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The Frequency of Allergic Rhinitis among Obstructive Sleep Apnea Patients: A Hospital-Based, Cross-Sectional Study

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Abstract. A relationship between obstructive sleep apnea and allergic rhinitis is controversial. Allergic rhinitis may potentially worsen severity of sleep apnea and hence, treating allergic rhinitis may actually improve sleep apnea as well as habitual snoring. Our aim was to determine the prevalence of allergic rhinitis among obstructive sleep apnea patients. In this cross-sectional study, all patients were referred to the Sleep Clinic at King Abdulaziz University Hospital from February to August 2013 and agreed to participate in the study were recruited. The diagnosis of obstructive sleep apnea was based on Berlin questionnaire followed by confirmatory Polysomnography. Allergic rhinitis was confirmed *via* focused history and clinical examination. Seventy adults were recruited, with mean age of 49.3 ± 13.42 years, and mean body mass index of 38.5 ± 12.63 kg/m^2. 54 (77.14%) patients were diagnosed to have obstructive sleep apnea, 26 (48%) of them had allergic rhinitis. No significant association was found between allergic

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rhinitis and severity of obstructive sleep apnea (p-value < 0.05). In conclusion, the prevalence of allergic rhinitis among obstructive sleep apnea patients was found to be 48.15%, with no clear correlation to the severity of obstructive sleep apnea.

Keywords: Obstructive sleep apnea, Allergic rhinitis, prevalence.

Introduction

Obstructive sleep apnea (OSA), and as a consequence of its prevalence and associated morbidity and mortality, is a sleep disorder that indeed requires all clinicians' attention. In the United States, 24% of men and 9% of women suffer from OSA[1]. Unfortunately, such epidemiological data are lacking for Saudi Arabia in particular and the Middle East in general. Obstructive sleep apnea pathology is summed up as a narrowed airway that closes up intermittently during sleep, leading to a disrupted sleep and consequent complications; namely those afflicting the cardiovascular system[2].

A recent literature review by Koinis-Mitchell *et al.*[3], reported that OSA is more common in patients with allergic diseases, as upper and lower airway resistance can increase the risk for sleep-disordered breathing events. In addition, this review also emphasized that nasal congestion in patients with allergic rhinitis (AR) is a risk factor for apnea and snoring. Moreover, Léger *et al.*[4] reported that sleep in general is significantly more impaired in patients with severe AR than in those with the milder form. Therefore, treating AR may actually improve severity of OSA as well as habitual snoring. However, this relationship between AR and OSA remains controversial in the literature and similar local epidemiological data are lacking. Our study is aimed to determine the prevalence of AR among OSA patients attending King Abdulaziz University Hospital (KAUH).

Methods

In this cross-sectional study, a consecutive sample of all adult patients (age 18-99 years) who were referred to the sleep clinic at KAUH in Jeddah from February to August 2013 were recruited. A trained physician interviewed each patient individually. A questionnaire collected data on the following: 1. Demographic data

and comorbidities; 2. Berlin questionnaire to screen for the diagnosis of OSA; 3. The Epworth Sleepiness Scale (ESS) to assess daytime sleepiness; 4. Symptoms of AR and atopy.

Our primary end point was estimating the frequency of AR among patients with OSA. The Hospital Ethical Committee approved this study and a written informed consent was obtained from all patients.

Instruments

Berlin Questionnaire[5,6]

This widely used validated questionnaire consists of 11 self-reported questions used to identify individuals at high risk for sleep apnea. It covers three categories of apnea signs and symptoms, namely: snoring, daytime sleepiness, and obesity/high blood pressure. Patients are instructed to answer the questions, which vary between 'yes; no' and 'multiple-choice questions' to all three categories. These responses are then analyzed by the physician or medical staff according to pre-specified key answers. If the individual scores positive in at least two of the three categories, he/she is deemed to be at high risk for OSA.

Epworth Sleepiness Score[7,8]

The Epworth Sleepiness Score (ESS) is a validated, effective and widely used self-administered questionnaire used as a tool to measure subjective daytime sleepiness. A 4-point rating scale from (0-3) is used to evaluate how likely the patient would of doze off or fall asleep in 8 different situations or activities that most people engage in during their daily lives. The sum of these points is then calculated (0-24). A score of more than 10 is considered to have excessive daytime sleepiness.

