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Reviews

Sleep impairment and daytime sleepiness in patients with allergic rhinitis: the role of congestion and inflammation

Alison Thompson, MS [*]; Niti Sardana, MD [†]; and Timothy J. Craig, DO [*]

[*] Penn State University, Hershey Medical Center, Hershey, Pennsylvania
[†] New York Presbyterian Hospital, New York, New York

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ABSTRACT

Objective: To investigate the association of rhinitis with stress, fatigue, decrease productivity, inflammation, and sleep disordered breathing.
Data Sources: Medical literature obtained from OVID and PubMed searches in February 2013 using the search terms "sleep," "rhinitis," "allergic rhinitis," "somnolence," and "fatigue".
Study Selections: Studies were selected based on the US Preventive Services Task Force levels 1, 2, and 3.
Results: Allergic rhinitis is a disease that severely affects patients' quality of life and is increasing in prevalence worldwide. Nasal congestion is reported as the most common and bothersome symptom; it is often associated with sleep-disordered breathing, a likely cause of sleep impairment in rhinitis-affected individuals. The end result is a reduced quality of life and productivity and an increase in daytime sleepiness, fatigue, and stress. Current treatment modalities include intranasal corticosteroids, which have been found to reduce nasal congestion. Clinical trials on intranasal corticosteroids have provided data on sleep-related end points, and these studies report that the improved nasal congestion is associated with improved quality of life with better sleep and reduced daytime fatigue. Alternate therapies, including montelukast, also decrease nasal congestion and positively influence sleep, but to a lesser extent.
Conclusion: This review examines nasal congestion and cytokine changes and the associated sleep impairment in allergic rhinitis patients and the effect on daytime performance. It elaborates the adverse effects of disturbed sleep on quality of life and how therapies directed at reducing nasal congestion can relieve such effects.

Introduction

Allergic rhinitis (AR) is thought to affect up to 40% of the population, and its prevalence is increasing worldwide.[1] In the United States alone, estimates suggest that 60 million people are affected by AR. Approximately 80% of people with AR are symptomatic before 20 years of age, and the overall prevalence of AR in children is reported to be 40%.[2,3]

AR can be categorized as perennial or seasonal based on the allergen sensitivity and timing of the inflammatory stimulus. In addition, severity of symptoms, effect on productivity, and quality of life can affect the categorization. In addition, according to Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines, the duration of symptoms is important in determining classification and treatment.[4] Symptoms include nasal congestion, rhinorrhea, sneezing, and pruritus of the eyes, nose, and throat.[2] Typical sleep-related problems seen in AR include sleep-disordered breathing, sleep apnea, and snoring, all of which are associated with nasal obstruction and cytokine changes.[5]

Allergy-induced nasal congestion has a large effect on both children and adults. The 2009 Pediatric Allergies in America survey emphasized that congestion or stuffy nose is the most reported symptom that affects children.[6] In adults, the 2009 Burden of Rhinitis in America survey indicated that sleep disturbance played a major negative role in rhinitis patients, with less than 5% of the almost 4000 AR patients surveyed experiencing 100% sleep adequacy.[7] In a recent survey of individuals with AR, 68% of respondents with perennial allergic rhinitis (PAR) and 48% with seasonal allergic rhinitis (SAR) reported that their condition interfered with sleep.[8] Overall, sleep impairment is a significant problem for patients with AR, and nasal congestion is one of the main causes.

Rhinitis also poses a significant socioeconomic burden. In 2000, it was estimated that more than $6 billion was spent on prescription medications for AR.[2,3,9] In 2005, these costs almost doubled according to a report by the Agency for Healthcare Research Quality. These socioeconomic costs include those for treatment, reduced productivity, and the use of inappropriate therapies. Both the

Reprints: Timothy J. Craig, DO, Penn State University, College of Medicine, Department of Allergy/Immunology, 500 University Dr 29 UME, Hershey, PA 17033; E-mail: tcraigpsu@yahoo.com.

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Medical Outcomes Study Short Form Health Survey and the Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) have found that AR significantly affects patients' quality of life, which further contributes to the costs listed above.[10,11]

Treatments directed at the symptomatic management of AR, particularly those that reduce nasal congestion and inflammation, have been found to improve patients' sleep and quality of life. Unfortunately, the data to prove a causal relationship between nasal congestion and inflammation and sleep disturbance are limited. Thus, further research is warranted.

We performed OVID and PubMed searches of the medical literature and selected studies based on the US Preventive Services Task Force levels 1, 2, and 3 in February 2013 using the search terms "sleep," "rhinitis," "allergic rhinitis," "somnolence," and "fatigue". This review explores the importance of congestion and inflammation in people with rhinitis and also addresses the adverse effects of disturbed sleep on quality of life, productivity, and performance. Finally, this review describes therapeutic modalities that can reduce these adverse effects by targeting the underlying problems that affect sleep.

Nasal Congestion and Sleep Impairment

Depending on methods used and populations surveyed, rhinitis has a prevalence of 15% to 40%, and more than 50% of these individuals have congestion as their main symptom. Even more concerning are the effects of congestion on those who experience it. Stull et al[12] concluded that congestion alone accounted for 73% of the adverse outcomes associated with allergic rhinitis, including poor sleep, missed work, and activity impairment. Congestion had a much greater effect on patients than any other symptom of rhinitis assessed. According to individuals in this cohort, 30% of impaired sleep was secondary to congestion. Congestion alone was calculated to have a direct cost of US $3.4 billion and an indirect cost of US $3.1 billion.

