RISKS AND COMPLICATIONS OF UNDIAGNOSED OBSTRUCTIVE SLEEP APNEA
FOR THE PERIOPERATIVE PATIENT

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COMPLICATIONS OF UNDIAGNOSED OBSTRUCTIVE SLEEP APNEA

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Obstructive sleep apnea (OSA) is very common. An estimated 82% of men and 92% of women with moderate to severe sleep apnea have not been diagnosed. This potentially leaves patients at risk for perioperative complications. The perioperative risk of patients with OSA may be reduced by appropriate screening to detect undiagnosed OSA patients. OSA is a very serious condition that diminishes quality of life and is also associated with many common co-morbid conditions. Studies have documented an increase incidence of coronary artery diseases, hypertension, congestive heart failure, cerebrovascular accidents, gastroesophageal reflux disease and other potentially life threatening conditions in patients with OSA. This paper provides information that is essential for Nurse Practitioners and other health care providers to screen and diagnosis this very common and preventable health condition.
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Obstructive sleep apnea (OSA) is a disorder characterized by repetitive episodes of apnea or reduced inspiratory airflow due to upper airway obstruction during sleep (Olson 2011). Obstructive sleep apnea is the most common sleep–related breathing disorder and is widely recognized as a public health problem. In the United States OSA is more prevalent than asthma and is as common as diabetes mellitus (Krieger & Caples 2007). When sleep is disrupted in OSA by arousals, apneas, and hypopneas, the consequences include cardiovascular morbidity, excessive sleepiness, depressed mood, cognitive impairment, and diminished quality of life (Hirshkowitz 2008).

According to Stierer, Wright, George, Thompson, Wu and Collop (2010) OSA has been recognized as a potential independent risk factor for adverse perioperative outcomes. Although the prevalence of OSA in the general population has been estimated to be between 2% and 4%, there is a higher incidence in certain subpopulations such as males and obese subjects. Many people with OSA have not been diagnosed. The actual prevalence of OSA in the general population may be as high as 80% to 90% of all patients.

Despite its high prevalence and significant adverse effect on a patients functioning and quality of life, excessive sleepiness often goes unrecognized in the primary care setting. The complications from OSA can negatively affect a surgical outcome. The incidence of perioperative complications (ie, preoperative, intraoperative and postoperative complications collectively) is increased among patients with OSA (Olson 2011). The Joint Commission has suggested that a National Patient Safety Goal should be the reduction of perioperative complications in patients with OSA.
Statement of Purpose

The American Society of Anesthesiology and American Academy of Sleep Medicine has developed a clinical practice guideline for the perioperative management of patients with OSA. Common among the guidelines is an emphasis on maintaining a high index of suspicion for OSA, careful use of medications, vigilant monitoring for evidence of upper airway obstruction, and an integrated team approach to perioperative management (Olson 2010).

Nurse practitioners and other primary care providers need to be acutely aware that excessive sleepiness is a common problem. There are associated problems which stem from OSA such as medical, neurologic, and psychiatric disorders that are seen in the primary care setting. The purpose of this paper is to determine the symptoms that lead to a diagnosis of OSA in the primary care setting and how to best provide a treatment plan to reduce the associated risks during the perioperative period of care.

Pathophysiology

Apnea is the cessation of airflow at the nose and mouth for more than ten seconds and indicates complete obstruction of the upper airway. Apnea is considered obstructive if there is continued respiratory effort despite airflow cessation. In central sleep apnea (CSA) the brains' respiratory control centers are imbalanced during sleep. CSA is a rare type of sleep apnea. In CSA, the area of the brain that controls breathing doesn’t send the correct signals to the breathing muscles. As a result, there is no effort to breath at all for brief periods. In people with CSA, snoring does not typically occur (Pollard & Rice 2006).
Hyperpnea is defined as a 50% reduction in airflow for at least 10 seconds or more times per hour of sleep associated with snoring and a 4% decrease in oxygen saturation (Paje & Kremer 2006). Blood levels of carbon dioxide and the neurological feedback mechanism do not react quickly enough to maintain an even respiratory rate, with the entire system cycling between apnea and hyperpnea, even during wakefulness. Sleep abolishes proprioceptive feedback from thoracic and upper airway receptors and suppresses chemical feedback, which increases neural output to the pharyngeal muscles. At sleep onset, all or any of these mechanical, neural, and structural factors contribute to upper airway collapse that either fully eliminates or substantially reduces ventilation. During airway obstruction hypoxemia, hypercapnia, and a decrease in pH development causes a progressive increase in ventilator drive to the respiratory pump and upper airway muscles (Paje & Kremer 2006). The patient stops breathing and then starts again. There is no effort made to breathe during the pause in breathing; there are no chest movements.

