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REVIEW

Anxiety in middle-aged men with obstructive sleep apnea: State of the science

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Abstract

Purpose: This article presents the state of the science of anxiety in middle-aged men with obstructive sleep apnea (OSA). OSA affects 10% of men in this population. Psychological outcomes, especially anxiety, have a significant impact on quality of life, yet are essentially ignored.
Data sources: Search of CINAHL, MEDLINE, PsycINFO, and PsycARTICLES, with the key words "sleep apnea" and "anxiety" and with age and gender limits, resulted in 107 articles. Based on established inclusion criteria, 71 studies were excluded. The resulting 36 studies were critically evaluated by sample characteristics, anxiety measurement, and results.
Conclusions: Anxiety was noted in 34 of the 36 samples, most commonly measured using the Hospital Anxiety and Depression Scale, the State Trait Anxiety Inventory, and the Beck Anxiety Inventory. Effects of treatment on anxiety were significant.
Implications for practice: Anxiety is common in middle-aged men with OSA, but is not adequately studied in this population. Psychological screening for anxiety at the time of OSA diagnosis is warranted, but is not encouraged in the clinical guidelines. More primary care attention is needed on psychological implications that impact OSA treatment adherence. Advanced practice nurses can be instrumental in ensuring comprehensive assessment of patients with OSA, especially psychological aspects of the disease.

Introduction

Obstructive sleep apnea (OSA) is the most common form of sleep-disordered breathing (Rakel, 2009). In the literature, OSA is less commonly referred to as obstructive sleep apnea syndrome (OSAS), obstructive sleep apnea–hypopnea syndrome (OSAHS), sleep apnea-hypopnea syndrome (SAHS), and sleep apnea syndrome (SAS; Saunamäki & Jehkonen, 2007). It is characterized by repetitive, complete (apnea), and partial (hypopnea) obstructions of the airway during sleep. These episodes of airway obstruction cause fragmented sleep because of intermittent periods of oxygen desaturation and arousals from sleep (Saunamäki & Jehkonen, 2007).

The severity of OSA is measured by the number of apneic and hypopneic episodes per hour, most commonly referred to as the apnea–hypopnea index (AHI). The AHI is calculated by adding the total number of apneic and hypopneic episodes and dividing that number by the total hours of sleep (Pack, 2006). The AHI may also, but less commonly, be expressed as the respiratory disturbance index (RDI). The RDI is a broader measure that includes respiratory effort-related arousals (RERAs), events that lead to sleep arousals or microarousals but that do not fulfill the criteria for hypopneic or apneic episodes (Loube & Andrada, 1999). Both of these indices (AHI and RDI) are best measured during an overnight, in-laboratory polysomnography (Pack, 2006). The polysomnogram is considered to be the "gold standard" for diagnosing OSA (Rakel, 2009). Interpretation of its results categorizes an AHI of 5–15/h as mild, 15–30/h as moderate, and over 30/h as severe OSA (Pack, 2006).

The first description of OSA dates back to 1965, but most of the medical knowledge about OSA and progress in its treatment has occurred over the past 20 years (Pack, 2006). The incidence of OSA has increased, currently affecting approximately 4% of all males (Andrews & Oei, 2004). It is most prevalent in middle-aged men (aged

40–64), reported as high as 10% in that age group (Andrews & Oei, 2004). Males have as high as an 8:1 higher prevalence compared to females (Olsen, Smith, & Oei, 2008).

There are numerous risk factors associated with OSA. The most important modifiable risk factor for OSA is obesity (Andrews & Oei, 2004). Obesity is present in approximately 70% of individuals with OSA (Andrews & Oei, 2004). OSA rates are shown to be higher in the United States compared to other countries, such as Israel, Italy, and Sweden (Andrews & Oei, 2004), possibly because of higher obesity rates; U.S. males aged 15 and over rank fifth in world obesity rates (World Health Organization, 2010). In fact, candidates for bariatric surgery are among the high-risk populations for OSA (Epstein et al., 2009). Others include those with cardiovascular problems, such as hypertension, congestive heart failure, coronary artery disease, atrial fibrillation, and nocturnal dysrhythmias; neurovascular problems, such as stroke; and endocrine problems including type 2 diabetes mellitus (Epstein et al., 2009). High-risk drivers (e.g., commercial truck drivers) must also be carefully screened (Epstein et al., 2009), because OSA has been linked to higher motor vehicle accident rates (Akashiba et al., 2002). Careful physical assessment, especially focusing on the respiratory, cardiovascular, and neurologic systems, is critical in the identification of those males at highest risk for OSA.