In the Pediatric Allergies in America survey, 52% of respondents reported that they experienced congestion most days of the week, making congestion the predominant symptom that affects children. Seventy-five percent of the respondents called congestion the most bothersome symptom. When health care professionals were polled with a similar question, 92% deemed congestion the worst symptom in their patients.[6] Children in this cohort were described as less likely to be happy, energetic, peaceful, and full of life. Parents thought that their child's rhinitis had a negative effect on performance in school, sports, and activities. Furthermore, parents rated their rhinitis-affected children as being less healthy, less productive, limited in the ability to work, and more likely to have difficulty completing tasks. A total of 40% of parents believed allergies affected their child's sleep; 32% reported their children had difficulty falling asleep, 26% reported their children awakened at night due to sleep problems, and 29% reported their children had a lack of good sleep.[6] As demonstrated here, both the pattern and quality of sleep were affected by allergies.

Adults with allergic rhinitis experience similar sleeping difficulties; AR patients were more likely to have poor sleep compared with those with nonallergic rhinitis or those without rhinitis symptoms. Only 3.6% of patients with AR symptoms in the previous month had 100% quality of sleep during this time vs 19.2% who had no symptoms of rhinitis.[7] Overall, reports estimate that 57% of adults and 88% of children with AR have sleep problems and associated poor productivity and difficulties at work.[13]

Evidence of Sleep Impairment

As previously described, rhinitis is associated with sleeping difficulties, daytime somnolence, and fatigue. Because the symptoms of AR, particularly nasal congestion, adversely affect sleep, the ARIA guidelines use the degree of sleep impairment to classify AR severity.[6] Sleep disturbances associated with AR consist of both microarousals and sleep-disordered breathing (ranging from snoring to obstructive sleep apnea [OSA] and/or hypopnea).[14–17] Individuals with frequent nighttime rhinitis symptoms have been found to be more likely to have chronic excessive daytime sleepiness or chronic nonrestorative sleep than those who rarely have such symptoms.[18] Actigraphy studies have provided objective evidence for the discrepancy in the amount of sleep disturbance between adults with PAR and healthy control participants.[19]

Studies in children have reported that AR and allergic sensitization are associated with snoring.[20] Rhinitis has also been established as an independent risk factor for disordered sleep in children, as demonstrated by Bixler et al.[21] A study in young adults with asthma found the presence of concomitant AR to be independently related to difficulties inducing sleep and also to daytime sleepiness.[22] As indicated in this study, the evidence of sleep impairment is apparent across all age groups.

Mechanisms of Sleep Impairment

To reduce the effect of AR on patients' daily living, it is essential to identify the mechanisms that underlie sleep impairment and daytime fatigue. Multiple mechanisms have been addressed that may contribute to these adverse effects, particularly nasal congestion. Still, other rhinitis symptoms, such as ocular itch, may play a role.[25,26] It is unclear whether fatigue is more a result of nasal congestion than other symptoms of rhinitis. Fatigue could also result from the direct effects of inflammatory cytokines. Current evidence suggests that underlying pathophysiologic changes of the AR, including cytokines, also contribute to decreased sleep quality and can affect latency to and duration in rapid eye movement (REM) sleep. In addition, cytokines, such as interleukin (IL) 1 and tumor necrosis factor (TNF), can result in daytime somnolence and fatigue.[23,27] Figure 1 and Figure 2 illustrate the importance of cytokines in rhinitis and sleep impairment. Figure 1 highlights that cytokines are elevated in sleep apnea and that similar elevations are seen in patients with rhinitis and sleep disturbance. These cytokines can worsen sleep quality and cause daytime somnolence and fatigue. Figure 2 emphasizes the effect that cytokines can have on sleep.

Nasal congestion occurs when capacitance vessels dilate in the cavernous tissues of the nasal turbinates.[26] This leads to a smaller internal nasal diameter, which increases airway resistance to nasal airflow and results in nasal obstruction.[26] In addition to subjective clinical assessments of the severity of nasal congestion, objective measures of nasal airflow (eg, peak nasal inspiratory flow), airway resistance and conductance (rhinomanometry), and nasal cavity volume and area (acoustic rhinometry) have been used to determine the degree of congestion (nasal patency).[27]

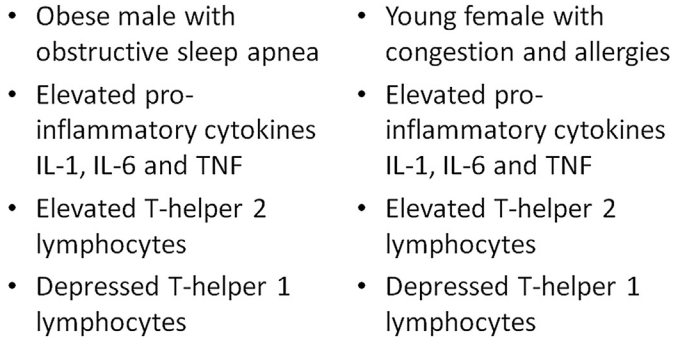

Figure 1. Comparing cytokine changes from an obese male with obstructive sleep apnea to a young female with rhinitis and sleep disturbance