12-1-2011

Anesthesia Implications for Obstructive Sleep Apnea

Jessica Bratrud

ANESTHESIA IMPLICATIONS FOR OBSTRUCTIVE SLEEP APNEA

by

Jessica Bratrud

Bachelor of Science in Nursing, University of North Dakota, 2011

An Independent Project

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Masters of Science

Grand Forks, North Dakota

December

2011

PERMISSION

Title: Anesthesia Implications for Obstructive Sleep Apnea
Department: Nursing
Degree: Master of Science

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Abstract

Obstructive sleep apnea (OSA) affects 33% of the population. Eighty percent of those are undiagnosed (Downey, 2011). This number is expected to grow as our population gets older and more obese. Forty one million surgical procedures are performed in the United States each year, so this does affect the practice of Certified Registered Nurse Anesthetist's (CRNA). OSA can lead to an array of complications including cardiac arrhythmias, coronary artery disease, hypertension, congestive heart failure, myocardial ischemia, cerebrovascular insufficiency, intracranial hypertension, gastroesophageal reflux disease, difficult intubation, and unanticipated admissions to the ICU. It is estimated that the average life span of a patient with untreated OSA is 58 years, which is much shorter than the average life span of 78 years for men and 83 years for women (Chung & Elsaid, 2009).

Obstructive Sleep apnea is a sleep disorder that involves cessation of or significant decrease in airflow while breathing. It is the most common sleep disordered breathing and is characterized by recurrent episodes of airway collapse during sleep. These episodes are associated with recurrent arousals from sleep and a decrease in oxyhemoglobin saturations (Downey, 2011).

This independent project is intended to bring awareness to anesthesia professionals regarding the pathophysiology, recommendations, diagnosis, and treatment of obstructive sleep apnea.

Introduction

According to Chung, Yuan and Chung (2008), "obstructive sleep apnea (OSA) is a common sleep disorder caused by repetitive partial or complete obstruction of the upper airway and is characterized by episodes of cessation of breathing during sleep lasting for more than ten seconds" (p. 1543). This disorder affects nearly 18 million Americans and nearly 80%-95% are undiagnosed (Nagelhout & Plaus, 2010). Approximately 10% of women and 24% of middle aged men are affected by this disorder and the numbers are increasing as our population gets older and more obese (Sabers, Plevak, Schroeder & Warner, 2003). Obstructive sleep apnea has been associated with significant morbidity and mortality. This disorder has been known to be an independent risk factor for increased perioperative mortality.

Patients with OSA are predisposed to a variety of serious complications before and after surgery. Some of these complications include cardiac arrhythmias, coronary artery disease, hypertension, congestive heart failure, myocardial ischemia, cerebrovascular insufficiency, intracranial hypertension, gastroesophageal reflux disease, difficult intubation, and unanticipated admissions to the ICU. According to Jain and Dhand (2004), "nearly fatal respiratory complications and even unexpected deaths have been reported after surgery in patients with serious obstructive sleep apnea that have been unrecognized or inadequately treated in the perioperative and postoperative periods" (p. 482).

Anesthesia adds an increased risk to this category of patients. The sedatives, analgesics, and anesthetic agents given to these patients depress the central nervous system and respiratory system. Jain and Dhand (2004) stated that "the administration of sedation or anesthesia may worsen, or even induce significant sleep apnea during surgery" (p. 483).

Problem Statement

Obstructive sleep apnea is becoming more prevalent in the United States. It is known that the lack of recognition of obstructive sleep apnea can cause suboptimal preparation for surgery and increase the risk of adverse events during surgery. Obstructive sleep apnea patients are predisposed to upper airway obstruction during sleep. This upper airway obstruction leads to apnea, which leads to the need for vigorous breathing efforts to open the collapsed airway. When this happens patients arouse from sleep to restore their airway. This is repeated several times during a night of sleep. Sedatives and anesthetic agents cause similar events to occur during and after administration. Adequate knowledge on diagnosis and optimization of the patient with obstructive sleep apnea, indicate a smooth perioperative and postoperative timeline. This is done by increasing our knowledge of obstructive sleep apnea, what it does to the body, and how to identify patients with this particular disorder.

Purpose

As stated previously, obstructive sleep apnea is a highly prevalent disorder in the United States. It is a disorder that can cause significant morbidity and mortality in the perioperative period. Isono (2009) stated that "recent growing evidence indicates that obstructive sleep apnea is an independent risk factor for development of hypertension, cardiovascular morbidity and mortality, and sudden death" (p. 908).

This review was performed to gather evidence-based information on the pathophysiology, diagnosis, treatment and optimization of obstructive sleep apnea. It can draw attention to the specific needs of this growing population during the perioperative and post-operative period.

Significance

Obstructive sleep apnea affects 18 million people worldwide. Over half of these 18 million are undiagnosed and therefore untreated. If OSA is an independent risk factor for a variety of clinical problems and increased length of hospital stay, then increased knowledge of this disorder is imperative for health providers. As stated by Moos et al. (2005), "the anesthesia provider may be the last healthcare provider to identify undiagnosed OSA before surgery" (p. 203). They went on to say, "patient advocacy and patient safety should always remain at the forefront of our care" (p. 203).

Student Registered Nurse Anesthetists (SRNA), Certified Registered Nurse Anesthetists (CRNA), Anesthesiologists and any other anesthesia provider should be aware of the implications associated with obstructive sleep apnea. Clear knowledge of the diagnosis and optimization can allow for a smooth transition from perioperative to postoperative phases.

