relies on a comprehensive medical, psychiatric and sleep history, it remains a challenge to the clinician to determine the relation of comorbid diseases to insomnia symptoms. Therefore, the reliability of insomnia diagnoses may be greatly enhanced with the use of standardized diagnostic and assessment tools like PSG in selected cases with suspected organic sleep disorder. In the present study, insomnia referrals represent 9.3% only of the total referrals to the SDC. This finding is expected, as PSG is usually not indicated for the routine assessment of insomnia. Our results illustrated that PSG can have an important role in the assessment of patients with chronic insomnia when the AASM practice parameters are followed (1). PSG directed the treating clinician to the possible causes of insomnia in 83.6% of the studied cases.

An interesting finding of this study is the high percentage of patients who had subjective insomnia (SSM). Forty percent of the studied patients who complained of chronic insomnia had normal PSG parameters. Few published data addressed the prevalence of subjective insomnia in patient with chronic insomnia. The most comprehensive of these studies was the survey reported by Coleman et al. (12), who reported that over one third of their patients with primary insomnia met the diagnostic criteria of subjective insomnia (SSM) (normal PSG + insomnia complaints). In a recent study that identified subjective insomnia based on patients' averaged sleep measures across six nights of PSG monitoring; the prevalence of subjective insomnia was reported to be 34.4% (13). Those patients labeled as subjective insomnia or SSM remain intriguing yet extremely confusing. While some sleep experts considered this entity as a unique diagnostic subtype, others disagreed about the specific clinical significance of the apparent misjudgments such individuals make about their sleep (14). Admittedly, the available evidence supporting the distinctiveness of such diagnostic subtype is inconclusive; however, dismissing these distinctive findings in some patients with chronic insomnia appears premature at this stage.

Twenty five percent of our insomniac patients had SDB. Most of the earlier studies addressing the assessment of patients with insomnia tried primarily to clarify the role of PSG in assessing insomnia (15,16), and a few of these have assessed SDB prevalence in insomniacs (17,18). Interestingly, most of the previous studies did not use nasal prong pressure transducer technology to assess nasal flow, which in turn might have affected the accuracy of detecting subtle cases of SDB (19). Krakow et al. (17), reported that 50% of a representative sample of SDB patients have clinically substantive symptoms of insomnia. SDB is typically described as a disorder of excessive daytime sleepiness, but not all patients with SDB demonstrate hypersomnia. It seems that we do not consider SDB in the differential diagnosis of insomnia at all. Unfortunately, most clinicians are taught that patients with insomnia do not need PSG. Furthermore, the majority of insurance companies in many countries do not approve PSG, if it is ordered for patients with the primary complaint of insomnia. This position may need to be reviewed and clinicians dealing with insomniac patients -especially psychiatrists- must consider the potential for undiagnosed SDB in their patients, particularly when behavioral and pharmacotherapy fail to ameliorate symptoms. Such patients should be referred for PSG.

In the present study, seven (10.4%) patients had classical tonic alpha-delta sleep. The alpha-delta sleep EEG pattern was first reported by Hauri and Hawkins in 1973, as tonic (more or less continuously riding upon the background of non-REM sleep) (20). Alpha-delta sleep is a known EEG pattern during sleep; however, while some cite this pattern as a distinct pathological entity associated with fibrositis syndrome (20,21), others look to this EEG sleep pattern as an extremely non-specific sleep pattern with unclear pathophysiology and question its legitimacy as a diagnosis (22).

In summary, our results illustrated the importance of PSG in the assessment of selected patients with chronic insomnia. PSG is important in uncovering covert disorders like SDB and PLM disorder that might otherwise escape detection, especially if there is no bed partner available to observe sleep. In addition, PSG affords the clinician several indices of arousal and the percentage of different sleep stages that may prove helpful in characterizing and addressing cases of insomnia. Moreover, it enables the treating clinician to detect the intrusion of alpha wave into deeper sleep. Our results demonstrated that high percentage of insomniacs have subjective insomnia, a topic that needs further research to establish standardized diagnostic criteria, establish the validity of this condition, and assess its pathophysiology, long-term course and morbidity. Finally, the prevalence of SDB is common among patients with chronic insomnia, which should heighten the awareness of clinicians evaluating insomnia complaints and prompt further study of both disorders.

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