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Obstructive Sleep Apnea: Educational Considerations for Nurse Anesthetists

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OBSTRUCTIVE SLEEP APNEA: EDUCATIONAL CONSIDERATIONS FOR NURSE ANESTHETISTS

By

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CHAPTER ONE

Introduction

Sleep is an integral part of human existence and is now, more than ever, the subject of clinical and research interest (Herder, Schmeck, Appleboom & de Vries, 2004). During sleep, especially rapid eye movement (REM) sleep, the body is at its most relaxed state, and a three-dimensional collapse of the oropharynx muscle (musculus genioglossus and musculus geniohyoideus) and fatty tissue around the upper airway may cause obstruction (Herder et al., 2004). Obstructive sleep apnea syndrome (OSAS) is a pathophysiological disorder characterized by episodic interruption of breathing during sleep, OSAS is primarily a disorder of the upper airway at the level of the pharynx (Biddle, 1999). When this obstruction occurs, sleep apneas develop. The brain responds to each of these apnea events by waking the person in order to resume breathing. Since apnea events can happen hundreds of times per night, sleep becomes broken and ineffective (American Society of Anesthesiologists [ASA], 2004).

The Greek word "apnea" literally means "without breath". Charles Dickens described this condition in "Joe , the Fat Boy" in his *Pickwick papers* where he observed a obese and hypersomnolent boy (Connolly, 1991). Since then, this condition often has been referred to as the "Pickwickian syndrome". There are three types of apnea: obstructive, central, and mixed. Of the three, obstructive is the most common (American Sleep Apnea Association [ASAA], 2000). In all three, people stop breathing repeatedly during their sleep, sometimes hundreds of times during the night and often for a minute or longer (ASAA, 2000). In obstructive sleep-disordered breathing, the airway completely (apnea) or partially (hypopnea) occludes despite continued respiratory effort (Meoli, Rosen, Kristo, Kohrman & Gooneratne, 2005). Arousals from sleep temporarily restore upper airway patency, only to be

followed by a repetitive cycle of airway collapse and arousal. This phenomenon produces sleep fragmentation and can lead to significant nocturnal hypoxemia (Meoli et al., 2005). Obstructive sleep apnea syndrome (OSAS) may produce significant complications including an increased risk of hypertension, cardiac arrhythmias, myocardial infarction, and stroke (Meoli et al., 2005). In this paper, obstructive sleep apnea will be the main focus for adults and children.

To be classified as sleep apnea, there must be complete cessation of breathing for ten seconds or longer. Such episodes can occur in normal persons, particularly during the onset of sleep, during rapid eye movement bursts, and following body movements (Chung & Crago, 1982). Sleep apnea is diagnosed if, during seven hours of nocturnal sleep, at least thirty apnoeic episodes are observed both in rapid eye movement and non-rapid eye movement sleep, some of which must appear repeatedly in non-rapid eye movement sleep (Chung & Crago, 1982). Symptomatic patients with sleep apneas syndrome might stop breathing hundreds of times during a single night with episodes of apnea lasting between 20 and 90 second. Sometimes these patients are apnoeic during 50 percent of sleep time (Chung & Crago, 1982). To experience hypopneas the individual or individuals must have a greater than 50% diminishing of airflow or oxygen desaturations greater than 3% for ten seconds or more (Herder et al., 2004). Sleep related disorders (obstructive sleep apnea and hypopneas) effect between 2-4% of middle-aged adults with a male to female ratio of 2: 1 (Loadsman & Hillman, 2001). Obstructive sleep apneas (OSA) are thought to have mainly affected the obese with a Body Mass Index (BMI>30) and elderly (Gupta, Parvizi, Hanssen & Gay, 2001). And yet, it is predicted that obstructive sleep apnea patients are under reported in approximately 80% of patients (Herder et al., 2004). OSA is not just specific to adults; children will experience OSA.

In children, the most common cause of OSA is enlarged tonsils and adenoids in the upper airway (Lucile Packard Children's Hospital, 2001-2004). OSA occurs in children of all ages, but it is thought to be most common in pre-school aged children and children with Downs syndrome and other congenital conditions affecting the upper airway such as a large tongue and small jaw (Schroeder, 2002). The classifications of OSA for children are the same for adults. Unlike adult OSA, in children there is an equal prevalence of affected boys and girls (Warwick & Mason, 1998).

OSA symptoms experienced by adults include loud snoring, daytime somnolence, headaches, memory problems, anxiety, sexual dysfunction, impotence, and nocturia (Stalford, 2004). Potentially life-threatening complications include arrhythmias, systemic hypertension, pulmonary hypertension, left ventricular hypertrophy, ischemic heart disease, stroke, and depression (Stalford, 2003). Symptoms for children may include; loud snoring or noisy breathing during sleep, periods of apnea (no breathing), mouth breathing (due to blocked nose passages by enlarged tonsils and adenoids), restlessness during sleep, excessive daytime sleepiness or irritability and hyperactivity during the day (Lucile Packard Children's Hospital, 2001-2004). Enuresis, nightmares and morning headaches may also occur (Warwick & Mason, 1998).