Presenting findings associated with OSA include symptoms reported by the bed partner, especially loud snoring, breathing interruptions, and frequent nocturnal awakenings (Epstein et al., 2009). Symptoms reported by the patient occur across physical and emotional spectrums, ranging from impaired concentration, memory loss, and headache, to irritability, anxiety, and depression (Kjelsberg, Ruud, & Stavem, 2005; Rakel, 2009). Excessive daytime sleepiness (EDS) is one of the primary symptoms of OSA (Rakel, 2009). These symptoms have a tremendous effect on the individual's ability to function, and have been shown to lead to increased traffic, work-related, and domestic accidents (Akashiba et al., 2002). Individually and collectively, these factors have a negative impact on the OSA sufferer's overall quality of life, with many patients reporting interpersonal problems within partner, family, social, and work relationships (Reishtein et al., 2006).

Physical findings associated with OSA include a thick neck (greater than 17 inches in males); reduced upper airway size related to tonsillar, tongue, and uvular enlargement; nasal abnormalities; and hypertension (Andrews & Oei, 2004; Epstein et al., 2009; Rakel, 2009). Obesity, defined as a body mass index (BMI) of 30 kg/m^2 and over (Centers for Disease Control and Prevention, 2012), is another common finding in the majority of men with OSA (Andrews & Oei, 2004). Health history may reveal use of alcohol and/or sedatives; both have been shown to exacerbate OSA symptoms (Andrews & Oei, 2004).

Untreated moderate to severe OSA is associated with increased morbidity and mortality, especially because of cardiovascular and neurovascular events (Pack, 2006), such as arrhythmias, myocardial infarction, and stroke (Głebocka, Kossowska, & Bednarek, 2006). Because OSA sufferers are also involved in an increased number of traffic accidents, this factor increases mortality risk. Other comorbid conditions include metabolic disturbances, such as type II diabetes, and psychiatric problems (Rakel, 2009). Among the OSA-anxious population, researchers have found permanent neurostructural brain abnormalities via magnetic resonance imaging; these changes are noted especially in areas of the cortices, thalamus, hippocampus, and amygdala (Antic et al., 2011; Kumar et al., 2009).

To date, the most effective intervention to manage the symptoms of OSA is continuous positive airway pressure (CPAP); however, adherence is poor (Olsen et al., 2008; Rakel, 2009). Approximately one fourth of all CPAP users discontinue it within the first year (Aloia, Arnedt, Riggs, Hecht, & Borrelli, 2004) for reasons that range from discomfort and a feeling of claustrophobia from the mask to inconvenience and interference with travel (Aloia et al., 2004; Olsen et al., 2008). Of those who continue with CPAP, the majority do not use it consistently or for the specified number of hours prescribed (Aloia et al., 2004). Motivational strategies, referred to as motivational enhancement therapy for CPAP (ME-CPAP), have been developed to improve CPAP compliance (Aloia et al., 2004). Alternative interventional strategies include mandibular advancement splinting (Nambu, Nagasaka, Fujita, Hamada, & Fukuoka, 1999), and surgical dilation of the upper airway by way of extended uvulopalatal flap (Li et al., 2004) or radiofrequency tissue ablation (Uloza, Balsevicius, Sakalauskas, Miliauskas, & Zemaitiene, 2009).