Theoretical Framework

The conceptual framework used to guide this review is Faye Glenn Abdellah's theory, Twenty-One Nursing Problems. Faye Abdellah used her theory to focus on nursing as a comprehensive service. According to Abdellah, nursing was based on an art and science that molded the attitudes, competencies, and technical skills of the individual nurse. These comprehensive services included:

- Recognizing the nursing problem
- Deciding the appropriate course of action

- Providing continuous care of the patients total needs
- Adjusting the care plan to meet needs
- Helping individuals to become more self directing in their own health
- Instructing nursing personnel and family to allow individuals to help themselves
- Helping the individual to adjust
- Helping other health professions in planning for optimal health
- Continuous evaluation

This nursing theory was divided into a list of 21 nursing problems that were identified by 10 steps and 11 nursing skills to develop treatment.

The 10 steps to identify the client's problems include:

1. Learning to know the patient
2. Sorting out relevant and significant data
3. Making generalizations about available data in relation to similar nursing problems
4. Identifying a therapeutic plan
5. Testing generalizations, and make additional generalizations
6. Validating the patients' conclusions about their nursing problem
7. Continuing to observe and evaluate over a period of time
8. Exploring the patients' and families' reaction
9. Identifying how the nurse feels about the patient's nursing problem
10. Discussing and developing a comprehensive nursing care plan

The 11 Nursing Skills include:

1. Observation of health status
2. Skills of communication

3. Application of knowledge

4. Teaching of patients and families

5. Planning and organization of work

6. Use of resource materials

7. Use of personnel resources

8. Problem-Solving

9. Direction of work of others

10. Therapeutic use of the self

11. Nursing procedure

The 21 nursing problems are split into three categories: physical, sociological, and emotional needs of clients; types of interpersonal relationships between the nurse and the patient; and common elements of client care ("Nursing Theories," 2011).

Definitions

Perioperative is the time from when the patient is admitted into the hospital or clinic for surgery until the patient is discharged. It includes pre-operative, intra-operative and post-operative periods (MedicineNet.com, n.d.).

Obstructive Sleep Apnea is a common sleep disorder caused by repetitive partial or complete obstruction of the upper airway and is characterized by episodes of cessation of breathing during sleep lasting for more than ten seconds. It includes 3 categories including: mild, moderate and severe. (Hines & Marschall, 2008)

Sedatives are agents or drugs used to relax, calm, or sooth someone. Often given to cause relaxation, alleviate stress and anxiety or excitement (MedicineNet.com, n.d.).

Analgesics are medications used to reduce or eliminate pain, without resulting in loss of consciousness (MedicineNet.com, n.d.).

Anesthetics are medications used to induce partial or total loss of sensation. It can be used for surgical, as well as, medical reasons. Anesthetics can be administered topical, regional, or general depending the type and site of need (MedicineNet.com, n.d.).

Rapid eye movement sleep (REM) is characterized by an increase in respirations and heart rate. The muscles may twitch in the face, fingers, and legs. Intense dreaming occurs during this stage due to heightened cerebral activity. In addition, during this stage major voluntary muscle groups become paralyzed. This stage of sleep only comprises approximately 20% of your total sleep time (Remedies Health, n.d.).

Process

This review was performed by gathering literature based research in the area of adult obstructive sleep apnea. Electronic databases used for this search included PubMed, CINAHL, Cochran Database, and SCOPUS. Key words included: obstructive sleep apnea, obstructive sleep apnea syndrome, adult surgical patient, REM sleep, sleep apnea, risk of sleep apnea in perioperative patients, diagnosis of sleep apnea, treatment of obstructive sleep apnea, and pre-operative treatment of obstructive sleep apnea. CINAHL and PubMed databases provided the majority of the search words for this project.

Review of Literature

Pathophysiology

Hines and Marschall (2008) defined obstructive sleep apnea as

> Airflow cessation of more than 10 seconds and characterized by frequent episodes of apnea or hypopnea during sleep. Hypopnea is airflow decreased below a given

> percentage of the surrounding baseline and may also require the presence of some degree of oxyhemoglobin desaturation (p.299).

The severity of obstructive sleep apnea varies from person to person and is measured by the average number of incidents (desaturations) per hour, also known as the apnea-hypopnea index (AHI). It is measured overnight in a sleep lab by using polysomnography and is defined as positive by having five or more desaturations per hour.

Snoring, daytime somnolence, and physiologic changes are manifestations of airway obstruction. Daytime somnolence is due to frequent episodes of interrupted sleep during the night. Physiologic changes include arterial hypoxemia, arterial hypercarbia, polycythemia, systemic hypertension, pulmonary hypertension, and right ventricular failure.

Often people associate obstructive sleep apnea with obese people; however, it can be prevalent in both the obese and non-obese. Obese people have increased adipose tissue in the neck and pharyngeal tissues that are thought to lead to narrowing of the airway and subsequently lead to sleep apnea. Non-obese people have tonsillar hypertrophy or craniofacial skeletal abnormalities that lead to narrowing of the airway and sleep apnea.

During sleep, maintenance of the upper airway depends on the tone of the pharyngeal muscle and the dilator muscles. These muscles prevent airway collapse in individuals. During sleep, these pharyngeal muscles collapse causing turbulent airflow and snoring. Apnea occurs when the airway collapses. This collapse results in the need for a vigorous breathing effort to open the collapsed airway, and arousal from sleep occurs to restore airflow. Arousal from sleep in obstructive sleep apnea is an important defense mechanism to overcome the upper airway obstruction.