Purpose

The purpose of this paper is to educate the reader about obstructive sleep apnea (OSA), and it's importance for how the anesthesia provider needs to have a basic knowledge and understanding about the patients who present to the operating room (OR) that are at high risk for OSA. This knowledge base will allow the anesthesia provider to be better prepared and treat airway difficulties that are frequently encountered by the patients who suffer from OSA post-operatively.

Problem

This paper has addressed the important link that sleep apnea has to anesthesia providers. Most patients with sleep apnea that undergo surgery have not been diagnosed as having sleep apnea. The postoperative period is a particularly critical time for patients with OSA. There have been reports of serious respiratory complications and even death in this post-operative population (Stalford, 2004). Anesthesia providers need to know the "warning signs" of patients who suffer from sleep apnea and an understanding of the acute and residual influences that anesthetic drugs have on the airway muscles and reflexes involved in airway patency (Stalford, 2004; Loadsman & Hillman, 2001).

Theoretical Framework

The theoretical framework used in this paper is Malcolm Knowles adult learning theory. Malcolm Knowles used the term "andragogy" to guide his theory in the adult educational field. Knowles defines andragogy as "the art and science of helping adults learn (Smith, 1999). There are five assumptions about adult learners that Knowles uses in his theory:

1. **Self-concept:** As a person matures his self-concept moves from one of being a dependent personality toward one of being a self-directed human being.
2. **Experience:** As a person matures he accumulates a growing reservoir of experience that becomes an increasing resource for learning.
3. **Readiness to learn:** As a person matures his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles.
4. **Orientation to learning:** As a person matures his time perspective changes from one of postponed application of knowledge to immediacy of application, and

accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem centeredness.

5. **Motivation to learn:** As a person matures the motivation to learn is internal (Smith, 1999).

Each of these assumptions attempts to explain what and how the adult learns. This theory is a good and important theory because it helps to explain how adults go about by, in many ways, unconsciously learning throughout their life span. The assumptions of experience, readiness to learn, orientation to learning and motivation to learn will be independently applied to how CRNA's learn.

The assumption of experience states; as a person matures he accumulates a growing reservoir of experience that becomes an increasing resource for learning. A new graduate CRNA is equipped with a multitude of book knowledge and, in some areas, little clinical experience. Over the years as the CRNA grows in wisdom and experience with accumulated clinical knowledge, this gained experience is used to help the CRNA accomplish his tasks with a greater sense of security as opposed to a new graduate. The knowledge that is gained by the CRNA during his/her practice is presented in many forms; Meetings, educational workshops, presentations, policy and procedures and guidelines to name just a few. These educational tools are used by the CRNA to add to their knowledge base that will ultimately help him/her to continue to grow in their practice and continue to deliver optimal anesthetic care.

"As a person matures his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles". This statement is Malcolm Knowles "readiness to learn assumption". This assumption, as perceived by the author of this project, deals with the CRNA's ability to understand the relevance of education as it is needed to carry out a

particular task. That is to say that when the CRNA understands that an educational tool, such as a guideline for OSA is presented, the CRNA will understand it's importance and learn from this tool and implement this new knowledge in his/her practice in order to provide better quality anesthesia care.

The third assumption of this project from Malcolm Knowles theory deals with the orientation to learn. The assumption states: as a person matures his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem centeredness. The anesthesia provider is already a mature adult, so it is safe to assume that there is an immediacy of application of knowledge toward that of problem solving. An example of this would be the anesthesia provider's drive and determination to learn and understand what the signs and symptoms of a patient with OSA may exhibit and how to go about treating this individual post-operatively in the safest manner possible.

The last assumption of Knowles theory that will be discussed is "motivation to learn". Knowles states, "As a person matures the motivation to learn is internal". As The CRNA becomes more comfortable and confident, overtime, in their abilities as an anesthetist, they may begin to reach out independently and explore more educational opportunities (workshops, conferences etc.) so as to become more aware of what is occurring in their professional environment that surrounds their practice. This will in turn allow the CRNA to continue to build a stronger knowledge base that will in turn allow even a greater atmosphere of professionalism and caring directed toward the safe care of their patients.

Definitions

The following definitions will help the reader elucidate some of the terminology that is discussed in this project.

1. Sleep Apnea: Complete cessation of breath for at least ten seconds.
2. Hypopnea: Greater than 50% diminishing airflow or oxygen desaturations greater than 3% for ten seconds or more.
3. Body Mass Index (BMI): An index used in estimating an individual for obesity.
4. Obstructive sleep apnea: Absence of airflow at the mouth and nose despite respiratory movement.
5. Mallampati: Method of assessing whether or not an airway will be a difficult to intubate.
6. Difficult airway: An airway that may have partial or total obstruction to airflow at certain times.
7. Laryngeal mask airway (LMA): An anesthetic delivering tube that is inserted through the mouth and down the throat where it fits above the larynx.
8. General Anesthesia: Drug-induced reversible depression of the central nervous system resulting in the loss of response to and perception of all external stimuli.
9. Regional Anesthesia: Using a combination of injected drugs to provide anesthesia to certain areas of the body.

