ORIGINAL ARTICLE

Insomnia in Obstructive Sleep Apnea Syndrome: Tip of the Iceberg

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Abstract

Background: Obstructive sleep apnea syndrome (OSAS) and insomnia are two of the most common sleep disorders that coexist frequently having distinctive clinical features and therapeutic domain.

Methodology: Patients presenting to our pulmonary medicine department with either the symptoms of OSAS or referred with risk factors were evaluated with insomnia severity index (ISI) and overnight polysomnography after a detailed history, clinical examination, calculation of pretest probability score and relevant pre-requisite workup.

Results: Enrolled 100 patients were diagnosed case of OSAS, of these 65% were males and 35% were females. The mean age of the study group was 49.88 years (SD = 12.15). The youngest patient studied was 7 years old and the oldest was 74 years. The average BMI of our patients was 33.35 kg/m^2. Epworth sleepiness score (ESS) was normal in 24% of patients, 15% had mild, 25% had moderate, and 36% had severe excessive daytime sleepiness. As per the apnea-hypopnea index (AHI), mild OSAS was seen in 31%, 25% had moderate, and 44% had severe OSAS. The ISI revealed that 34% of patients had no clinically significant insomnia while 35% had subthreshold insomnia, 11% had moderate clinical insomnia, and 20% had severe clinical insomnia. A statistically significant association was seen between AHI and ESS, ISI with AHI, and ESS with ISI.

Conclusion: ISI is a simple, reliable, and valid instrument to detect cases of insomnia and there is an increased prevalence of insomnia in OSAS patients. High prevalence leads to increased severity of OSAS and significant neurobehavioral morbidity and early detection aids in distinctive therapeutic domain.

Keywords: Apnea–hypopnea index, Epworth sleepiness score, Insomnia, Insomnia severity index, Obstructive sleep apnea syndrome, Polysomnography.

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Introduction

There is an amplifying recognition of the global incidence and health consequences of obstructive sleep apnea syndrome (OSAS). It causes cessation or a significant decrease in airflow in the presence of breathing effort during sleep. These episodes are combined with recurrent oxyhemoglobin desaturations and awakening from sleep. Diagnosis of OSA is based on the presence of (1) excessive daytime somnolence, (2) two of the following—snoring, witnessed apneas, unrefreshed sleep, fatigue, inability to concentrate, and (3) polysomnography (PSG) demonstrates apnea-hypopnea index (AHI) >5. Alternatively, OSA is also diagnosed in the absence of symptoms if AHI is >15.[1] Insomnia definition encompasses sleep-specific complaints such as inability to stay asleep, difficulty in falling asleep, early morning arousals, or unrefreshing or nonrestorative sleep or as a disorder denoting sleep and waking symptoms. The prevalence of insomnia can vary, from 6 to 48%.[2] Insomnia is subtyped further based on frequency, duration, and etiology. The qualitative insomnia diagnostic criteria suggested include: wake after sleep onset or sleep-onset latency greater than 30 minutes, occurring at a minimum 3 times per week, and with at least 6 months duration.[3] Use of only sleep-specific insomnia symptoms may be an inadequate approach to demonstrate clinically significant insomnia. Sleep complaints along with the inclusion of daytime symptoms add to a more admissible definition of insomnia in research practice, as these prompt patients to seek treatment.[4]

Obstructive sleep apnea syndrome and insomnia are two common sleep disorders. The association between the two was described by Guilleminault et al. in 1973.[5] Several studies have documented the overlap of these disorders, with the insomnia symptoms in patients with OSA being 40–60%, far greater than in the general population.[6,7] Approximately 30–50% of adults experience occasional transient insomnia while 10–18% report chronic insomnia.[8–10] Obstructive sleep apnea and insomnia are assumed as opposing clinical conditions, in regard to alertness and sleepiness. A comorbid relationship between insomnia and OSA has been demonstrated in a range of studies. The reported prevalence of this comorbidity varies within the literature, as does the relationship between insomnia and the AHI. The purpose of the current study is to assess the prevalence and profile of insomnia in patients with OSA.