Administration of sedatives and anesthetic agents, depress the central nervous system causing inhibition of respiration and reduced functional residual capacity leading to atelectasis. In addition, these medications have the tendency to cause the upper airway to collapse by depressing skeletal muscle tone and relaxing the upper airway (Jain & Dhand, 2004). Persons in natural sleep have the ability to arouse during these episodes of apnea. However, persons with a depressed central nervous system, as in patients who are sedated or anesthetized, may not have this ability. As stated by Jain and Dhand (2004) "the sum of these effects is that apnea could have life-threatening consequences for the sedated or anesthetized patients with obstructive sleep apnea" (p. 483).

Sleep abnormalities may continue into the post-operative phase undetected due to the fact that the patient is not monitored as vigorously. Sedatives and anesthetics may linger into the post-operative phase causing apnea when the artificial airway is no longer in place. Due to several factors including pain, analgesics, and hormonal and metabolic changes after surgery, total sleep time is reduced and there is a significant reduction in REM sleep. Recovery could take as long as a week causing increased apneas and development of nocturnal hypoxemia.

Patients with untreated OSA have episodic hypoxemias during REM sleep that lead to brief arousals and cause profound sympathetic activation, which may cause hemodynamic instability and an increased mean arterial pressure. Surgical stress and postoperative pain can increase this sympathetic activation even further. As stated by Kaw et al. (2006), "as a result of chronic adrenergic arousal, patients with sleep apnea may have down-regulated alpha receptors and beta receptors, and thus have an attenuated response to vasopressors" (p. 200).

Surgery and anesthesia affect the way we sleep. Several studies noted by Kaw et al. (2006) documented that sleep was reduced in amount and quality on the first postoperative night. REM sleep is usually absent on the first postoperative night, and sometimes into the second and third nights. REM sleep does return with increased density and duration, which leads to increased episodes of hypoxemia. Vasu et al. (2010) stated that "because of this rebound, REM-associated hypoxemic episodes may increase 3-fold on the second and third postoperative nights, leading to increased risk for complications" (p. 1023). These episodes can often occur once oxygen therapy has been discontinued, causing significant respiratory abnormalities.

In normal awake individuals, upper airway collapse is prevented by phasic activity of the pharyngeal muscles producing a contraction immediately before inspiration to resist the negative pressure generated by the diaphragm. This contraction is reduced during REM sleep and by the administration of narcotics.

Recommendations

According to Gali et al. (2007)

> The American Society of Anesthesiologists has published practice guidelines that include recommendations regarding the perioperative management of OSA. The guidelines include presumptive diagnosis of OSA based on elevated body mass index (BMI), increased neck circumference, snoring, craniofacial abnormalities affecting the airway, daytime hypersomnolencence, and abnormalities on the airway exam (p. 582).

These guidelines were set into place to reduce the risk of adverse outcomes in patients with OSA and to improve perioperative care.

Jain and Dhad (2004), stated that

> Preoperative recognition of OSA, constant control of the airway, titration of analgesic and sedative drugs, and careful monitoring could avoid many unexpected complications after surgery. In patients with OSA, nasal continuous positive airway pressure (CPAP) should be used for 48 to 72 hours after surgery and during sleep thereafter. Preferably, the optimal setting of CPAP should be determined before surgery is undertaken in patients with OSA (p. 487).

According to Seet and Chung (2010), diagnosis and severity of OSA should be confirmed in a patient with known OSA prior to surgery. Obtaining a current history and reviewing the patient's polysomnography results should be achieved. One should note the AHI of the patient. It may be necessary to refer patients with severe OSA and who have not been using their CPAP device, or have had recent exacerbations of OSA symptoms.

If the patient has been using CPAP, this therapy should be continued in the preoperative period. The anesthesia provider should anticipate a difficult airway, use short-acting anesthetic agents, opioid minimization, full reversal of neuromuscular blockade verified prior to extubation, and extubation fully awake in a non-supine position (Seet & Chung, 2010).

Predicting Obstructive Sleep apnea

According to Gross et al. (2006), the American Society of Anesthesiologists recently published guidelines recommending that patients should be screened for OSA prior to their surgical procedure. Identifying these patients preoperatively will help in the decision for intraoperative and post-operative care and, insure the patient receives the most optimal treatment prior to induction of anesthesia. Several tests can be used to predict obstructive sleep apnea. Some of these tests are explained below.

Polysomnography is recognized as the gold standard for diagnosis of OSA. It is very expensive and, due to this expense, it is limited in the testing sites and equipment. According to Jigajinni, Sultan, and Radhakrishnan (2009), Polysomnography involves the measurement of sleep stages using an electroencephalogram (EEG), electrooculogram (EDG), or chin electromyogram (EMG) and correlates them with respiratory (ie. oxygen saturation, airflow and respiratory efforts) and cardiovascular parameters (blood pressure, pulse rate and (ECG), as well as, body position and movements.

Felmons criteria: Felmons et al. (as stated in Gali et al., 2007) uses the patient's neck circumference, history of hypertension, and clinical symptoms to generate an OSA likelihood score. Flemons criteria has a moderate sensitivity and a positive predictive value (Gali et al., 2007).

Oxygen Desaturation Index (ODI) is a relatively inexpensive marker for post-operative apnea related events. It is used in the outpatient setting. The ODI is the average number of oxygen desaturations greater than or equal to 4% below the patients baseline per hour. According to Adesanya, Lee, Greilich, and Joshi (2010), "Patients with an ODI of five or more per hour were found to have a higher incidence of postoperative complications, including respiratory, cardiovascular, GI, and bleeding abnormalities" (p. 1490).