CHAPTER II

Review of literature

Introduction

An extensive literature review was conducted to gather the information needed to introduce obstructive sleep apnea to the reader. There were many articles that were

researched on the topic of obstructive sleep apnea. The articles that were used ranged from the years 1982-2005. The literature used in this research paper was clinical reviews and informational research articles to help elucidate the subject matter of OSA for the reader. The most significant areas of OSA that the author discovered were articles that explained in depth the concepts of the pathophysiology, pre-operative aspects, peri-operative aspects (Induction, maintenance phase and extubation) and post-operative aspects of OSA.

Pathophysiology of obstructive sleep apnea

A narrow floppy upper airway provides the pathophysiological basis for OSA. Usually this type of airway does not cause problems during wakefulness. However, with sleep, the associated loss of skeletal muscle tone makes the upper airway still narrower and floppier, particularly during REM sleep when muscle relaxation is profound (Loadsman & Hillman, 2001). First, the structures will tend to vibrate as turbulent flow patterns are produced, with snoring as the result. Second, the areas of the upper airway that are not supported by bone or cartilage will collapse, with resultant partial or complete obstruction (Hillman, Platt & Eastwood, 2003). During an apneic event, the soft palate moves posteriorly, meeting the posterior pharyngeal wall and leading to occlusion (Moos, Prasch, Cantral, Huls & Cuddeford, 2005). Upper airway collapse occurs when excessive negative inspiratory pressure exceeds the opposing forces generated by the dilator abductor muscles of the upper airway due to excessive tissue pressure and ineffective tissue driving pressure (Moos et al., 2005). Negative oropharyngeal pressure from decreased upper airway muscle activity, a small pharyngeal cavity, high pharyngeal compliance, and increased resistance leads to upper airway collapse. This obstruction will continue until sleep is interrupted and muscle tone restored. The results of airway occlusion and continued respiratory effort include arterial hypoxemia, hypercarbia, and a decrease in pH (Moos et al., 2005). Usually

these interruptions are momentary arousals lasting less than fifteen seconds and the sufferer is unaware of them (Loadsman & Hillman, 2001). Occasionally, the obstructive event will result in an awakening, and the sufferer may complain of waking suddenly or with a snort or a snore (Loadsman & Hillman, 2001). Upon arousal, breathing is restored and after a few breaths, deeper sleep will resume with the recurrence of the problem as the muscles again relax. Individuals with more severe cases of OSA, this cycle of apneas and arousals may occur hundreds of times at night, therefore leading to lethargy and somnolence throughout the daytime hours.

When airway occlusions occur, the body will experience a variety of harmful effects. Pulmonary artery pressure increases with the vigorous inspiratory efforts made against a closed airway during upper airway sleep apnea episodes. Very large intrathoracic pressure swings develop. At the onset of ventilation, intrathoracic pressure immediately drops to a normal range, but increases in pulmonary artery pressure are typically sustained (Chung & Crago, 1982). Pulmonary hypertension also results from protracted hypoxia and acidosis, which induce vasoconstriction in the pulmonary vascular bed, with eventual onset of medial thickening and secondary right heart failure (Chung & Crago, 1982). Systemic hypertension is present in many cases. Abnormalities that contribute to both systemic hypertension and myocardial dysfunction include hypoxia and increased circulating catecholamines. Continuous electrocardiographic monitoring shows a variety of arrhythmias during the night in association with repeated sleep apnea. The early parts of the apneic periods are often accompanied by sinus bradycardia, atrioventricular block and prolonged asystoles. Increasing efforts are associated with tachycardia, ventricular extrasystoles and runs of ventricular tachycardia (Chung & Crago, 1982). The typical brady-tachycardia cycle offers strong presumptive evidence on Holter monitor for a diagnosis of sleep apnea (Chung &

Crago, 1982). Arrhythmias have been the possible cause of sudden death during sleep in such patients.

The pathology for children is usually simpler. As mentioned earlier, most OSA's of younger children are due to enlarged tonsils and adenoids. Neuromuscular disease and craniofacial anomalies also play a role with infant OSA. With and already anatomical narrowed upper airway, when a child is sleeping the relaxation of the upper airway muscles collapses the airway further and the enlarged tonsils or adenoids will cause occlusions. There are many symptoms associated with OSA for both children and adults. See table 1.

Pre-operative aspects of OSA

Anesthetists are the key figures in the early recognition of undiagnosed obstructive sleep apnea, because of their role in pre-operative screening (Herder et al., 2004). The anesthesia provider may be the last healthcare provider to identify undiagnosed OSA before surgery (Moos et al., 2005). Because OSA is underdiagnosed, a high index of suspicion should be maintained, therefore a patient who exhibits signs and symptoms of OSA, yet is undiagnosed, may present a challenge to the anesthesia provider (Moos et al., 2005). Obstructive sleep apnea affects every phase of anesthesia care (Moos et al., 2005). In the preoperative phase, centrally acting depressants promote pharyngeal collapse in obese patients with OSA (Moos et al., 2005). General anesthesia suppresses upper airway muscle activity, and it may impair breathing by allowing the airway to close (ASAA, 1996). Airway assessment is essential during an anesthetic preoperative visit (Connolly, 1991). A history of airway difficulties during previous anesthetics and operations should be obtained from the patient or previous anesthetic records (Barash, Cullen & Stoelting, 2001). The patient should be questioned about symptoms suggestive of obstructive sleep apnea (excessive nocturnal snoring, with or without apneic episodes), which may suggest a