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Table 1: Age distribution

Age in years	*Percentage (%)*
<10	2
11–12	0
21–30	4
31–40	13
41–50	25
51–60	43
61–70	11
71–80	2

Table 2: Body mass index (BMI)

BMI (kg/m^2)	*Male (%)*	*Female (%)*	*Total (%)*
<24.9	6	3	9
25–29.9	22	5	27
30–34.9	14	15	29
35–39.9	13	5	18
>40	10	7	17

Methodology

This prospective cross-sectional study was conducted with academic ethics committee permission at the Department of Pulmonary Medicine of TNMC & BYL Nair Hospital (ECARP/2018/128). The study included patients with symptoms of OSAS. Patients unwilling to give consent were excluded from the study. Participants were evaluated with a detailed history of symptoms of OSA like snoring, apneas, choking in sleep, nocturia, excessive daytime sleepiness, early morning headache, irritable mood, memory lapses, etc. Clinical examination, that is, general and systemic examination was done. Height, weight, neck, waist and hip circumference, cricomental distance, and Mallampati grading were taken on the same visit. A pretest probability score like the Epworth sleepiness scale (ESS) was calculated. Investigations such as hemogram, fasting blood sugar, postprandial blood sugar, lipid profile, thyroid profile, and arterial blood gases (ABG) were obtained. Chest X-ray (CXR), and two-dimensional echocardiography (2DECHO) were performed. All patients underwent overnight PSG. In the diagnosed cases of OSAS prevalence of insomnia was assessed with the help of history, clinical evaluation, and insomnia severity index (ISI) questionnaire. The ISI has 7 questions. The answers were added to get the ISI and were graded accordingly.

Results

We included 100 patients in our study. All 100 were diagnosed as cases of OSAS on overnight PSG. Of the studied participants, 65% were males and 35% were females. The mean age of the study group with OSAS was 49.88 years (SD = 12.15). Table 1 shows the age distribution of cases. The average body mass index (BMI) of our patients was 33.35 kg/m^2. Most of our patients were overweight or obese with just 9% of patients having a normal or low BMI. Of the rest, 27% of patients were overweight, 29, 18 and 17% had mild, moderate, and morbid obesity, respectively (Table 2). Of the various co-morbidities that were present in the OSAS patients, the most common was hypertension seen in 54% of patients followed by diabetes mellitus in 45%, metabolic syndrome in 27% Gastroesophageal reflux disease in 25%, hypothyroidism in 14%, and others such as allergic rhinitis, sinusitis, bronchial asthma were about in 7%. It was found that 24 patients had Epworth sleepiness score (ESS) <10 signifying normal daytime sleepiness, while 15% had ESS between 11 and 12 revealing mild excessive daytime sleepiness, 25% between 13 and 15 with moderate sleepiness, and 36% had more than 16 with severe excessive daytime sleepiness. Among the 65 male patients, 7 (10.7%), 14 (21.5%), and 29 (44.6%) had mild, moderate, and excessive daytime sleepiness, respectively while among the 35 female patients, 8 (22.8%), 11 (31.4%), and 7 (20%) had mild, moderate, and excessive daytime sleepiness, respectively. So about 50 (76%) males and 26 (74%) females had excessive daytime sleepiness (Table 3). The severity of OSAS was assessed using an overnight PSG. A total of 31% of cases had mild OSAS, 25% had moderate OSAS, and 44% had severe OSAS. Among the 65 male patients, mild OSAS was present in 21 (32.3%) patients while moderate in 14 (21.5%) and severe in 30 (46.1%). Among the 35 female patients, 10 (28.5%),11 (31.4%), and 14 (40%) were presented as mild, moderate, and severe OSAS, respectively (Table 4). Epworth sleepiness score was found to have a statistically significant association with AHI grading. Using the ISI among the patients with OSAS, it was found that 34% of patients had an ISI score less than 7 signifying no clinically significant insomnia while the majority of them, about 35% had a score of 8–14 suggesting subthreshold insomnia, 11% had a score of 15–21 signifying moderate severity of clinical insomnia, and 20% of patients had severe clinical insomnia with a score between 22 and 28. Among the males; insomnia was not significant in 30 (46.1%), subthreshold insomnia in 21 (32.3%), moderate clinical insomnia in 5 (7.6%), and severe clinical insomnia in 9 (13.8%), while among the females, insomnia was not significant in 4 (11.4%), subthreshold insomnia in 14 (40%), moderate clinical insomnia in 6 (17.1%) and severe clinical insomnia in 11 (31.4%) (Table 5). So about 35 (53.8%) males and 31 (88.5%) females had insomnia (Table 6). The severity of insomnia was found to have a statistically significant association with AHI grading (p-value = 0.042 which was statistically significant with Chi-square test) (Table 7). The severity of insomnia had a statistically significant association