According to Hwang et al. (2008), the home noctural oximetry test demonstrated that the rate of postoperative complications increases in proportion with the episodes of overnight desaturation. This test is not considered accurate and is known to record a wide range of sensitivity and specificity (Hwang et al, 2008).

Chung et al. (2008) developed and validated the STOP questionnaire. The STOP-BANG questionnaire is a screening modality of OSA used in the preoperative setting. STOP-BANG stands for snoring, tiredness during daytime, observed apnea, high blood pressure, body mass index (greater than 35), age (older than 50), neck circumference (greater than 40cm) and gender (male). It is an 8 question yes/no answer test. Patients are classified as being high risk for OSA if their STOP-BANG score is 3 or greater. If they receive a score of less than 3 they are considered low risk. According to a study performed by Vasu et al. (2010), "STOP-BANG scores indicative of high risk of OSA confer a heightened (approximately 10-fold) risk of post-operative complications in patients undergoing elective surgery" (p. 1022). According to Seet and Chung (2010), "in a meta-analysis of clinical screening tools for OSA, the STOP-BANG was identified as being easy to use and having a favorable diagnostic odds ratio, making it more suitable for predicting severe OSA in the preoperative setting" (p.851).

The Berlin Questionnaire is a commonly known questionnaire to predict OSA. This questionnaire consists of 10 items composed of five questions on snoring, three questions on excessive daytime sleepiness, one on sleepiness while driving, and one inquiring about hypertension. Gender, age, weight, height, and neck circumference are also recorded. The severity scores of these answers are then calculated and the patient is put into a high or low risk category. The Berlin questionnaire is highly sensitive and specific, but many care-givers feel it is too complicated to administer preoperatively.

Management

Preoperative Management

Once a patient is a known OSA patient or a suspected OSA patient, precautions should be performed to minimize adverse outcomes. As stated by Jain and Dhand (2004), " in a patient suspected of having sleep apnea, if the situation permits, surgery should be postponed until the patient has been evaluated by means of overnight polysomnogram" (p. 485). Every effort should be made to identify patients with OSA and to institute CPAP before and after surgery.

A patient with OSA should be considered a difficult tracheal intubation. According to Siyam and Benhamou (2002), difficulty with tracheal intubation occurs eight times more often in OSA patients than in non-OSA patients. With this knowledge adequate airway preparation in accordance with ASA guidelines for difficult airway management guidelines should be taken into consideration.

Patients should be adequately preoxygenated prior to induction of anesthesia. Some sources indicated that sedatives used for anxiolysis should be titrated slowly or eliminated altogether. As stated by Adesanya et al. (2010), "Preoxygenation with 100% oxygen until exhaled or end-tidal oxygen is at least 90% can be accomplished by using CPAP at 10cm H_20 for 3 to 5 minutes with the patient in a 25^0 head up position" (p. 1494).

Intraoperative Management

A high mallampati score predicts difficulty with intubation. This should be considered with OSA patients as stated previously. During intubation, avoidance of brief loss of airway control must be avoided. According to Jain and Dhand (2004), "intraoperative airway risks may be reduced by direct visualization with a fiberoptic bronchoscope for intubation in patients with increased neck circumference and skeletal deficiency" (p. 486).

Several criteria should be met prior to extubation. The patient should be fully awake, orientated and able to follow commands. Neuromuscular blockade should be fully reversed and patient should be able to sustain a head lift for more than 5 seconds. Patient must have an adequate vital capacity and peak inspiratory pressure as well as a respiratory rate greater than 12 per minute. Moos et al. (2005) stated that "a respiratory rate less than 12 per minute may indicate an unacceptable amount of circulating opioids" (p. 200). Placing the patient in reverse trendelenburg position will minimize diaphragm compression. An oral or nasal airway should be in place prior to extubation and, if difficulties were experienced on intubation, the tube could be removed over an airway exchanger.

Jhain and Dhand (2004) stated that "monitoring may need to be continued in an intermediate care setting for a longer period than that required in patients who do not have OSA" (p. 486). In those cases it might be helpful to position the patient in the lateral position rather than supine if airway obstruction occurs in the recovery room.

Postoperative Management

Careful monitoring and vigilance is required in the first 24 hours postoperatively. Significant complications usually emerge within 2 hours postoperative. CPAP may be used if the patient tolerates it. Oxygen therapy should be used with caution because hypoxemia is the key factor for producing arousal during apnea. As stated by Jain and

Dhand (2004), "by removing the hypoxic drive, supplemental oxygen may increase the incidence and duration of apneic episodes" (p. 486).

Treatment

Treatment for clinical OSA management includes weight loss, avoidance of alcohol and sedatives, application of nasal CPAP, oral appliance therapy (enlarging the pharyngeal airway by moving the tongue or mandible forward), and surgical approaches such as tracheostomy, uvulopalatopharyngoplasty (UPPP) and maxillofacial surgery. CPAP has been shown to be the most effective, but it is estimated that less than half of all patients prescribed CPAP use it for more than 4 hours per night on at least 70% of nights.

CPAP improves cardiac output in OSA patients. According to Celen and Peker (2010), "CPAP therapy results in decreased LV preload and afterload, reversal of systolic and diastolic dysfunction and normalization of the cardiac output" (p. 275).