Diagnosis of Obstructive Sleep Apnea

Obstructive sleep apnea was screened using Berlin questionnaire score. Patients with high-risk underwent a confirmatory over-night full Polysomnography (PSG). Polysomnography (PSG) is a diagnostic test for OSA. Full-night, attended, in-laboratory PSG is

actually considered the gold-standard diagnostic test for OSA. During PSG, the patient sleeps while connected to a variety of monitoring devices that record physiologic variables including sleep stages, electrocardiography, oxygen saturation, airflow, respiratory efforts, snoring, and leg movements. The number of respiratory events during sleep including apneas and hypopneas may be diagnostic of OSA[9,10]. Apnea is defined according to American Academy of Sleep Medicine (AASM) as a decrease in flow by 90% or more for at least 10 seconds[11]. Hypopnea is also defined based on AASM as a decrease in flow by 30% or more for at least 10 seconds together with 3% or more in oxyhemoglobin saturation and/or terminating by electroencephalography (EEG) arousal[11]. The average number of episodes of apnea and hypopnea per hour of sleep *i.e.,* the apnea-hypopnea index (AHI) was calculated to be used in the diagnosis of OSA[12]. The diagnosis of OSA is said to exist if AHI is 5 with symptoms or signs of disturbed sleep; or it is 15 regardless of symptoms[12]. Cutoff points of ≥ 5, ≥ 15, and ≥ 30 were used for categorizing the patients into mild, moderate and severe OSA patients, respectively[12].

Establishing Allergic Rhinitis

According to the AR and its Impact on Asthma (ARIA), AR is defined as, "a symptomatic disorder of the nose induced after allergen exposure by an IgE-mediated inflammation". It is characterized by a complex of symptoms that consists of any combination of the following: rhinorrhea, nasal congestion, sneezing, nasal itching, and/or postnasal drip.

Following the ARIA guidelines[13], allergic rhinitis was diagnosed mainly *via* focused history concerning three main symptoms (rhinorrhea, sneezing and nasal itchiness and nasal blockage), supportive findings of physical signs (pale mucosa, hypertrophied inferior turbinate), and an increased level of total serum IgE antibody and/or identified sensitization to inhalant allergens based on serum allergen-specific IgE antibody measurements.

Statistical Analysis

The statistical analysis was done using STATA, version 12.0, software for Macintosh (StataCorp LP, College Station, TX, USA). Categorical variables are presented as counts and percentages; the continuous variables are presented as means and standard deviations (SD). Comparison between AR and non-AR groups was done using Chi-square (χ^2) and Fisher's exact tests for categorical variables. A p-value of 0.05 was accepted for statistical significance.

Results

A total of 70 patients were screened for OSA during the study period. Table 1 lists the demographic data of the study participants. 58.6% (41) were males and the mean age was 49.3 ± 13.42 years.

Table 1. Demographic data of the study participants.

Total Number of Patients (N)	70
Age (Years) Total	49.3 ± 13.42
Male	48.9 ± 12.3
Female	50.1 ± 15.06
Gender	
Male	41(58.57%)
Female	29(41.43%)
BMI* (kg/m^2) Total	38.5 ± 12.63
Male	35.55 ± 10.92
Female	42.65 ± 13.87

**BMI: Body Mass Index*

Fifty-four (77.14%) patients of our sample population were diagnosed with OSA, 26 (48.15%) of them had AR. Table 2 shows the frequency of AR among those with OSA and their clinical characteristics. The mean AHI of those patients was high (36.95 ± 22.8).

Table 2. Frequency of AR among OSA patients and their clinical characteristics.

Total	54 (77.14%)		
AR status:	AR	Non-AR	
	N (%) or SD	N (%) or SD	P-value
	26* (48.15%)	28* (51.85%)	0.896*
AHI	36.95 ± 22.8	36.15 ± 34.12	> 0.05
ESS Score	13.9 ± 6.7	13.6 ± 5.96	> 0.05
Comorbidities:			
DM	12 (46.15%)	10 (35.71%)	> 0.05
HTN	17 (65.38%)	16 (57.14%)	> 0.05
Stroke	3 (11.54%)	2 (7.14%)	> 0.05
IHD	7 (26.92%)	5 (17.86%)	> 0.05
GERD	10 (38.46%)	16 (57.14%)	> 0.05
COPD	4 (15.38%)	2 (7.14%)	> 0.05
BA	7 (26.92%)	9 (32.14%)	> 0.05

* *Pearson Chi 2(1) = 0.0169*

ESS: Epworth sleepiness scale, DM: Diabetes Mellitus, HTN: Hypertension, IHD: Ischemic heart disease, GERD: Gastro-esophageal reflux disease, COPD: Chronic obstructive pulmonary disease, BA: Bronchial asthma.