After an episode of apnea, breathing may be faster (hyperpnea) for a period of time. During this time several factors can change a relationship between PO2 and SO2, causing the oxyhemoglobin dissociation curve to shift to the right or left. A shift to the right depicts hemoglobin’s decreased affinity for oxygen or an increase in the ease with which oxyhemoglobin disassociates and oxygen moves into the cells. A shift to the left depicts hemoglobin’s increased affinity for oxygen, which promotes association in the lungs and inhibits dissociation in the tissues. The oxyhemoglobin dissociation curve is shifted to the right by acidosis (low pH) and hypercapnia (increased PaCO2) (McCance & Huether 2006).
The pathogenesis of OSA is multi-factorial. Contributing factors include airway anatomy, upper airway dilator muscles, and ventilator stability. The site of upper airway obstruction typically lies in the pharynx. The pharyngeal luminal area during inspiration reflects a balance between collapsing intra-pharyngeal negative suction pressure and dilating forces provided by the pharyngeal muscles. In conscious individuals, the patency of the retropalatal, retroglossal, and retroepiglottic pharynx is maintained by the central nervous system’s continually mediated contraction of the tensor palatine, the genioglossus, and the hyoid bone muscles. These dilator muscles oppose the negative collapsing force developed during inspiration. This activation of muscle tone is typically reduced during sleep and, in many individuals, leads to compromised patency of the upper airway with turbulent airflow and snoring. In obese patients, more adipose tissues in the pharyngeal structures increase the likelihood that relaxation of the upper airway muscles will cause collapse of the soft walled oropharynx between the uvula and the epiglottis.
EXTRALUMINAL PRESSURE IS INCREASED BY SUPERFICIALLY LOCATED MASSES AND THE UPPER AIRWAY IS COMPRESSED EXTERNALLY (PAJE & KREMER 2006).

Figure 1

*Anatomy of Normal Airway Potential Airway Obstruction*

![Image of anatomy](http://www.aafp.org/afp/991115ap/2279_f1a.jpg)

**Literature Search Strategies**

A combination of search strategies was utilized related to the topic of interest. The initial search included websites such as GoogleScholar.com, Uptodate.com, and Medline.com. The Portland Veteran’s Administration’s databases were utilized. The one database that was the most useful was Pubmed.com. Search terms utilized included “Primary Care”, “OSA”, and “Perioperative OSA”. Only sources that were available in full text were utilized. There were literally hundreds of articles on the topic. Because OSA was not on the forefront of medical research prior to the early 90’s, resource materials that were no older than five years were utilized. The information provided the most recent and up to date materials available. The materials utilized included retrospective studies, surveys, self administered questionnaires,
nasal congestion, as well as reports of witnessed behaviors such as sleepiness, gasping, choking, snorting or the absence of breathing while asleep (Olson 2010).

Table 2

**STOP Questionnaire**

1. **Snoring:** Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?

2. **Tired:** Do you often feel tired, fatigued, or sleepy during the daytime?

3. **Observed:** Has anyone observed you stop breathing during your sleep?

4. **Blood Pressure:** Do you have or are you being treated for high blood pressure?

*High risk of OSA, answering yes to two or more questions. Low risk of OSA, answering yes to less than two questions.


According to Seet & Chung (2010), patients with OSA may have an increase in post-operative adverse respiratory events, sustained arrhythmias, hypertension, and other cardiovascular events. The gold standard for the diagnosis of OSA is polysomnography. The Berlin Questionnaire and the American Society of Anesthesiologists OSA checklist are useful screening tools, while the STOP and the STOP-BANG Questionnaires are easy to use in adults (Seet and Chung 2010).

In a study by Stierer, Wright, George, Thompson, Wu and Collop (2010), relevant perioperative data and complications were tracked and recorded. This study also included a self
administered questionnaire using a Likert Scale. Differences in median estimated propensities for OSA were considered by this data. The preoperative survey was completed by 3,553 consecutive subjects. A total of 2,139 patients had perioperative data and estimated propensity scores. Ninety-four of the 2,139 (4.4%) patients gave a self-reported prior diagnosis of OSA. One hundred three (4.8%) patients were found to be at high risk of OSA based on the survey. Seventy-five percent of the patients with >70% propensity for OSA had not been diagnosed. 94 of the 2,139 (4.4%) patients gave a self-reported prior diagnosis of OSA. The study results reported that undiagnosed sleep apnea is very common in the ambulatory surgery setting. The questionnaires used in this investigation are not 100% predictive, and may fail to identify patients with OSA, particularly in those who are young, thin, or female.