This is accomplished by decreasing inspiratory muscle movement which removes apnea episodes. This treatment reduces the exaggerated negative intrathoracic pressure, reverses the increased venous return to the right ventricle, and shifts the interventricular septum to the left as well as reduces left ventricular filling. Moreover, effective decline in surges of blood pressure also have been shown to have a beneficial impact on diastolic function, stroke volume and cardiac output.

Hwang et al. (2010) suggested

> the perioperative use of continuous positive airway pressure (CPAP) reduces the rate of complications in OSA patients. CPAP stabilizes fluctuations in blood pressure, improves upper airway patency and ventilation, reduces

> myocardial ischemia, and decreases the incidence of cardiac arrhythmias. (p.1132)

CPAP therapy prior to surgery appeared to reduce the rate of serious complications and shorten the average length of hospital stay by about one day. In a study reported by Jain and Dhand (2004), "treatment of OSA with nasal CPAP for 4 to 6 weeks prior to surgery causes an increase in pharyngeal size and a decrease in tongue size according to MRI results" (p. 485). It is recommended that the identification of OSA be made, and nasal CPAP used preoperatively and postoperatively.

The choice of postoperative analgesia is also an important consideration since narcotics and benzodiazepines have been shown to adversely affect sleep disordered breathing. (Jain & Dhand, 2004) According to the ASA guideline as stated in Chung and Elsiad (2009),

> Regional anesthesia is recommended to reduce the possibility of negative adverse events associated with systemic opioids. A multimodal approach with combinations of analgesics from different classes and different sites of analgesic administration is a prudent strategy for perioperative pain management. The use of nonsteroidal anti-inflammatory analgesics is strongly recommended. Agents such as acetaminophen, tramadol and other nonopioid analgesics and their combinations can be used to provide effective pain relief and reduce opioid consumption, thus alleviating the opioid related adverse effect of respiratory depression. Other novel approaches such as ketamine, clonodine, or gabapentin can be utilized (p. 409).

Chung, Yuan and Chung (2008), found using dexmedetomidine as a sedative and anesthetic in OSA patients beneficial due to the lack of respiratory depression associated with its use. With the use of this drug, opioid analgesia can be decreased or even avoided due to its analgesic properties. However, in their findings, they caution that respiratory depression can occur if dexmedetomidine is co-administered with opioids.

Discussion

Interpretation

Obstructive sleep apnea is a prevalent disorder in the United States. It is essential that a diagnosis is made and interventions applied when a patient presents for surgery. Although it is ideal that the patient be screened prior to the surgical day, this is not always feasible. Anesthesia providers need to have adequate knowledge on the diagnosis of OSA. Once these patients have been identified, precautions need to be taken for optimization of that patient.

When a decision is made to continue with surgery whether, outpatient or inpatient, an appropriate plan of care must be obtained for the OSA patient. Use of regional anesthesia should be used where appropriate. If regional techniques can not be used for a specific surgery, the use of alternative medicines should be used.

All patients with a diagnosis of OSA should be notified of their risks prior to surgery. Notification of the benefits of CPAP usage may increase the use of their machine. CPAP should be used for several weeks pre-op, and for a least a week post-operatively.

Outcome

The purpose of this study was to increase the knowledge of OSA for anesthesia providers. A thorough literature review was completed and data compiled. The outcomes revealed included:

1. A patient presenting for surgery whom is not diagnosed with OSA should be screened using one of the screening tools provided.
2. Anyone that has a diagnosis of OSA and those found to have OSA using the criteria provided should be optimized prior to surgery.
3. Optimization would include early diagnosis of OSA, and treatment prior to surgery if needed.
4. CPAP should be used prior to surgery and for at least 1 week post-operatively.
5. Knowledge that the patient may have a difficult airway for intubation should be taken into consideration and alternative airway devices should be utilized.
6. Vigilance and patient advocacy should be considered at all times during the perioperative period.
7. If able, use of regional anesthesia should be used for patients with OSA.

Implications for Nursing

Each hospital should have a policy regarding OSA. All anesthesia professionals and nursing staff should be aware of the complications and interventions with this diagnosis. Faye Glenn Abdellah's theory, Twenty-One Nursing Problems, was chosen for the framework to guide this independent project. This theory applies to all nursing and medical staff emphasizing the need to continue to educate each other on evidence based practice. Medicine is always changing, and projects like this one, used to educate staff, can increase our knowledge and better the outcomes for patients.

As a recommendation for research, need for further studies on diagnosis and implementation into practice are needed. With the occurrence of large groups of patients being undiagnosed, more education needs to be given to the pre-operative diagnosis of OSA. It is recommended that the Polysomnography is the gold standard for diagnosis, but as stated in the literature, it is expensive and the waiting list is long. Research on easier less expensive diagnosis protocols would be beneficial for diagnosing this large group of patients with OSA that go undiagnosed.

Education

This project will be presented at the North Dakota State biannual CRNA state meeting. People attending the meeting include, SRNA's from the University of North Dakota, and Texas Wesleyan programs. Faculty members from the University of North Dakota and CRNA's from across North Dakota will also be in attendance. It will be presented in PowerPoint format (see appendix A) with a question and answer session following the presentation.

Conclusion

Obstructive sleep apnea is a prevalent disorder in the United States. Although there are several patients are diagnosed with OSA each year, many more remain undiagnosed. Optimization prior to surgery is of utmost importance for this group of people. Appropriate planning and knowledge of alternative methods of anesthesia should be taken into consideration. Regional anesthesia is strongly encouraged if the surgery deems appropriate. If regional anesthesia is not appropriate, strong consideration for use of dexmedetomidine with little or no opioid therapy is advised. If neither of these is considered, the patient should be monitored post-operatively for desaturations.