While much is known and published about the physical effects of OSA and its treatment, not as much attention is directed to the psychological outcomes of OSA, including anxiety and depression (Andrews & Oei, 2004; Olsen et al., 2008; Saunamäki & Jehkonen, 2007). In fact, both of these phenomena, especially anxiety, are understudied in relation to OSA, and are not addressed in the clinical guidelines for the management of OSA (Epstein et al., 2009). OSA sufferers report anxiety in varying degrees, from mild to panic levels (Edlund, McNamara, & Millman, 1991), stemming from the multitude of distressing symptoms they endure on a daily basis and the effects of these symptoms on relationships with others.

The relationship between anxiety and OSA is unclear. Overlapping symptoms and interfering factors complicate this relationship even further. The presence of psychological comorbidity in the patient with OSA significantly impacts his quality of life (Ye, Liang, & Weaver, 2008). In a study identifying predictors of health-related quality of life in subjects with OSA (Ye et al., 2008), anxiety was the strongest predictor overall. Consequently, the relationship between OSA and anxiety warrants further attention.

The purpose of this article is to present the state of the science of anxiety in middle-aged men with OSA. A literature review of studies establishing the relationship between anxiety and OSA is presented to promote further understanding of this phenomenon. The prevalence of anxiety in the context of OSA is explored within the empirical and methodological dimensions. Nursing implications and recommendations for primary care practitioners are also proposed.

Method

A review of the literature was conducted using CINAHL, MEDLINE, PsycARTICLES, and PsycINFO databases with the search terms "sleep apnea" and "anxiety." Search limits included English language, human subjects, males, and middle age (40–64 years). Because most advancements in OSA research have occurred over the past 20 years, the search was expanded to the years 1992 through 2012. The initial search yielded 103 results. Of these 103 studies, 71 articles were excluded because they did not meet the following inclusion criteria:

- Utilized a quantitative research method;
- Collected data from a sample that was predominantly male and middle aged;
- Reported OSA severity (AHI or RDI); and
- Measured anxiety using a standardized instrument and reported related statistics.

An additional search resulted in four newer studies, all of which met the inclusion criteria. A complete summary of the included studies is available in Table S1.

Results

Thirty-six studies were analyzed for this review (see Table S1). All of the studies were quantitative, with a large majority of the studies descriptive and correlational in nature. Eight were experimental in design (Głebocka et al., 2006; Jokic, Klimaszewski, Sridhar, & Fitzpatrick, 1998; Kumar et al., 2009; Marshall, Neill, Campbell, & Sheppard, 2005; Muñoz, Mayoralas, Barbé, Pericás, & Agusti, 2000; Profant, Ancoli-Israel, & Dimsdale, 2003; Ramos Platón & Sierra, 1992; Yue et al., 2003); of these, five involved healthy (no OSA) controls (Głebocka et al., 2006; Kumar et al., 2009; Muñoz et al., 2000; Ramos Platón & Sierra, 1992; Yue et al., 2003). It appeared that statistical reporting improved as the studies progressed through the years.

Most of the research related to anxiety among men with OSA has been conducted in the United States. By country of the primary author or country of participants, eight of the studies were conducted in the United States; four each in Spain and China; three each in Poland and the U.K.; two each in Canada and Taiwan; and one each in Scotland, Israel, Japan, Switzerland, Ireland, Australia, Norway, New Zealand, Lithuania, and Portugal (see Table S1). Anxiety among middle-aged men with OSA appears to be an issue with global implications.

Studies exploring OSA and anxiety have been conducted across the fields of medicine, psychology, and nursing. By discipline of the primary author, 21 studies were conducted by medicine, three by nursing, and one by dietetics. Even with this interdisciplinary attention, much is still unclear about the relationship between anxiety and OSA.

Many of the studies were conducted on convenience samples gathered from sleep centers. Sample sizes ranged from 16 to 2271, with as high as 118,105 participants in a database review of the Veterans Health Administration (Sharafkhaneh, Giray, Richardson, Young, & Hirshkowitz, 2005). Most of the samples from the included studies were smaller in size. There were 21 studies in the sample size range from 20 to 60 subjects, four studies in the sample size range from 61 to 100, and 11 studies in the sample size range over 100. Because it was the population of interest and was set as an inclusion criteria, the majority of participants in the studies were men, ranging from 12 (60%) to 1977 (87%); the mean ages varied within the middle-age range, spanning from 41.33 to 57.6 years (see Table S1).