potential for mechanical airway obstruction when the level of consciousness is decreased (Barash et el., 2001). Patients with such histories, and those presenting for operations designed to alleviate such conditions (tracheostomy, palatoplasty), should be scrutinized especially closely, because they may present formidable airway difficulties (Barash et al., 2001). This includes assessment of temporomandibular joint function, oral inspection (especially if the patient is obese and macroglossia appears to be present), assignment of oropharyngeal classification, assessment of mobility of the neck, and measurement of thyroid-mandibular length (Connolly, 1991). Lateral soft tissue radiographs of the neck in neutral and extended positions, computed tomographs of the pharynx, hypopharynx, and the larynx, or consultation with an otolaryngologist for a specialized work-up may help delineate airway difficulties before surgery (Barash et al., 2001). If a difficult intubation is anticipated, an awake intubation should be done. Selection of the intubation technique should be based on physical examination findings and history in relation to general anesthesia (Moos et al., 2005). The periods of induction with intubation and emergence with extubation must be planned and executed carefully by the anesthesia provider (Moos et al., 2005). In addition to airway assessment, a thorough cardiovascular assessment is needed to identify evidence of, and assure preoperative control of pulmonary hypertension, heart failure, dysrhythmias, and systemic hypertension (Connolly, 1991). Common clinical features of pulmonary hypertension are dyspnea on exertion, syncope, and chest pain (Connolly, 1991). Further studies may reveal evidence of pulmonary hypertension. ECG may demonstrate right ventricular hypertrophy, and chest radiography may demonstrate cardiomegaly and enlargement of the pulmonary arteries (Connolly, 1991). Echocardiography may further confirm right ventricular hypertrophy. Arterial blood gases usually reveal moderate hypoxemia and hypercarbia (Connolly, 1991).

Pulmonary function testing (PFT) may be helpful. It may uncover unsuspected restrictive lung disease or resting hypercarbia and hypoxemia (Connolly, 1991). Obesity is common in patients with OSA but not invariably present. Morbidly obese patients and those patients in whom a difficult intubation is anticipated are at increased risk for aspiration. Thyroid function testing should be done to rule out hypothyroidism as a cause of sleep apnea (Connolly, 1991).

During preoperative assessment of the patient, one must be aware of the high tendency of obstructive sleep apnea patients to develop acute upper airway obstruction after minimal sedation. Hypoglossal nerve activity is exquisitely sensitive to minimal levels of anesthesia, and the genioglossus muscle tone that maintains upper airway patency may be lost (Connolly, 1991). Therefore, no sedatives should be given preoperatively.

There are many symptoms accompanying OSA. A few of these symptoms can be screened for by the anesthetist, such as; heavy and persistent snoring, sudden awakenings accompanied by choking, apneas observed by the bed partner, and excessive sleepiness during daytime (Herder et al., 2004). Many of the symptoms associated with sleep apnea are not very specific to the disease. A full night polysomnography is the definitive test to determine if a patient had OSA or not. Obesity (BMI> 30) and a large neck circumference (>44 cm) have a strong correlation with severe OSA. These conditions involve extensive tissue enlargements of the upper airway (Herder et al., 2004). Patients with OSA have sequelae of other conditions that increase the risk of co-morbidity. Hypertension and cardiovascular disease are very prevalent with the OSA sufferer along with polycythemia due to chronic nighttime hypoxia (oxygen saturation < 80%) and frequent cardiac arrhythmias. Assessing the patient for risk of intubation is also important in the pre-operative aspect of OSA.

Mallampati scores (I, II, III, or IV, I being the easiest to intubate and IV being the most difficult) are used by anesthesia providers to help in the prediction of difficult endotracheal intubations (Morgan & Mikhail, 2002). Patients with a high Mallampati score together with nasal obstruction are a risk factor for obstructive sleep apnea because the airway at the oropharyngeal level is reduced owing to a larger tongue (Herder et al., 2004). Alterations in craniofacial morphology may also contribute to OSA. But many of these alterations do not have a strong correlation to the risk of OSA. Two anatomical landmarks have been shown to be important in patients with obstructive sleep apnea; an inferiorly positioned hyoid (distance between chin and hyoid bone) and increased length of soft palate (Herder et al., 2004). Any patient diagnosed as having OSA should be treated as having a difficult airway until proven otherwise. Post-operative swelling and bleeding of the upper airway due to traumatic intubations, especially in the severely obese should be anticipated. Pre-operative preparations in children are also important.

As with adults, it is important for the child anesthesia provider to have an awareness of some of the clinical features of OSA syndrome in children. The anesthetist should enquire specifically about the sleeping habits and snoring in all children (Warwick & Mason, 1998). If clinical features of OSA syndrome are present, a full pre-operative assessment should include baseline investigations of hematocrit, ECG and pulse oximetry (Warwick & Mason, 1998).