Table 3: Epworth sleepiness score (ESS)

ESS grade	*Male (%)*	*Female (%)*	*Total (%)*
0–10	15	9	24
11–12	7	8	15
13–15	11	14	25
16–24	29	7	36

Table 4: Severity of OSAS

AHI severity	*Male (%)*	*Female (%)*	*Total (%)*
Mild	21	10	31
Moderate	14	11	25
Severe	30	14	44

Table 5: ISI score

ISI score	*Male (%)*	*Female (%)*	*Total (%)*
0–7	30	4	34
8–14	21	14	35
15–21	5	6	11
22–28	9	11	20

Table 6: Association between ESS grade and AHI

AHI/HR	*ESS grade <10*	*ESS grade >10*	*Frequency (n)*	*Chi-square*	*p-value*
<15	13	18	31		
>15	11	58	69		
Total	24	76	100	7.923	0.0048*

**p*-value is statistically significant

Table 7: Association between ISI grade and AHI/HR

AHI/HR	*ISI grade <7*	*ISI grade >7*	*Frequency (n)*	*Chi-square*	*p-value*
<15	15	16	31		
>15	19	50	69		
Total	34	66	100	4.144	0.042*

**p*-value is statistically significant

Table 8: Association between ISI grade and ESS grade

ESS grade	*ISI grade <7*	*ISI grade >7*	*Frequency (n)*	*Chi-square*	*p-value*
<10	13	11	24		
>10	21	55	76		
Total	34	66	100	5.723	0.017*

**p*-value is statistically significant

with ESS, ESS grading > 10 (*p*-value = 0.017 which was statistically significant using Chi-square test) (Table 8).

Discussion

Insomnia and OSA are prevalent sleep disorders. Approximately 30–50% of adults experienced transient insomnia while about 10–18% reported chronic insomnia. In adult population, the prevalence of OSA which is defined by AHI ≥ 5 events per hour is approximately 3–7% in men and 2–5% in women. Both these disorders have a positive correlation with age through middle adulthood. Excessive daytime sleepiness is more common than insomnia among patients under evaluation for OSA. However, forthcoming evidence from research studies has consistently indicated high rates of coexistence of the two disorders. The prevalence of insomnia among OSA patients reported in previous studies varied widely, from 7 to 84%, perhaps due to the different study sites and conditions or operational definitions for insomnia. Studies estimated that the prevalence of clinically significant insomnia was between 9 and 15% in the general population while 17.2% of the subjects reported insomnia symptoms and 7.6% reported frequently witnessed apnea.[11,12] Case series designed to study the use of PSG in the diagnosis of insomnia documented that 3–10% of insomnia cases were attributable to OSA.[13] A hypothesis that the sleep disruption caused by OSA may contribute to chronic insomnia complaints was suggested. Recent studies showed that 50% of patients with OSA suffered clinically significant insomnia simultaneously.[6] Other studies dealing with specific cohorts of patients, the prevalence of insomnia was found to be as high as 83 or 91%.[14] Another study, with more stringent and conservative criteria, reported a significant proportion (39%) of OSA patients had moderate levels of clinical insomnia.[15] Another study reported that the prevalence of co-occurring insomnia and OSA was 67.4%.[16] The authors also noticed a weak correlation between OSA severity and co-occurring insomnia. However, a historical cohort study involving 6,892 participants aged 40–45 years reported the prevalence of insomnia and OSA as 5.1% and 8.4%, respectively,[17] with 0.6% of participants proclaimed to have both sleep disorders.