OSA severity was reported via the mean AHI in 20 studies, the median AHI in one study, and the mean RDI in four studies; two studies reported the subjects' AHI as 20 or greater. The remaining nine studies did not report severity in numbers. Of the 20 studies reporting the mean AHI, the distribution ranged from 14 severe OSA and 5 moderate OSA to 1 mild OSA.

Although obesity is such a critical factor associated with OSA, it was not a central focus in the studies. In the study of 49 obese men newly diagnosed with OSA (Traviss, Barr, Fleming, & Ryan, 2002), 36 men reported a mean weight gain of 17 pounds (mean BMI 36.5) since the time of OSA diagnosis (mean 5.6 years). The other studies also involved primarily obese men, defined as a BMI of 30 kg/m^2 or higher (Centers for Disease Control

and Prevention, 2012). Of those studies reporting mean BMI, the numbers ranged from 25.3 to 38 (see Table S1). Thick neck size (greater than 42 centimeters), because of excess adipose tissue, is also a risk factor for OSA (Andrews & Oei, 2004; Rakel, 2009). Lewis, Seale, Bartle, Watkins, and Ebden (2004) discussed measuring collar size of each subject, but the mean was not reported.

Thirty-four of the studies researched anxiety with other factors, as opposed to anxiety in isolation, in OSA sufferers. Twenty studies demonstrated statistically significant results in relation to anxiety and OSA, most of which were Pearson's correlations and *t* tests; 14 resulted in clinically significant results and 2 studies showed no relationship between anxiety and OSA (see Table S1). Anxiety prevalence ranged from 12% to 50%.

Fifteen of the studies involved OSA intervention. Twelve studies tested CPAP and its effects on anxiety (Borak et al., 1994; Borak, Cieślicki, Koziej, Matuszewski, & Zieliński, 1996; Doherty, Kiely, Lawless, & McNicholas, 2003; Engleman et al., 1999; Engleman, Martin, Deary, & Douglas, 1994; Joseph, Zuriqat, & Husari, 2009; Marshall et al., 2005; Muñoz et al., 2000; Profant et al., 2003; Ramos Platón & Sierra, 1992; Sánchez, Buela-Casal, Bermúdez, & Casas-Maldonado, 2001; Stepnowsky, Bardwell, Moore, Ancoli-Israel, & Dimsdale, 2002). Nine of the 12 studies demonstrated decreases in anxiety among CPAP users (Borak et al., 1994, 1996; Doherty et al., 2003; Engleman et al., 1999, 1994; Joseph et al., 2009; Profant et al., 2003; Ramos Platón & Sierra, 1992; Sánchez et al., 2001). Length of CPAP treatment ranged from 1 week to 1 year, with a mean of 4.4 months. Three of the 12 studies utilized placebo control—two with sham CPAP (holes drilled into the mask to cause an air leak and low levels of pressure ranging from one to two centimeters of water; Marshall et al., 2005; Profant et al., 2003) and one with oral placebo (ranitidine 300 mg homologue inactive; Engleman et al., 1999). The two studies utilizing sham CPAP (Marshall et al., 2005; Profant et al., 2003) did not result in statistically significant changes in anxiety levels, possibly because of their short time frames (1 and 3 weeks). CPAP compliance rates were not consistently reported in these studies.

Alternative treatments for OSA were explored. One study involved mandibular advancement splinting (Nambu et al., 1999), and two others involved surgical intervention by way of extended uvulopalatal flap (Li et al., 2004) and radiofrequency tissue ablation (Uloza et al., 2009). All three of these studies involving alternative interventions resulted in statistically significant decreases in anxiety levels.

Methodological dimension

Instruments used to measure anxiety within the studies were tallied to determine the most common. The top three were chosen for further review. Of the 36 studies, 10 used the Hospital Anxiety and Depression Scale (HADS), five used the State-Trait Anxiety Inventory (STAI), and five used the Beck Anxiety Inventory (BAI). A search was conducted within CINAHL, MEDLINE, PsycARTICLES, and PsycINFO, as well as the Health and Psychosocial Instruments (HaPI) database, for the psychometrics of these three instruments, especially the test–retest reliability and internal consistency values.