References

Adesanya, A., Lee, W., Greilich, N., & Joshi, G. (2010). Perioperative management of obstructive sleep apnea. *Chest, 138*(6), 1489-1498.

Analgesics. (n.d.) From MedicineNet definitions. Retrieved from http://www.medterms.com/script/main/alphaidx.asp?p=a_dict

Anesthetics. (n.d.) From MedicineNet definitions. Retrieved from http://www.medterms.com/script/main/alphaidx.asp?p=a_dict

Celen, Y., & Peker, Y. (2010). Cardiovascular consequence of sleep apnea: III-impact of continuous positive airway pressure treatment. *Anatolian Journal of Cardiology, 10*, 274-280.

Chung, F., Yegneswaran, B., Liao, P., Chung, S., Vairavanathan, S., Islam, S., Khajehdehi, A., Shapiro, C., (2008). STOP Questionnaire: A tool to screen patients for obstructive sleep apnea. *Anesthesiology, 108*(5), 812-821.

Chung, F., & Elsaid, H. (2009). Screening for obstructive sleep apnea before surgery: why is it important? *Current opinion in anaesthesiology, 22*, 405-411.

Chung, S., Yuan, H., & Chung, F. (2008). A systemic review of obstructive sleep apnea and its implications for Anesthesiologists. *Anesthesia & Analgesia, 107*(5), 1543-1563.

"Current Nursing" (n.d). Nursing theories. Retrieved from http://currentnursing.com/nursing_theory/Abdellah.html

Downey, R. (2011). Obstructive sleep apnea. Retrieved from http://emedicine.medscape.com

Gali, B., Whalen, F., Gay, P., Olson, E., Schroeder, D., Plevak, D., Morgenthaler, T., (2007). Management plan to reduce risks in perioperative care of patients with presumed obstructive sleep apnea syndrome. *The Journal of Clinical Sleep Medicine*, *3*(6), 582-588.

Gross, J., Bachenberg, K., Ydens, L., Yu, S., Benumof, J., Caplan, R. (2006). Practice guidelines for the perioperative management of patients with obstructive sleep apnea. *Anesthesiology*, *104*, 1081-1093.

Hines, R., & Marschall, K. (2008). *Stoelting's Anesthesia and Co-Existing Disease* (5 ed.). Philadelphia: Churchill Livingston.

Hwang, D., Shakir, N., Limann, B., Sison, C., Kalra, S., Shulman, L., Greenberg, H., (2008). Association of sleep-disordered breathing with postoperative complications. *Chest*, *133*, 1128-1134.

Isono, S. (2009). Obstructive sleep apnea of obese adults. *Anesthesiology*, *110*, 908-921.

Jain, S., & Dhand, R. (2004). Perioperative treatment of patients with obstructive sleep apnea. *Current Opinion in Pulmonary Medicine*, *10*, 482-488.

Jigajinni, S., Sultan, P., & Radhakrishnan, D. (2009). Not just a patient that snores. Obstructive sleep apnoea: the perioperative concerns through the eye of the anaesthetist. *Journal of perioperative practice*, *19*(11), 395-399.

Kaw, R., Michota, F., Jaffer, A., Ghamande, S., Auckley, D., & Golish, J. (2006). Unrecognized sleep apnea in the surgical patient. *Chest 2006*, *129*, 198-205.

Moos, D., Prasch, M., Cantral, D., Huls, B., & Cuddeford, J. (2005). Are patients with obstructive sleep apnea syndrome appropriate candidates for the ambulatory surgical center. *AANA Journal*, *73*(3), 197-205.

Nagelhout, J. J., & Plaus, K. L. (2010). *Nurse anesthesia* (4th. ed.). Amsterdam: Elsevier.

Perioperative. (n.d.) From MedicineNet definitions. Retrieved from http://www.medterms.com/script/main/alphaidx.asp?p=a_dict

"Remedies Health" (n.d.) Retrieved from Remedies Health.com. http://healthcommunities.com

Sabers, C., Plevak, D., Schroeder, D., & Warner, D. (2003). The diagnosis of obstructive sleep apnea as a risk factor for unanticipated admissions in outpatient surgery. *International Anesthesia Research Society, 96*, 1328-1335.

Seet, E., & Chung, F. (2010). Management of sleep apnea in adults-functional algorithms for the perioperative period: Continuing Professional Development. *Canadian Journal of Anesthesia, 57*, 849-864.

Sedatives. (n.d.) From MedicineNet definitions. Retrieved from http://www.medterms.com/script/main/alphaidx.asp?p=a_dict

Siyam, M., & Benhamou, D. (2002). Difficult endotracheal intubation in patients with sleep apnea syndrome. *Anesthesia & Analgesia, 95*, 1098-1102.

Vasu, T., Doghramji, K., Cavallazzi, R., Grewal, R., Hirani, A., Leiby, B., Markov, D., Reiter, D., Kraft, W., Witkowski, T. (2010). Obstructive sleep apnea syndrome and postoperative complications. *Arch Otolaryngol Nead and Neck Surgery, 136*(10), 1020-1024.

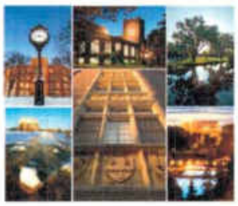
Appendix

Anesthesia implications for obstructive sleep apnea

Anesthesia Implications for Obstructive Sleep Apnea

Jessica Bratrud, SRNA

University of North Dakota



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Introduction

- Obstructive Sleep apnea affects nearly 18 million people in the United States. (Nagelhout and Plaus. 2010)
- According to Nagelhout and Plaus (2010), nearly 80-95% of people are undiagnosed.
- Approximately 10% women and 24% men are affected.
- Number is increasing as population gets older and more obese.