In Figure 1, the frequency of AR is shown after stratifying patients as having into mild, moderate and severe OSA.

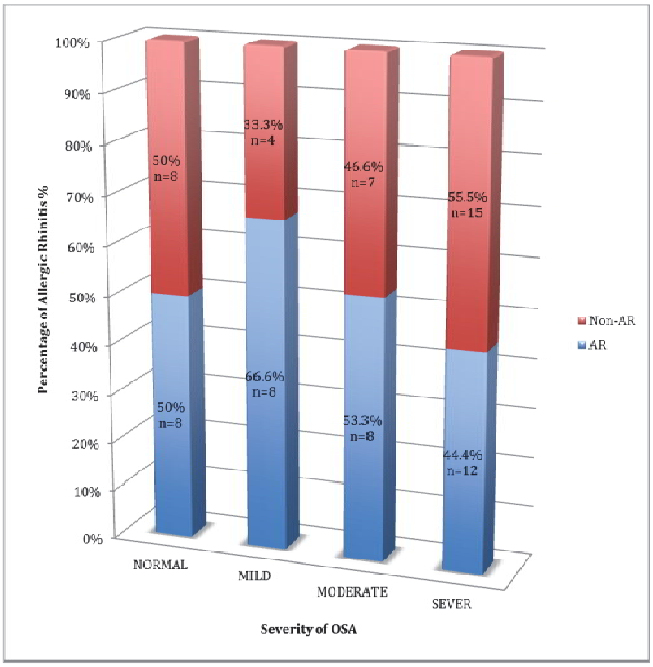

Fig. 1. Frequency of AR according to severity of OSA: (*Pearson's Chi 2(3) = 1.6776 P = 0.642; **OSA was classified into different severities in reference to different values of AHI. Normal (AHI = 0 – 4.9), Mild (AHI = 5 – 14.9), Moderate (AHI = 15 – 29.9), Sever (AHI > 30).

Discussion

In our study, OSA was seen in (77.14%) among our study population and AR was high (48.15%) among them as noted in Table 2. However, when we stratified the patients into different categories according to the severity of OSA, no significant relationship was identified (Pearson's chi 2(3) = 1.6776, P = 0.642). In fact the frequency of AR was found to be higher among patients with mild OSA compared to those with severe OSA.

The high frequency of OSA detected in our sleep clinic patients is not surprising since it was previously reported. 21% to 90% of patients referred for sleep evaluation were found to have sleep apnea[14], especially in those with associated conditions such as hypertension, diabetes and gastro-esophageal reflux disease[15-17].

Obstructive sleep apnea patients with AR were exceptionally high in our study. In a similar study, Gül *et al.,*[18] investigated 80 patients with OSA, and found 23% to have allergic rhinitis. Kramer *et al.,*[19] also reported that 11.7% of 119 adult subjects with OSA were found to have AR. The prevalence of AR in the later study is much less compared to our finding. In contrast, Canova *et al.*[20] reported increased prevalence of perennial AR in OSA patients compared to those with Chronic Obstructive Pulmonary Disease (COPD). However, this prevalence of the above mentioned studies could be underestimated or overestimated due to the high chance of selection and recall bias. In addition, this discrepancy in results might also be attributed to the difference of severity of OSA in the study population. Canova *et al.*[20] study had a more severe OSA with a mean AHI of 38.5, pointing to a possible relationship between the severity of OSA and AR. This relationship has been refuted in our study, since patients with a high mean AHI (36.53 ± 28.95) were found to show an upward trend of AR when compared with those with mild OSA, yet no significance was found. This might be due to our small sample size population leading to nearly similar frequencies of AR among our OSA patients with different severities.

