

The effect of allergic rhinitis on the degree of stress, fatigue and quality of life in OSA patients

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Abstract Both allergic rhinitis (AR) and obstructive sleep apnea (OSA) are known to increase stress and fatigue, but the result of their coexistence has not been studied. The objective of this study was to evaluate the amount of stress and fatigue when AR is combined with OSA. One hundred and twelve patients diagnosed with OSA by polysomnography were enrolled. Among them, 37 patients were diagnosed with AR by a skin prick test and symptoms (OSA-AR group) and 75 patients were classified into the OSA group since they tested negative for allergies. We evaluated the Epworth sleepiness scale (ESS), stress score, fatigue score, ability to cope with stress, and rhinosinusitis quality of life questionnaire (RQLQ) with questionnaires and statistically compared the scores of both groups. There were no significant differences in BMI and sleep parameters such as LSAT, AHI, and RERA between the two groups. However, the OSA-AR group showed a significantly higher ESS score compared to the OSA group (13.7 ± 4.7 vs. 9.3 ± 4.8). Fatigue scores were also significantly higher in the OSA-AR group than in the OSA group (39.8 ± 11.0 vs. 30.6 ± 5.4). The OSA-AR group had a significantly higher stress score (60.4 ± 18.6 vs. 51.2 ± 10.4). The ability to cope with stress was higher in the OSA group, although this difference was not statistically significant. RQLQ scores were higher in the OSA-AR group (60.2 ± 16.7 compared

to 25.1 ± 13.9). In conclusion, management of allergic rhinitis is very important in treating OSA patients in order to eliminate stress and fatigue and to minimize daytime sleepiness and quality of life.

Keywords Allergic rhinitis · Obstructive sleep apnea · Stress · Fatigue · Quality of life

Introduction

Allergic rhinitis (AR) is an upper airway disease that affects 10–40% of the world's population due to worsening atmospheric pollution and extended hours spent in closed spaces with poor ventilation. AR interferes with daily life and sleep, as well as with social life and work productivity, leading to social issues. The major symptoms of allergic rhinitis include rhinorrhea, nasal obstruction, and sneezing, which can lead to psychiatric disorders and excess stress and fatigue in social and daily activities, ultimately reducing the quality of life [1–3].

Obstructive sleep apnea (OSA) causes apnea during sleep due to upper airway obstruction. OSA has been increasing due to obesity caused by westernized diets and economic or social activities relating to poor sanitation. OSA may cause hypoxia due to repeated apnea during sleep and could influence the cardiovascular system, autonomic nervous system, and endocrine system due to abnormal sleep patterns. The resulting stress and fatigue also decrease quality of life [4].

Despite these concerns, there is still a dearth of studies regarding the effect of comorbid AR and OSA. Therefore, we examined the differences in polysomnographic parameters, stress and fatigue, and quality of life in OSA patients with AR compared to patients with only OSA.

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Table 1 Patient characteristics

	OSA-AR group (<i>n</i> = 37)	OSA group (<i>n</i> = 75)
Age (mean)	21–55 (41.37 ± 13.53)	20–68 (45.38 ± 13.15)
Sex (M:F)	29:8	65:10
BMI	25.4 ± 4.7	26.3 ± 3.5

OSA-AR obstructive sleep apnea with allergic rhinitis, OSA obstructive sleep apnea without allergic rhinitis, BMI body mass index

Materials and methods

Subjects

The subjects of this study were 112 patients who visited a sleep clinic due to sleep apnea and snoring and who underwent polysomnography for the diagnosis of OSA. All of these patients underwent an allergic skin prick test and/or a multiple allergic simultaneous test (MAST). AR was diagnosed based either on the size of the wheal compared to a controlled histamine test in the case of a skin prick test, or by an IgE (specific immunoglobulin E) greater than 0.35 kU/L for each antigen in the MAST with nasal symptoms. This group of patients was divided into the OSA-AR group (OSA with AR) and the OSA group (OSA without AR). Of the 112 subjects, there were 37 patients in the OSA-AR group and 75 in the OSA group. There were 73 male and 39 female patients and their ages varied from 20 to 68 years (Table 1). The average BMI for the OSA-AR group was 25.4 kg/m², while that of the OSA group was 26.3 kg/m², with no statistical difference between the two groups.