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What is OSA?

- Obstructive Sleep Apnea (OSA) is a common disorder caused by repetitive partial or complete obstruction of the upper airway and is characterized by episodes of cessation of breathing during sleep lasting for more than ten seconds. (Chung, Yang, Chung 2008)

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OSA

- According to Jain, and Dhand (2004) "nearly fatal respiratory complications and even unexpected deaths have been reported after surgery in patients with serious obstructive sleep apnea that have been unrecognized or inadequately treated in the peri-operative and postoperative periods."
- This disorder has been known to be an independent risk factor for increased peri-operative mortality.

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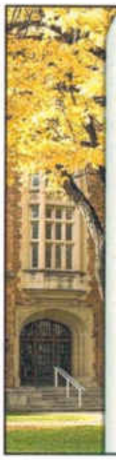

OSA

- Patients with OSA are predisposed to a variety of serious complications before and after surgery.
- Some of these include cardiac arrhythmias, coronary artery disease, hypertension, congestive heart failure, myocardial ischemia, cerebrovascular insufficiency, intracranial hypertension, gastroesophageal reflux disease, difficult intubation, and unanticipated admissions to the ICU

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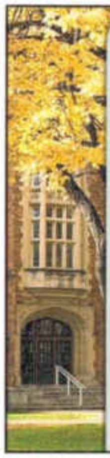

OSA

- Snoring, daytime somnolence, and physiologic changes are manifestations of airway obstruction.
- Daytime somnolence is due to frequent episodes of interrupted sleep during the night.
- Physiologic changes include: arterial hypoxemia, arterial hypercarbia, polycythemia, systemic hypertension, pulmonary hypertension, and right ventricular failure.

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Problem Statement

- Obstructive sleep apnea is becoming more prevalent in the United States.
- It is known that the lack of recognition of obstructive sleep apnea can cause suboptimal preparation and increase the risk of adverse events.

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Problem

- Obstructive sleep apnea patients are predisposed to upper airway obstruction during sleep.
- This upper airway obstruction leads to apnea, which leads to vigorous breathing efforts to open the collapsed airway.
- The patient arouses from sleep to restore their airway.
- This is repeated several times, during a night of sleep.
- Sedatives and anesthetic agents cause similar events to occur during and after administration.

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Problem

- Sedatives and anesthetic agents, depress the central nervous system, causing inhibition of respiration, and reduced functional residual capacity leading to atelectasis.
- They also have the tendency to cause the upper airway to collapse by depressing skeletal muscle tone and relaxing of the upper airway. (Jain and Dhand 2004)
- Persons in natural sleep have the ability to arouse during these episodes of apnea.

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Problem Continued

- However, persons with a depressed central nervous system, as in patients that are sedated or anesthetized, may not be able to have this ability.
- As stated by Jain and Dhand (2004) "the sum of these effects is that apnea could have life-threathening consequences for the sedated or anesthetized patients with obstructive sleep apnea (p. 483)."

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Problem

- Adequate knowledge on diagnosis and optimization of the patient with OSA, indicates a smooth peri-operative and postoperative timeline.
- This is done by increasing our knowledge of OSA, what it does to the body, and how to identify patients with this disorder.

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Significance

- As stated previously, OSA is often undiagnosed.
- If OSA is an independent risk factor for a variety of clinical problems and increased length of hospital stay, increased knowledge is mandatory
- " The anesthesia provider may be the last healthcare provider to identify undiagnosed OSA before surgery"
- "Patient safety and patient advocacy should always be at the forefront of our care" (Moos et al. 2005)

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How can we identify these patients?

1. Polysomnography: This is recognized as the gold standard for diagnosis of OSA. It is very expensive, and is limited in its resource.
2. Felmons criteria: Felmons et al looks at the patients neck circumference, history of hypertension, and clinical symptoms.

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Identification STOP-BANG

3. STOP-BANG: The STOP-BANG questionnaire is a screening modality of OSA used in the preoperative setting.

- STOP-BANG stands for snoring, tiredness during daytime, observed apnea, high blood pressure, body mass index (greater than 35), age (older than 50), neck circumference (greater than 40cm) and gender (male). It is an 8 question yes/no answer test. Patients are classified as being high risk for OSA if their STOP-BANG score is 3 or greater. If they receive a score of less than 3 they are considered low risk.

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STOP-BANG Continued

- As stated by Seet and Chung (2010) "in a meta-analysis of clinical screening tools for OSA, the STOP-Bang was identified as being easy to use and having a favorable diagnostic odds ratio, making it more suitable for predicting severe OSA in the preoperative setting (p.851)."

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Management: Pre-operative

- Consider difficult intubation
- Difficulty with tracheal intubation occurs eight times more often in OSA patients than in non-OSA patients. (Siyam and Benhamou, 2002)
- Adequate preoxygenation
- "Preoxygenation with 100% oxygen until exhaled or end-tidal oxygen is at least 90% can be accomplished by using CPAP at 10cm H_20 for 3 to 5 minutes with the patient in a 25° head up position." (Adesanya et al, 2010)
- Anxiolysis titrated or eliminated

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Management: Intraoperative

- Avoid loss of airway control
- Limit amount of opioid use
- Extubate once fully awake

Management: Postoperative

- Oxygen therapy should be used with caution because hypoxemia is the key factor for producing arousal during apnea.
- "By removing the hypoxic drive, supplemental oxygen may increase the incidence and duration of apneic episodes." (Jain and Dhand, 2004)
- Use CPAP at pre-operative settings if patient tolerates

Recommendations

- Diagnosis of OSA and use of CPAP pre-operative and post-operative
- Peled et al suggested that the perioperative use of continuous positive airway pressure (CPAP) reduces the rate of complications in OSA patients.
- CPAP stabilizes fluctuations in blood pressure, improves upper airway patency and ventilation, reduces myocardial ischemia, and decreases the incidence of cardiac arrythmias.