Peri-operative aspects of OSA

One of the most important characteristics of OSA patients is their exquisite sensitivity to all sedatives (Daley, Norman & Coveler, 1998). Therefore, be careful when sedating individuals who have sleep apnea pre-operatively. Pre-operative sedation with benzodiazepines has an anticonvulsive and muscle relaxing effect on the upper airway

musculature, causing an appreciable reduction in the pharyngeal space (Herder et al., 2004). Barbiturates, opioids and benzodiazepines also have more direct effects, and have been shown to increase the frequency of obstructive sleep apneas compared to the natural sleep state (Daley et al., 1998). Based on the aforementioned considerations, it is best to only administer sedative agents in the holding room or operative room itself. Preoperative sedation is contra-indicated in sleep apnea patients, as these patients are much more susceptible to respiratory depression and obstruction after premedication (Chung & Crago, 1982). When sedative agents are used on an OSA patient, cardio-respiratory monitoring and airway managing equipment must be immediately available. When the sedative agents have been administered in the OR, the next step the anesthetist must deal with is intubation.

The sedative drugs given by the anesthetist before intubation may exacerbate a difficult airway. Induction in sleep apnea patients can provoke a life-threatening situation (Chung & Crago, 1991). These patients may develop respiratory obstruction during induction, which is usually relieved by elevation of the jaw or insertion of a naso-pharyngeal or oropharyngeal airway (Chung & Crago, 1982). At the time of induction, the airway is best controlled using an oropharyngeal airway that is of the proper size and correctly positioned to hold the base of the tongue out of the airway (Meoli et al., 2003). If the proper size is not available, a nasopharyngeal airway may be used but it must be long enough to extend into the retroglottic portion of the hypopharynx (Meoli et al., 2003). The primary goal in the care of the sleep apnea patient is maintenance of constant airway control either by the patient or by the anesthetist (Meoli et al., 2003). A three to five minute period of pre-oxygenation is useful in order to decrease the rate of oxyhemoglobin desaturation should intubation prove difficult. Two-person ventilation, one for jaw positioning and mask seal and the other for ventilation, may be needed to mask ventilate an obese patient. If there is any suspicion of the

patency of the upper airway or of difficult intubation, an awake intubation is indicated with the assistance of fiberpotic laryngoscopy, or induction with an inhalation anesthetic should be considered with avoidance of muscle relaxants (Chung & Crago, 1982). The equipment for the management of a difficult airway should be in place before induction of general anesthesia (Herder et al., 2004). These include different sizes of orotracheal tubes, laryngoscope blades, laryngeal mask airways (LMA) and fiber optic devices for emergency situations. Once again, oxygen should be administered for three or more minutes before intubation and wherever possible during the process of establishing a secure airway and also after extubation (Herder et al., 2004). Patients with extreme anatomical anomalies should be intubated in an alert condition (awake intubation). The awake state allows the patients to maintain their own airway until intubation, and then the patient is put to sleep. Optional local anesthesia of the upper airway should be exercised with and awake intubation to decrease pain and discomfort.

In addition to the standard procedures of intubation, there should be careful attention given to potential occlusion of the upper airway in patients with OSA. Intubation over a fiberoptic scope with or without mild sedation should be considered if there is any doubt about the ability to intubate the patient (Meoli et al., 2003). Considerable care should be exercised in paralyzing an OSA patient for intubation. If the patient can be easily ventilated with a mask after initial induction, then a paralyzing agent may be used, preferably a short acting agent such as succinylcholine (Meoli et al., 2003). In these patients all such drugs should be administered by titration until the desired effect is achieved (Benumof, Dagg & Benumof, 1997). While muscle paralysis may facilitate intubation, the patient can experience dangerous levels of oxygen desaturation before recovery of spontaneous breathing (Boushra, 1997). In the event of unsuccessful intubation, alternative methods of securing the

airway must be immediately available, including mask ventilation, an esophageal obturator tube, transtracheal jet ventilation, and equipment for tracheotomy (Meoli et al., 2003).

The choice between local anesthesia with or without sedation, regional anesthesia with or without sedation, and general anesthesia is important (Meoli et al., 2003). In terms of airway safety, local anesthesia without sedation may be preferable. Even so, the use of analgesics in the post-operative period might create an airway problem. Sedation may be more dangerous for OSA patients than general anesthesia because the sedated patient's ability to protect his or her own airway may be dangerously compromised (Meoli et al., 2003). Patients with OSA tend to be more sensitive to what would otherwise be nonobstructive doses of drugs (Harget, 2004). With general anesthesia administered with proper precaution during induction and awakening, the airway is "controlled" during the procedure. An inhalational drug may accomplish maintenance of anesthesia. One must keep in mind that ventilatory responses to CO2 are attenuated by all inhalational drugs and the ventilatory responses to hypoxemia are abolished at very low levels of all inhalational drugs (Connolly, 1991). Therefore, at the termination of an inhalational anesthetic, controlled or assisted ventilation should be continued to ensure washout of the inhalatioinal drug (Connolly, 1991).