Polysomnography

Polysomnography was performed for all patients overnight in the hospital. Polysomnography (Embla S7000 Recording System, Denver, CO, USA) consisted of an electroencephalogram (C3/A1, C4/A2, O1/A1, O2/A2), an electrooculogram, an electromyogram of the cheeks and tibialis anterior muscles, an electrocardiogram, a nasal cannula/pressure transducer for measuring sleep stage, measurement of respiration and abnormal movement, an inductive plethysmograph for measuring movements on the chest and abdomen, and oxymetry for measuring oxygen saturation (SaO₂). Polysomnographic measurements were as follows: apnea hypopnea index (AHI), respiratory effort-related arousal event (RERA), minimal O₂ saturation (LSAT), total sleep time (TST), REM sleep time (REMST), and slow wave sleep (SWS). Apnea was defined as a greater than 90% decrease in airflow for more than 10 s while hypopnea was defined as a greater than 30% decrease in airflow and 4%

decrease in oxygen saturation for more than 10 s. Respiratory effort-related arousal was defined as the number of respiration-related arousals per hour with a flow limitation of more than 10 s that were not categorized as apnea or hypopnea. LSAT was the lowest oxygen saturation during sleep. When AHI (the sum of the number of apnea and hypopnea events per hour of sleep) was greater than 5, the patient was diagnosed with OSA. Various sleep parameters such as AHI, RERA, LSAT, TST, REMST, and SWS were compared between the two groups.

Questionnaires

A total of five questionnaires were distributed to the patients. The Epworth sleepiness scale (ESS) is a questionnaire designed to assess daytime sleepiness based on eight situations where patients can fall asleep during daily activities; patients are deemed to have constant sleepiness when the score is higher than 10 out of 24. The Chalder fatigue scale (CFS) is a questionnaire for assessing physical and mental fatigue and consists of 14 questions ranging from 1 to 4 points each; the higher the score, the higher the degree of fatigue. The daily hassles scale (DHS) is an index for assessing daily stress levels and consists of 36 questions ranging from 1 to 4 points each. Higher scores mean that patients are exposed to more stress in daily activities. The Conner–Davidson resilience scale (CD-RISC) consists of 25 questions that are rated on a scale of 0–4 to assess patients' stress-coping skills. The rhinoconjunctivitis quality of life questionnaire (RQLQ) is a questionnaire designed to assess the quality of life of patients with nasal disease and consists of 28 questions in seven categories. Each question is rated on a scale of 1–5. The results of each questionnaire were compared to verify whether there were any differences between the two groups.

Statistical analysis

Differences between the groups were assessed using the Mann–Whitney *U* test and the Wilcoxon signed-rank test. Analyses were conducted using SPSS (ver. 12.0, SPSS Inc, Chicago, IL) and a *P* value less than 0.05 was considered indicative of statistical significance.

Results

The results of the polysomnography revealed an AHI of 18.2 ± 20.5 for the OSA-AR group and 22.6 ± 20.0 for the OSA group, and the difference between groups was not statistically significant. RERA and LSAT were 10.7 ± 5.3 and 85.1 ± 8.7 for the OSA-AR group and 11.4 ± 8.0 and 83.6 ± 6.9 for the OSA group, respectively, with no statis-

Table 2 Comparison of sleep parameters between the OSA-AR and OSA groups

	OSA-AR group	OSA group	<i>P</i>
AHI	18.2 ± 20.5	22.6 ± 20.0	0.32
RERA	10.7 ± 5.3	11.4 ± 8.0	0.69
LSAT	85.1 ± 8.7	83.6 ± 6.9	0.41
TST	366.09 ± 51.2	367.47 ± 58.0	0.91
REMST	24.11 ± 6.5	25.73 ± 5.9	0.40
SWS	14.1 ± 2.9	14.3 ± 3.3	0.72

OSA-AR obstructive sleep apnea with allergic rhinitis, OSA obstructive sleep apnea without allergic rhinitis, AHI apnea hypopnea index, RERA respiratory effort-related arousal event, LSAT minimal O₂ saturation (%), TST total sleep time (min), REMST REM sleep time (%), SWS slow wave sleep (%)

Table 3 Comparison of ESS, fatigue, stress, coping stress, and RQLQ between the OSA-AR and OSA groups

	OSA-AR group	OSA group	<i>P</i>
ESS score	13.7 ± 4.7	9.3 ± 4.8	<0.05
Fatigue score	39.8 ± 11.0	30.6 ± 5.4	<0.05
Stress score	60.4 ± 18.6	51.2 ± 10.4	<0.05
Coping stress score	60.9 ± 12.7	66.5 ± 14.4	0.07
RQLQ	60.2 ± 16.7	25.1 ± 13.9	<0.05

OSA-AR obstructive sleep apnea with allergic rhinitis, OSA obstructive sleep apnea without allergic rhinitis, ESS Epworth sleepiness scale, RQLQ rhinoconjunctivitis quality of life questionnaire

tically significant differences. No significant differences were found for other sleep parameters between the two groups, including TST, REMST, and SWS (Table 2).