Our prevalence of AR is considered the highest when compared with other population-based studies conducted to describe the natural

history of AR. It has been found that 25% of the European population suffers from AR in 2004 and 2005[21,22]. Recently, Abdulrahman *et al.,*[23] reported AR in only 10% among the Middle Eastern population. On a local level, most of the studies have been conducted on children with 4 – 16 years of age. Although they showed a progressively rising trend for AR throughout the years from late seventies till present, the overall prevalence ranges from 24% - 26%[24-26]. Nevertheless, the finding of this study was almost double of the local data. There are several possible explanations to this outcome. This may be attributed to the small insufficient sample size and the possible selection bias as our sample was hospital-drawn, which could overestimate the observations for comorbidities. However, this comparison might be implausible due to variations in demographic data and assessment tools among the prior mentioned studies. Moreover, considering the increasing trend of AR among children in Saudi Arabia and the lack of similar studies in adults, our finding might simply reflect – at least in part - the current trend of AR among the adult Saudi population due to factors related to the rapid modernization of Saudi Society. These factors include changes in dietary habits, and exposure to environmental factors, such as indoor allergens, dust, sand storms and tobacco which have been strongly suggested to account for the increasing trends for allergic disorders in Saudi Arabia [27].

Although the literature is limited when it comes to adults, however, the available evidence supports the hypothesis of AR being a primary contributor to disturbed sleep and daytime fatigue [2,28-31]. The reason for that is not clearly understood, but nasal congestion has been widely suggested to play a significant role in the course of the disease. It increases the narrowing of the already narrowed upper airway, leading to increased airflow resistance, and consequently may add to the severity of OSA. This has been supported by several clinical trials that have shown subjective improvement in the quality of sleep upon receiving nasal steroids for nasal congestion [32]. Nevertheless, it was suggested that AR is not the main contributing factor in the majority of patients with moderate to severe OSA, and the medical treatment itself is considered inadequate on its own [33-35].

To the best of our knowledge, this study is the first of its kind in the region. It highlighted the likelihood of increased prevalence of AR in OSA patients. This dearth of evidence could hamper ample understanding of these conditions, consequently, rendering the patients management deficient and ineffective.

Our study came across certain limitations, including the small sample size and the selection bias arising from the hospital-drawn sample, which might have contributed to the potential inflation of our findings.

In conclusion, AR seems to be more frequent among obstructive sleep apnea population. However, further studies on a larger scale that aim to reveal causality rather than mere association, are highly recommended.

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Authors' Roles in the Study

All authors had participated in writing the manuscript. Drs. Khalid S. Sendi, Abdulkareem R. Fida, and Khalid I. Alnoury were in-charge of the ENT supervision and reviewed the manuscript.

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بحث مدى انتشار حساسية الأنف في مرضى انقطاع التنفس الانسدادي أثناء النوم: دراسة عرضية

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جامعة الملك عبدالعزيز

جدة . المملكة العربية السعودية

المستخلص. هناك ارتباط محتمل بين حساسية الأنف ومرض انقطاع النفس أثناء النوم، إلا أنه لم يتم اثباته بعد. حيث أن حساسية الأنف من شأنها أن تفاقم الوضع سوءاً. لذلك فإن علاج حساسية الأنف قد يحد من شدة إنقطاع النفس. في هذه الدراسة الميدانية، تم إستجواب جميع المرضى اللذين تمت إحالتهم إلى عيادة النوم في مستشفى جامعة الملك عبد العزيز في الفترة من فبراير إلى أغسطس٢٠١٣. التشخيص المبدئي لمرضى إنقطاع التنفس أثناء النوم تم بواسطة (استبيان برلين) وتم تأكيده بواسطة اختبار النوم. بالنسبة إلى حساسية الأنف فقد تم تشخيصها لدى المرضى من خلال التاريخ المرضي، الفحص الكلينيكي وفحوصات الدم الخاصة بالحساسية. ٧٠ مريضاً كان متوسط أعمارهم (١٣,٤٢± ٤٩,٣ سنة)

بينما كان متوسط كتلة الجسم (١٢,٦٣± ٣٨,٥ كجم/م^{٢}). ٥٤ مريضاً (٧٧,١٤٪) لديهم انقطاع النفس أثناءالنوم، ٢٦ (٤٨٪) منهم كانوا يعانون من حساسية الأنف. اتضح لنا أن هناك انتشاراً نسبياً واسعاً لحساسية الأنف (٤٨,١٥) لدى مرضى انقطاع النفس الانسدادي. مع هذا لم نتوصل إلى علاقة حتمية بين المرضين. لا تزال هذه الدراسة مستمرة. من أهم التوصيات المتعلقة بالدراسة: مواصلة البحث في هذا المجال بعمق وتضمين أعداد كبيرة من المرضى. بالإضافة إلى تطوير طرق بحثية جديدة وسليمة للكشف عن الأسباب المحتملة بدلاً من العلاقة الربطية البحتة.