Extubation is another critical time in the management of the known or suspected OSA patient because the potential for loss of airway control is again present (Meoli et al., 2003). Deep extubation is not an option for the apnea patient. Tracheal extubations on an individual with a difficult airway should be carried out only when the patient is conscious, communicative, and breathing spontaneously with and adequate tidal volume and oxygenation (Herder et al., 2004). The hazards include not only loss of airway control but also the risk of postobstructive pulmonary edema as the patient generates negative pressure

trying to breathe against a closed glottis or collapsed airway (Meoli et al., 2003). Adequate muscular tone of the upper airway should be present before the endotracheal tube is removed. Therefore, the patient must be sufficiently awake prior to extubation. The presence of purposeful movement, recovery of neuromuscular integrity demonstrated by neuromuscular blockade monitoring, sustained head lift for a minimum of five seconds and adequate voluntary tidal volume are helpful criteria in determining safety for extubation. Removal of the endotracheal tube should take place in the operating room, recovery room, or special care unit so that control of the airway, if lost, can be reestablished immediately. Immediate maximal head of bed elevation may reduce upper airway collapse, although this may not be sufficient in more severe OSA patients (Meoli et al., 2003). An appropriately sized oropharyngeal or nasopharyngeal airway should be immediately available. Application of a vasoconstricting nasal spray can improve the nasal caliber as well as reduce the risk of epistaxis during nasal airway placement (Meoli et al., 2003). A nasal airway placed prior to extubation may facilitate post-extubation nasal ventilation and CPAP application, especially in those with compromised nasal airway or difficult intubation.

Intraoperative narcotic use should be titrated carefully to achieve pain control without respiratory or upper airway compromise (Meoli et al., 2003). The use of local anesthetic blocks at the end of surgery may be very useful to minimize the need for systemic medications. However, local or topical anesthesia may not be appropriate in the upper airway since it has been shown in non-surgical patients to block airway mechanoreceptor that contribute to the arousal stimulus, an important defense mechanism in OSA patients (Berry, Kouchi, Bower & Light, 1995). Narcotic reversal agents should be available but used with extreme caution in these patients because the duration of action may be less than longer-

acting narcotic agents, and the patient may have a reduced sensorium and airway instability after the reversal has worn off (Meoli et al., 2003).

The peri-operative period for the children with OSA is very similar as with adults. Pre-oxygenation period is highly recommended with multiple instruments (orotracheal tubes, laryngoscope blades, LMA's and fiber optic equipment) available. The anesthesia care provider should use increased diligence when dealing with children who have OSA. This is warranted because of the decrease in respiratory reserves of children and increased morbidity and mortality because hypoxia develops much more rapidly in children as compared to adults.

Post-operative aspects of OSA

Most patients do not need continuous monitoring in the post-operative phase. Respiratory depression and repetitive apneas often occur directly after extubation in patients with OSA (Herder et al., 2004). The period of awakening from anesthesia after surgery can be problematic for sleep apnea patients (ASAA, 2000). As mentioned earlier, this depression is mainly caused by the administration of opioids before, during and after the surgery. Interestingly, it is implied that pain should be allowed to affect the surgical patient with OSA postoperatively. Pain would prevent the rebound of rapid eye movement sleep and diminish stage 3 and stage 4 sleep, which pre-disposes to the collapse of the upper airway and would cause a decline in the number of possible breathing depressions (Herder et al., 2004).

In the recovery room and the post-operative ward the OSA patient should be positioned in the lateral posture because of the particular tendency to upper airway obstruction when supine (Loadsmann & Hillman, 2001). The use of continuous positive airway pressure (CPAP) is highly recommended to reduce the number of hypoxic events that an OSA patient might experience. The potential problems associated with the use of

sedatives and opioids may be circumvented by the use of regional anesthesia. Therefore it is prudent for all anesthetists who deal with patients who have OSA to weigh the benefits versus the non-benefits of regional anesthesia as compared to general anesthesia.

When reviewing the post-operative complications of anesthesia and OSA, one must question the appropriateness of caring for patients with OSA in an Ambulatory Surgical Center (ASC) (Moos et al., 2005). The ASC environment differs from a hospital setting because patients are discharged to the home environment. The 24 hours postoperative are probably the most critical time (Meoli et al., 2003). Sleep apnea patients should be carefully monitored for periods of apnea and arrhythmias and should be kept in the recovery room for longer periods than usual (Chung & Crago, 1981). Patients known to have mild OSA are candidates for the ASC depending upon the procedure performed and the presence of comorbid disease (Meoli, 2003). Analgesic dosing must be carefully titrated to ensure that adequate pain relief is given without compromising upper airway muscle tone. If narcotics are found to be necessary in the post operative period, appropriate monitoring of oxygenation, ventilation, and cardiac rhythm should be provided as narcotic analgesics can precipitate or potentiate apnea that may result in a respiratory arrest (ASAA, 2000). Potential synergistic effects of medications should always be considered, especially with regards to central nervous system depression (Meoli et al., 2003). Residual anesthetics, analgesia, and airway edema may result in significant apnea in patients who may not have exhibited significant apnea in the preoperative phase (Moos et al., 2005). Sedative-hypnotics, anxiolytics, and other sedating medications should be used with caution, therefore patient monitoring is important to gauge medication effect (Meoli et al., 2003). Continuous pulse oximetry and heart rate monitoring with preset alarms should be used in the immediate postoperative period. Perioperative vigilance must continue into the postoperative period.