Greenberg-Dotan, Reuveni, Simon-Tuval, Oksenberg, Tarasiuk (2007) conducted a quantitative study to explore gender differences in co-morbidities and total health care utilization five years prior to diagnosis of OSA. The study matched 289 male patients with 289 female patients who had completed a polysomnographic (PSG) test which resulted in a diagnosis of OSA. The polysomnography test has been shown to be the most specific for diagnosing OSA (Stierer, et al., 2010). The study utilized a two-way analysis of variance to determine the significance of the total 5-year costs between all women and men in the study.

It was determined that compared to men with similar OSA severity, women were more frequent users of health care resources. Women with OSA reported atypical OSA symptoms, which may lead to other diagnosis such as depression, insomnia, and hyperthyroidism. Little is known regarding differences in morbidity and health care utilization prior to OSA diagnosis.
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based on gender. Women with typical symptoms may fail to get feedback from their partners and thus be unaware of the need to seek care or if aware, may feel uncomfortable about seeking help for a “male” problem. Also clinicians who are unaware that OSA is common in women will likely fail to recognize the problem, and women without typical symptoms will also be missed (Greenberg-Dotan, et.al 2007).

Gali, Whalen, Gay, Olson, Schroeder, Plevak, and Morgenthaler (2007) conducted a quantitative study reporting that the presence of undiagnosed OSA increased the perioperative morbidity and mortality for patients in perioperative care. Following surgery, patients were monitored in the Post Anesthesia Care Unit (PACU) for significant respiratory events: apnea, increased supplemental oxygen requirements, sedation, or episodes of desaturation (Whalen, et al., 2007). Initiation of the protocol began with screening of patients in the preoperative evaluation clinic to determine a sleep apnea clinical score (SACS). A SACS was generated for each patient and patients of scores of 15 or higher were categorized as “high risk”. A total of 2206 patients were screened, and data from 22 were excluded from analysis due to missing perioperative information or cancellation of surgery. Of these, 1923 had a low SACS and 251 had a high SACS. The frequency of unplanned ICU admission for low scores was 0.5%, compared with 8.8% for those with a high SACS score. Thus, a higher SACS score may be able to predict those patients who may require a unplanned ICU admission.

The ability to identify those individuals who are at risk for perioperative risks for OSA was determined to be the major problem with this study. Since OSA is not uncommon, it is vitally important to develop risk-stratification methods so that resources may be used wisely to
safeguard patients undergoing surgical procedures. Death and cardio respiratory complications have been associated with OSA during the postoperative period, it is necessary to advocate for intensive monitoring for OSA patients during this period (Gali, et. al 2010).

In a retrospective chart review, patients undergoing hip and knee replacements without a previous diagnosis of OSA were found to have a 24% incidence of complications, compared with 9% of those without OSA, including cardiac events, complications requiring transfer to an ICU, and respiratory events requiring support such as CPAP or intubation (Gali, et.al. 2007).

Tait, Voepel-Lewis, Burke, Kostrzewa and Lewis (2008) conducted a qualitative study of two-thousand twenty-five children between the ages of 2-18 who were undergoing non-cardiac elective procedures. The children were classified as being overweight or obese, utilizing an age and sex adjusted body mass index. Although the definition of adult obesity based on BMI (30kg/m2) is well established, there is no universally accepted criterion for use in children. This is because childhood BMI changes significantly as a function of age and sex. The Centers for Disease Control and prevention criteria define overweight children as BMI of greater than 85th percentile to less than 95th percentile and obesity is defined as having a BMI in the 95th percentile or greater. The incidence and severity of perioperative adverse events were collected prospectively. The study concluded that obesity in children and a history of OSA were strongly suggestive for perioperative critical adverse respiratory events in children. Respiratory events included: oxygen desaturation, coughing, breath holding, airway obstruction, laryngospasm,
difficult mask ventilation, and bronchospasm. These events are greater than ten percent of baseline for obese children.

Mador, Khamis, Nag, Mreyoud, Jallu and Mehboob (2010) conducted a quantitative retrospective study to determine whether OSA increases the risk of cardio-respiratory complications in patients who are undergoing endoscopic procedures. Procedures were performed in 639 patients: colonoscopies 68.5%, upper endoscopies 20.2%, and combined procedures 11.3%. The main study conclusion is that patients with OSA do not have a higher rate of cardio-respiratory complications when they undergo endoscopic procedures under conscious sedation as compared to those without OSA. In those patients undergoing endoscopic procedures with conscious sedation there appears to be no increased risk of cardiorespiratory complications (Mador, et. al 2010).