We enrolled 100 cases. Data were extracted from questionnaires and PSG. Among 100 patients with OSA diagnoses, 34 reported no insomnia complaints (OSA-only patients) and 66 had clinically meaningful insomnia complaints (OSA-plus patients). Similarly, Krell et al. found that about 54.9% of patients who received a diagnosis of OSA reported insomnia symptoms.[18] Thus, significant insomnia symptoms were reported by about 66% of the patients with OSA in this representative sample. As per our study, the severity of insomnia was found to have a statistically significant association with AHI grading (*p*-value = 0.042 which is <0.05—statistically significant at a 95% confidence interval using Chi-square). Population-based studies suggest that women are about two times more likely to report insomnia than men, while men are more than two-fold more likely to present with OSA than women. Women with OSA will complain more often of insomnia features than men, while women usually have lower AHI values than men. Ambrogetti et al. noted that 42% of men and 59% of women who underwent polysomnographic evaluation for OSA were suspected to have symptoms of insomnia.[17] In concordance with this, our study revealed among the 100 patients diagnosed with OSAS 65% were males and 35% were females. Though excessive daytime sleepiness was present in 50 (76%) males and 26 (74%) females, Insomnia was significant in 31 (88.5%) females as compared to males which was 35 (53.8%). Even with almost parallel AHI, men and women differ in their expression of this comorbidity. Snoring and sleepiness were similarly common in women and men, women more often described their main presenting symptom as insomnia. Women had less often a primary complaint of witnessed apnea. The frequency of snoring and daytime hypersomnolence was similar in both genders. Witnessed apnea was more frequent in men. Amborgetti et al. reported a higher frequency of sleep onset insomnia in women (62%) than men (53%).[19] Similarly self-reported insomnia was higher in women than in men (46.5 vs 33.9%).

In our study severity of insomnia was found to have a statistically significant association with AHI grading (p-value = 0.042). On the whole, much of the evidence confirmed that female gender was a risk factor for comorbid insomnia in OSA. A previous review also emphasized that OSA and insomnia share the same risk factors for the development of metabolic syndrome components, such as obesity, high blood pressure, glucose intolerance, and insulin resistance.[20] Most OSA patients have high BMI and a higher risk of developing insulin resistance, diabetes, and hypertension than normal individuals. Chronic sleep deprivation also causes obesity, insulin resistance, and metabolic syndrome. In concordance with that, our study also revealed most common comorbidity as hypertension seen in 54% of patients followed by diabetes mellitus in 45% of patients, metabolic syndrome in 27%, gastroesophageal reflux disease in 25%, and hypothyroidism in 14%. However, most clinical research has encountered that patients with concurring insomnia and OSA present with a lower BMI than exclusive OSA patients, and exclusive insomnia patients have lower BMI than insomnia-OSA overlap patients. Even in our study, overall about 27% were overweight and 64% were obese which includes 37 males and 27 females.

The symptomatology of both disorders has overlapping as well as distinct features. The ESS is an effective tool to measure excessive daytime somnolence. As per the ESS, about 76% had excessive daytime sleepiness. Among the 76, males were 50 and females were 26. About 15 patients had ESS between 11 and 12 signifying mild excessive daytime sleepiness, 25 patients between 13 and 15 with moderate sleepiness, and 36 had more than 16 with severe excessive daytime sleepiness. Among the 65 male patients, 7 (10.7%), 14 (21.5%), and 29 (44.6%) had mild, moderate, and excessive daytime sleepiness respectively while among the 35 female patients, 8 (22.8%), 11 (31.4%), and 7 (20%) had mile, moderate, and excessive daytime sleepiness, respectively. Thus, in our study, ESS was found to have a statistically significant association with AHI grading (p-value = 0.0048). The severity of insomnia was found to have a statistically significant association with Epworth Sleepiness Score, ESS grading > 10. All patients visiting should be screened for the comorbid conditions either at baseline or follow-up.

Conclusion

While baseline clinical assessment of the primary problem (OSA/insomnia) is already available, further screening assessment for the comorbidity should be actively pursued wherever available and possible. Obstructive sleep apnea patients should be screened for insomnia with screening questions. The predominance of excessive daytime sleepiness over fatigue or vice versa should be assessed. Similarly, insomnia patients should be screened with a clinical history, examination, and pre-test probability sleep scores followed by a PSG. Pretest probability scores, if routinely, and correctly used, can help predict the likelihood of OSAS, and the ISI questionnaire predicts the likelihood of insomnia. Our study provides further evidence that ISI is a simple, reliable, and valid instrument to detect cases of insomnia. There is a high prevalence (66%) of insomnia in OSAS patients. High prevalence leads to increased severity of OSAS and early detection helps in further management. The prevalence of insomnia is indeed the tip of the iceberg (combined OSA and insomnia). Limitations of the study include a single-center data and a referral bias with more severe cases of OSAS being referred to our center.

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