Nasal Continuous Positive Airway Pressure (CPAP) can provide vital airway support, even in OSA patients who have not been using it at home (Meoli et al., 2003).

Children once again are managed post-operatively in a manner very similar to adults. The main exception is patients that have life-threatening OSA can develop life threatening respiratory complications in the immediate post-operative period and these children should be observed intensively for at least twenty-four hours (Warwick & Mason, 1998). Some institutions have all patients with OSA of any severity who have received any opioids or other sedatives in the peri-operative period observed in the post anesthesia care unit (PACU) or intensive care unit (ICU) for at least 12 hours after the last dose (Daley et al., 1998).

The literature review for this project attempted to inform the reader about the pathopysiological, pre-operative, peri-operative and post-operative aspects of OSA. There are many articles beginning to surface concerning the importance that OSA may play in the surgical setting. Unfortunately, there is yet to be an established guideline for anesthesia providers to follow when it comes to determining an OSA patient from one who does not have OSA. Therefore it is the intended goal for the author of this project to try and establish a guideline that will make the process of determining an OSA patient a simpler task for the anesthesia provider.

Chapter Three

Introduction

With the research increasing in the study of obstructive sleep apnea (OSA), it is becoming more important for the health care provider in the operative phase to understand the importance that OSA may play in post-operative complications. Therefore it is important for the anesthesia provider to have a basic knowledge of the symptoms of OSA so as to be prepared on how to treat this type of patient postoperatively. The goal of this project is to educate the anesthesia provider on OSA and provide a guideline for anesthesia providers so as to aid in their education and abilities to treat a patient with OSA in the postoperative period.

Target Audience

The target audience in which this project is aimed is anesthesia providers in a rural northern mid-west hospital in a town of approximately 55,000. The extensive farming community and industries that surround the countryside of this rural town support the economy. There are higher educational opportunities for the citizens of this town with a University within the city limits and a smaller Community College across the river in Minnesota. There is a community hospital in this rural town of approximately 220 beds. The surgical services provided by this hospital consist of eleven operating rooms and multiple specialty areas (MRI, CT, etc.) serviced by the anesthesia staff. There are approximately twenty-seven anesthesia providers employed at the hospital. This includes both Certified Registered Nurse Anesthetists CRNA's) and Medical Doctor Anesthesiologists (MDA's). Recovery room personnel and nurses throughout the hospital who will be taking care of post surgical patients will also benefit from this project.

In-service

1. This project will be presented to the Nurse Anesthesia manager of the aforementioned rural hospital.
2. The Nurse Anesthesia manager and author of this project will go over the information contained in the project together and determine if there is sufficient and quality information where a guideline may be considered that anesthesia providers can use when assessing patients preoperatively for OSA.
3. This potential guideline will include the type of individual that is at a higher risk of suffering from OSA, symptoms that the OSA patient may suffer, questions that the anesthesia provider should ask the patient in order to determine possible OSA sufferers and the steps that anesthesia providers should be aware of when providing anesthesia to an OSA patient.
4. If it is determined that a guideline is to be made from the information contained in this project, the author and nursing supervisor will submit the information in draft form to the Nursing Administration office of this rural hospital in accordance to the hospitals own Patient Services Guideline.
5. Theses guidelines include; guidelines submitted in draft form, proper format, and a request for revision/update form should be completed and accompany the draft for individual drafts.
6. Once the Administration office has received this document, it will be typed and then the document/guidelines will be returned to the author and nurse manager for proof reading.

7. The final proofing includes; reviewing the rough draft and disperse the document among staff to be reviewed/revised. Make all changes/corrections in red.

8. Once the final proofing has been completed, the document/guidelines will be presented to the Procedure/Skill Validation Committee before finalization.

9. The Procedure/Skills Validation Committee will receive the document and review or disperse it to staff to be reviewed/revised per department manual. Once the document has been cleared by the Procedure/Skill Validation Committee, it will be returned to the Nursing Administration for finalization.

10. Once finalization is complete, one copy and a new manual index will be sent back to the department for filing in the Department/Procedure Manual.

Expected Results

The expected results that are hopefully achieved will be those where the anesthesia providers of this rural hospital will become more knowledgeable on how to treat an OSA patient in the perioperative period. With a set of newly researched guidelines from recent data about the subject matter, the possible guidelines that may be set forth should help to eliminate any questions or concerns regarding the special care that patients with OSA may require. This will hopefully attenuate any anxiety or concern for the anesthesia provider and hopefully allow for an enjoyable and productive environment for both the patient and anesthesia care provider.

Implications for Nursing

Nursing Practice and Education

There is a significant amount of research that is being conducted on sleep apnea at this time. Researchers are beginning to discover that sleep apnea is very common, almost as common as diabetes. It is important for anesthesia providers to know their patient before they begin to provide anesthesia. The information described in this paper will help to educate the anesthesia provider concerning the pathophysiology and symptoms that OSA sufferers may encounter. This information needs to be disseminated to other anesthesia providers so as to increase their knowledge base and awareness on OSA. The information in this paper may prove beneficial to nurse anesthesia students if provided during the didactic portion of the program.