The HADS (Zigmond & Snaith, 1983) was developed to detect states of depression and anxiety in patients in general medical settings. This tool is especially useful in populations where anxiety and depression may coexist with physical illness (McCue, Martin, Buchanan, Rodgers, & Scholey, 2003). The HADS is a self-assessment scale, comprised of two subsections: anxiety (HADS-A) and depression (HADS-D). Each subscale has seven items, for a total of 14. For each question, the user rates himself by selecting the best response among the choices for each item; the responses vary. The interpreter then scores each response on a Likert scale from 0 to 3. Total scores range from 0 to 21 on each subscale. Scoring is interpreted as 0–7, normal; 8–10, borderline abnormal; and 11–21 abnormal. Psychometric evaluation of the HADS has revealed high internal validity and reliability. In a study of 117 patients with chronic fatigue syndrome (McCue et al., 2003), the calculated Cronbach's alpha of the HADS total items, HADS-A subscale, and HADS-D subscale were .88, .86, and .81, respectively. The HADS has also been found to be an internally reliable measure of anxiety and depression ($r = .56$, $p < .001$; McCue et al., 2003). For studies examined in this review, it should be noted that no researchers using this instrument reported reliability or validity statistics for their particular studies.

The STAI (Spielberger, 1983) is a brief, self-assessment inventory designed to differentiate between and measure an individual's state (current feelings) and trait (general feelings over time) anxiety levels. The instrument consists of two subscales (state and trait), with 20 items in each. For the state-level anxiety assessment, the individual rates himself on each statement using a Likert scale, with responses from 1 (not at all) to 4 (very much so) based on how he feels at that very moment. For the trait scale, the individual again rates himself on each statement using a Likert scale, but this time with responses from 1 (almost never) to 4 (almost always) based on how he has felt, in general, in the past. The range of scores is between 20 and 80; the higher the score, the higher the level of anxiety (Spielberger, 1983). In a study that

reviewed 816 research articles published between the years 1990 and 2000 (Barnes, Harp, & Jung, 2002), it was found that the mean internal consistency and test–retest reliability for the STAI state subscale were .91 and .70, respectively, and for the STAI trait subscale were .89 and .88, respectively. Again, for studies examined in this review, it should be noted that no researchers using this instrument reported reliability or validity statistics for their particular studies.

The BAI (Beck, Epstein, Brown, & Steer, 1988) is a 21-item, self-report inventory for measuring anxiety in psychiatric clinical populations. The individual rates himself for each symptom on a Likert scale from 0 (not at all) to 3 (severely—I could barely stand it). The score is interpreted as a low anxiety level for a total between 0 and 21, a moderate anxiety level for a total between 22 and 35, and very high anxiety level for a total between 36 and 63. The inventory has demonstrated high internal consistency ($\alpha = .92$) and test–retest reliability (r (81) = .75; Beck et al., 1988). Of studies examined in this review, only one researcher reported internal consistency (α) levels (.92, .91, and .92 for the total sample, men, and women, respectively; Sanford, Bush, Stone, Lichstein, & Aguillard, 2008).

Conclusion

This review presents the state of the science of anxiety in middle-aged men with OSA, based upon data from 36 studies. Much was learned about the relationship between anxiety and OSA, with three major themes emerging from the data. First, a relationship appears to exist between OSA and anxiety. Anxiety is prevalent among middle-aged men with OSA, occurring at rates of 12%–50%. In 34 of the 36 studies examined, anxiety was found to be present. Sixteen studies reported statistically significant reductions in anxiety levels, most commonly as a result of OSA intervention. Anxiety levels positively correlated with AHI in many studies, indicating a relationship between the severity of OSA and anxiety level; higher levels of anxiety were noted in men with moderate to severe OSA (Borak et al., 1996; Sánchez et al., 2001).