However, ESS for the assessment of daytime sleepiness was significantly higher in the OSA-AR group (13.7 ± 4.7) compared to the OSA group (9.3 ± 4.8). The average fatigue score assessed by the CFS was significantly higher in the OSA-AR group (39.8 ± 11.0 vs. 30.6 ± 5.4). The average stress score assessed by the DHS was 64.0 ± 18.6 for the OSA-AR group and 51.2 ± 10.4 for the OSA group, and this difference was again statistically significant. Stress-coping abilities measured by the CD-RISC were slightly reduced in the OSA-AR group (60.9 ± 12.7) compared to the OSA group (66.5 ± 14.4), but this difference was not statistically significant. The RQLQ score assessing quality of life was 60.2 ± 16.7 for the OSA-AR group and 25.1 ± 13.9 for the OSA group, and this difference was statistically significant (Table 3).

Discussion

In this study we measured the quality of life, fatigue, daytime sleepiness, stress, and stress-coping skills of OSA patients.

We found that OSA patients with AR have significantly higher fatigue, daytime sleepiness, and stress compared to OSA patients without AR. Although not statistically significant, they also tended to lack stress-coping abilities. Quality of life was poorer in the OSA-AR group compared to the OSA group. Therefore, we strongly recommended that comorbid AR in OSA patients be treated sufficiently.

The upper airway consists of the nasal cavity, oral cavity, pharynx, larynx, and extrathoracic trachea with normal breathing occurring through the nasal and oral cavities. In theory, increased resistance in the nasal and oral cavities can cause snoring or obstructive sleep apnea [5, 6]. In fact, increased resistance in the nasal cavity causes intranasal turbulent flow and results in mouth breathing in order to circumvent the nasal obstruction, which promotes vibration in the pharynx that leads to snoring. On the other hand, nasal obstruction increases negative pressure in the pharynx and causes pharyngeal constriction and hypoxia in sleep to lead to obstructive sleep apnea [7–9]. Nasal obstruction is one of the major symptoms of AR, and nasal congestion degrades the quality of sleep and causes daytime sleepiness or chronic stress. According to Young et al. [10], patients with nasal congestion due to AR have a significantly higher frequency of habitual snoring, chronic sleep deprivation, serious daytime sleepiness and/or fatigue. Also, persistent rhinorrhea interferes with normal mucus transport, disturbing normal sleep and causing chronic fatigue and stress. OSA patients are often sensitive to perennial allergens and suffer more from AR [11].

The influence of AR on chronic fatigue, stress, and poor quality of life is not just because of the symptoms, but also includes pathophysiological reasons. Histamine, one of the most important mediators of allergic rhinitis, causes local vasodilation and increases mucus secretion, leading to nasal obstruction that results in chronic stress and poor quality of sleep [12–14]. Histamine controls sleep cycle, memory, and cognition through the H1 receptor of the brain [15]. Also, cytokines, such as cysteinyl leukotrienes, inhibit both rapid eye movement (REM) and non-REM sleep [16, 17]. REM sleep is related to the body's restorative functions and its disturbance ultimately leads to chronic fatigue, difficulty concentrating, and reduced productivity [17].

AR deteriorates the quality of sleep, causing daytime sleepiness that degrades the quality of life due to fatigue, increased risk of car accidents, poor performance at work, loss of memory, stress, oversensitivity and/or depression [18].

Léger et al. [19] reported that 43.7% of patients with AR suffer from fatigue even when they sleep normally at night. Their headaches, anxiety, depression, and daytime sleepiness are significantly higher compared to those without AR. In addition, the severity of AR is closely related to the average hours of daytime sleep and the frequency of

daytime sleepiness. When the symptoms of AR are not successfully controlled, patients experience a serious loss of cognitive function in addition to daytime sleepiness.

Conclusion

BMI and polysomnographic parameters, including AHI, RERA, TST and LSAT of the OSA-AR group were not significantly different from those of the OSA group. However, the OSA-AR group experienced a higher stress level, more fatigue, and poorer quality of life. These symptoms appear to be attributed to the influence of AR. Therefore, if OSA patients also have AR, it is important to treat their AR in order to relieve their stress and fatigue and to improve their quality of life.

Conflict of interest The authors report no conflicts of interest.

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