Recommendations

- ASA guidelines suggest the uses of regional anesthesia to reduce the possibility of negative adverse events associated with systemic opioids.
- Non-steroidal anti-inflammatories
- Agents such as acetaminophen, tramadol and other non-opioid analgesics and their combinations can be used to provide effective pain relief and reduce opioid consumption, thus alleviating the opioid related adverse effect of respiratory depression.
- Other medications such as ketamine, clonidine, gabapentin, or dexmedetomidine can be used

Conclusion

- Identify Patients at risk for OSA
- Optimize patient prior to induction of anesthesia
- Use CPAP post-operative if tolerated
- Use regional anesthesia when indicated
- Use non-opioid pain medications when able
- Vigilant monitoring for first 24 hours post-operative

References

Adesanya, A., Lee, W., Greilich, N., & Joshi, G. (2010). Perioperative Management of Obstructive Sleep Apnea. *Chest*, 138(6), 1489-1498.

Celen, Y., & Peker, Y. (2010). Cardiovascular Consequence of Sleep Apnea: II-impact of Continuous Positive Airway Pressure Treatment. *Anatolian Journal of Cardiology*, 10, 274-280.

Chung, F., Yegneswaran, B., Liao, P., Chung, S., Vairavanathan, S., Islam, S., et al. (2008). STOP Questionnaire: A Tool to Screen Patients for Obstructive Sleep Apnea. *Anesthesiology*, 108(5), 812-821.

Chung, F., & Elsaid, H. (2009). Screening for obstructive sleep apnea before surgery: why is it important? *Current opinion in anaesthesiology*, 22, 405-411.

Chung, S., Yuan, H., & Chung, F. (2008). A Systemic Review of Obstructive Sleep Apnea and Its Implications for Anesthesiologists. *Anesthesia & Analgesia*, 107(5), 1543-1563.

Gali, B., Whalen, F., Gay, P., Olson, E., Schroeder, D., Plevak, D., et al. (2007). Management Plan to Reduce Risks in Perioperative Care of Patients with Presumed Obstructive Sleep Apnea Syndrome. *The Journal of Clinical Sleep Medicine*, 3(6), 582-588.

Gross, J., Bachenberg, K., Ydens, L., Yu, S., Benumof, J., Caplan, R., et al. (2006). Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea. *Anesthesiology*, 104, 1081-1093.

Hines, R., & Marschall, K. (2008). *Stoelting's Anesthesia and Co-Existing Disease* (5 ed.). Philadelphia: Churchill Livingston.

Hwang, D., Shakir, N., Limann, B., Sison, C., Kalra, S., Shulman, L., et al. (2008). Association of Sleep-Disordered Breathing With Postoperative Complications. *Chest*, 133, 1128-1134.

Isono, S. (2009). Obstructive Sleep Apnea of Obese Adults. *Anesthesiology*, 110, 908-921.

References

Jain, S., & Dhand, R. (2004). Perioperative Treatment of Patients with Obstructive Sleep Apnea. *Current Opinion in Pulmonary Medicine*, 10, 482-488.

Jigajinni, S., Sultan, P., & Radhakrishnan, D. (2009). Not Just a Patient that Snores: Obstructive Sleep Apnoea: the perioperative concerns through the eye of the anaesthetist. *Journal of perioperative practice*, 19(11), 395-399.

Kaw, R., Michota, F., Jaffer, A., Ghamande, S., Auckley, D., & Golish, J. (2006). Unrecognized Sleep Apnea in the Surgical Patient. *Chest* 2006, 129, 198-205.

Moos, D., Prasch, M., Cantral, D., Huls, B., & Cuddeford, J. (2005). Are Patients with Obstructive Sleep Apnea Syndrome Appropriate Candidates for the Ambulatory Surgical Center. *AANA Journal*, 73(3), 197-205.

Nagelhout, J. J., & Plaus, K. L. (2010). *Nurse anesthesia*. (4 ed.). Amsterdam: Elsevier.

Sabers, C., Plevak, D., Schroeder, D., & Warner, D. (2003). The Diagnosis of Obstructive Sleep Apnea as a Risk Factor for Unanticipated Admissions in Outpatient Surgery. *International Anesthesia Research Society*, 96, 1328-1335.

Seet, E., & Chung, F. (2010). Management of sleep apnea in adults-functional algorithms for the perioperative period: Continuing Professional Development. *Canadian Journal of Anesthesia*, 57, 849-864.

Siyam, M., & Benhamou, D. (2002). Difficult Endotracheal Intubation in Patients with Sleep Apnea Syndrome. *Anesthesia & Analgesia*, 95, 1098-1102.

Vasu, T., Doghramji, K., Cavallazzi, R., Grewal, R., Hirani, A., Leiby, B., et al. (2010). Obstructive Sleep Apnea Syndrome and Postoperative Complications. *Arch Otolaryngol Head and Neck Surgery*, 136(10), 1020-1024.