Second, CPAP intervention significantly improves anxiety levels. Of the 12 studies assessing CPAP as an intervention and its effects on anxiety, four demonstrated statistically significant decreases in anxiety (Borak et al., 1994; Doherty et al., 2003; Engleman et al., 1994; Sánchez et al., 2001) and five demonstrated clinically significant decreases in anxiety (Borak et al., 1996; Engleman et al., 1999; Joseph et al., 2009; Profant et al., 2003; Ramos Platón & Sierra, 1992), as evidenced by decreases in anxiety instrument scores and reported improvements by subjects. However, long-term and consistent CPAP adherence is low. Motivational strategies to improve CPAP acceptance and tolerance are critical. Earlier recognition of anxiety, specifically at the time of OSA diagnosis, may have a positive impact on OSA treatment adherence and overall outcomes.

Third, psychological outcomes, especially anxiety, have not been studied as extensively as physical outcomes of OSA. There are gaps in the literature, especially involving studies examining anxiety in isolation with OSA. Of the 36 studies reviewed, none looked at anxiety alone; it was consistently measured with other factors, such as daytime sleepiness, depression, cognition, and quality of life factors. It was also studied in relation to specific interventions, especially CPAP. Further exploration of anxiety as a primary focus among the OSA population may serve to clarify its full impact.

Primary care implications

Advanced practice nurses can be instrumental in ensuring comprehensive assessment of patients with OSA. Three main areas of concern are assessment and diagnosis of OSA, management of both its physical and psychological manifestations, and implementation of motivational strategies for weight management and CPAP adherence. With focus on these areas, sleep apnea may be more effectively managed in the primary care setting. Subsequently, patients with OSA may experience a better quality of life.

Routine assessment and diagnosis of OSA, including its psychological effects, are critical for men with OSA. Anxiety, especially at severe and panic levels, has a major impact on breathing and sleeping. This, in turn, may exacerbate OSA symptoms and contribute to the resistance to treatment, especially since some patients express anxiety over the use of CPAP and the claustrophobic sensations it causes them. Ignoring these factors only contributes to the worsening of OSA disease and, in turn, increases the risk of morbidity and mortality of a disease that already carries a heavy healthcare burden. Screening for anxiety at the time of OSA diagnosis with a simple, self-rating tool, such as those presented in this review, may improve reporting of anxiety among the male OSA population and, in turn, may improve the comprehensive assessment of OSA in the primary care setting. Without comprehensive assessment, the full ramifications of OSA cannot be recognized or addressed.

Men living with OSA present with many distressing physical and psychological symptoms and comorbidities that impact their quality of life, usually in negative ways. These sequelae permeate into all aspects of their lives, affecting their overall health, and abilities to safely drive,

work, and maintain relationships (Reishtein et al., 2006). Improving the quality of assessment, care, and monitoring for these individuals should consequently improve quality of life for them.

Motivational strategies for weight loss and CPAP treatment adherence are additional critical areas of focus for primary care providers, but were not operationalized in these studies. Obesity is a major modifiable risk factor correlated with OSA, present in 70% of those diagnosed. In the 36 studies examined for this review, only one researcher explored the relationship between OSA, weight, and anxiety (Traviss et al., 2002); further attention to this relationship is warranted. Motivational strategies for weight loss must be implemented.

Of the 12 studies that examined CPAP and its effects on anxiety, the majority (75%) demonstrated improvements in OSA and decreases in anxiety. Because CPAP is the current gold-standard treatment for OSA (Aloia et al., 2004), primary care attention must be directed toward the assessment of why patients refuse, discontinue, or inconsistently use CPAP treatment; and the development of interventional strategies to motivate patients to use CPAP consistently.

Another area lacking focus involves the effects of OSA on bed partners, including their personal disrupted sleep patterns, anxiety about their partner's sleep-disordered breathing and its sequelae; and the resultant effects on their relationship, including intimacy. With improved partner assessment and health, OSA sufferers will hopefully receive improved partner support. Consequently, this may improve overall patient outcomes, both physical and psychological.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Table S1 Chronologic literature review of obstructive sleep apnea and anxiety