**Significance to Nursing**

Nurses and health care providers need to be aware of the symptoms and contributing factors of OSA. OSA is associated with obesity, systemic hypertension, pulmonary hypertension, cardiac arrhythmias, coronary artery disease, stroke, and heart failure. These co-morbidities contribute to the increased risk of perioperative complications in patients with OSA (Olson 2011). The need for primary care providers to be very diligent in the diagnosis and treatment of OSA is very important. See Table 2 for a list of signs and symptoms of OSA which indicates a need for further diagnostic studies specifically a sleep study (polysomnography).
Table 3

*Obstructive Sleep Apnea Signs and Symptoms*

**Major signs and symptoms of OSA:**
- Loud and chronic snoring
- Choking, snorting, or gasping during sleep
- Long pauses in breathing
- Daytime sleepiness, no matter how much time you spend in bed

**Other common signs and symptoms of OSA include:**
- Waking up with a dry mouth or sore throat
- Morning headaches
- Restless or fitful sleep
- Insomnia or nighttime awakenings
- Going to the bathroom frequently during the night
- Waking up feeling out of breath
- Forgetfulness and difficulty concentrating
- Moodiness, irritability, or depression

http://www.helpguide.org/life/sleep_apnea.htm

According to Olson, OSA is a prevalent disorder and most individuals who have OSA are undiagnosed. Thus, all preoperative medical histories, and physical examinations should look for symptoms and signs of OSA, not just a diagnosis history of OSA. This information may need to come from others (such as a parent or spouse) who are aware that the patient is sleepy or gasps, chokes, snorts, or stops breathing while asleep. In the primary care setting during the preoperative evaluations patients who do not have diagnosed OSA may need to defer elective surgery for a sleep study to determine the risk for the patient.

The primary method for diagnosing OSA at present is to have the patient undergo a sleep study known as polysomnography. OSA is diagnosed if the patient has an apnea index greater than 5, meaning more than five apneic episodes per hour, or a respiratory disturbance...
index (RDI) which is the combination of apneas and hypopneas, greater than 10 per hour. In the appropriate clinical setting, sleep apnea can be diagnosed by an RDI between 5 and 10. Because polysomnography is expensive and labor intensive, efforts are underway to find improved methods of diagnosing and screening for OSA. At this time the only alternative is overnight oximetry, which measures a patient’s oxygen saturations throughout the night. Overnight oximetry is not considered completely adequate as a screening test, because the oxygen levels in the blood of many patients with OSA do not provide the information needed to understand their condition (Swierzewski 2011). Unfortunately, studies using overnight oximetry as a screening tool for OSA have shown good specificity and positive predictive value, but poor sensitivity and negative predictive value. This means overnight oximetry may miss subjects with OSA who do not desaturate (Ryan PJ, Hilton MF, Boldy DA, et al 1995).

Summary

OSA is a very common condition in the community that often goes undiagnosed until there is a complication related to OSA. Sending a patient to have a surgical procedure using general anesthesia is putting both the provider and the patient at a high risk. Moderate-to-severe sleep apnea was associated with 33% mortality over 14 years compared to 6.5% and 7.7% mortality in people with mild or no sleep apnea (Marshall et al., 2008). Because the age of the population is increasing and obesity is on the rise, the likelihood that a patient having a surgical procedure who is not diagnosed with OSA may occur more often. A national research study needs to be conducted on how to best screen patients for OSA and how to best care for patients including education and treatment follow-up both in the primary care setting and during the
perioperative period of care. According to Olson, the impact of preoperative treatment of OSA on patient outcomes has been scarcely studied. There is moderate to high quality evidence from non-surgical patients that the treatment of OSA improves physiological outcomes that may be risk factors for perioperative complications. This provides the rationale for initiating therapy preoperatively, and also the need for continued research.

Patients with OSA are at high risk for perioperative complications and pose multiple challenges, including difficult airway management and increased incidence of postoperative complications. Because undiagnosed OSA is common, a focused history and physical examination followed by the administration of a screening tool would help to identify patients at

scientific reviews, screening protocols, literature reviews, and random sample studies. Of the fifty or so articles that were reviewed, they were further narrowed to eight of the most pertinent sources of information. The criteria for this paper was developed from a combination of sources taking into consideration primary care patients and also those patients in the perioperative period of care. The main focus of this paper lies in the assessment and diagnosis of OSA in the general population, and the associated risks for patients during the perioperative period of care, whether diagnosed previously with OSA or not.

Review of Literature

Stierer, Wright, George, Thompson, Wu, and Collop (2010) conducted a study utilizing a self-administered questionnaire, with a previously validated prediction model, evaluating the probability for OSA. Consecutive patients 18 years and older completed a self-administered
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