Nursing Research

As mentioned previously, there has been significant research toward the study of sleep apnea in recent years. Research needs to continue in this area because the number of individuals diagnosed with obstructive sleep apnea continues to rise yearly. The author believes that their needs to be more work done in sleep lab environments. These labs can diagnose and help in the treatment modalities with an individual with OSA. With this type of information on a patient's chart, the guessing game of who may or may not have obstructive sleep apnea can be alleviated. The author also believes that knowledge about obstructive sleep apnea needs to be disseminated to the general public so many individuals who suffer form the many symptoms that may accompany OSA will be able to go to their health care providers for a definitive diagnosis, thereby making any future operative procedures less stressful for the anesthesia provider because the diagnoses of OSA will already be determined.

Nursing Policy

Individuals with OSA will become a special population for anesthesia providers. Therefore it is imperative that the anesthesia provider be equipped with the special knowledge of how to handle this type of patient. Along with guidelines to help the anesthesia provider gather information, a sleep history should become a mandatory tool to also help give important information to the anesthesia provider about the unprotected airway during anesthesia and recovery. This invaluable information obtained may help the anesthesia provider to deliver anesthesia in an optimal way in which patient and provider satisfaction is at a maximum.

Summary

This paper focused on educating nurse anesthetists about patients with Obstructive Sleep Apnea (OSA). It specifically looked at the pathophysiology, pre-operative, intra-operative and post-operative aspects of individuals with OSA and how the nurse anesthetist should approach their anesthesia delivery with these types of patients. There is a lot of attention right now in the literature concerning anesthesia and the increased risk that it imposes on individuals with OSA. Much of the research concerning patients with OSA and anesthesia is in its infantile stage. The author of this article originally planned to form a preoperative guideline that could be used by anesthesia providers to help with their pre-operative assessment of sleep apnea individuals. Unfortunately, there was not sufficient proven data or information that would allow for some type of guideline/questionnaire to be formulated. Therefore this project turned into a literature review on OSA for educational purposes. Hopefully if future research on this topic is to be done, more scientifically proven data will be available for the researcher and a questionnaire could be developed to help the nurse anesthetist with their pre-operative screening and anesthetic plan for OSA patients.

Malcolm Knowles adult learning theory was used as the theoretical framework for this paper. The author of this paper used his theory because it deals with how adults learn. As mentioned previously, his theory attempts to explain what and how the adult learns through five assumptions: Self-concept, Experience, Readiness to learn, Orientation to learning and Motivation to learn. Since this paper/project is designed to educate adult learners at different levels of experience, training and abilities as nurse anesthetists the assumptions of experience, readiness to learn and motivation to learn have pertained to this paper. As a nurse anesthetist becomes more comfortable delivering anesthesia through their personal experiences, their readiness to learn and their motivation to learn possible new anesthetic techniques and approaches to anesthesia care will begin/continue. These new techniques and approaches can be attained through in-service's, conferences and journals to name a few. Since this paper is designed to deliver information to adult nurse anesthetist, the author feels that Knowles theoretical framework was the right framework for this project.

References

American Sleep Apnea Association (1996). Sleep Apnea And Same-Day Surgery. www.sleepapnea.org/sameday.html.

American Sleep Apnea Association (2000). Information about Sleep Apnea. www.sleepapnea.org/geninfo.html.

Barash, P.G., Cullen, B.F., & Stoelting, R.K. (2001). Clinical Anesthesia (4th ed.). Philadelphia: Lippincott Williams & Wilkins.

Benumof, j.l., Dagg, R., & Benumof, R. (1997). Critical Hemoglobin Desaturation Will Occur Before Return to an Unparalyzed State Following 1mg/kg Intravenous Succinylcholine. *Anesthesiology,* 84, 979-982.

Berrry, R.B., Kouchi, K.G., Bower, J.L., & Light, R.W. (1995). Effect of Upper Airway Anesthesia on Obstuctive Sleep Apnea. *American Journal of Respiratory Critical Care Medicine,* 151, 1857-1861.

Biddle, C. (1999). Sleep Apnea and other Disordered-Breathing Syndromes. *Current Reviews for Nurse Anesthetists,* 22, 3-7.

Boushra, N.N. (1996). Anesthetic Management of Obstructive Sleep Apnea Patients. *Canadian Journal of Anesthesiology,* 43, 599-616.

Chung, F., & Crago, R.R. (1982). Sleep Apnea Syndrome and Anesthesia. *Canadian Anaesthetists Society Journal,* 29, 439-445.

Connoly, L.A., (1991). Anesthetic Management of Obstuctive Sleep Apnea Patients.

Journal of Clinical Anesthesia, 3, 461-469.

Daley, D.M., Norman, P.H., & Coveler, L.A. (1998). Additional Safety Issues Cited for Sleep Apnea Cases. *Journal of Clinical Monitoring and Computing,* 14, 213-214

Gupta, R.M., Parvizi, J., Hanssen, A.D., & Gay, P.C. (2001). Postoperative Complications in Patients with Obstructive Sleep Apnea Syndrome Undergoing Hip or Knee Replacement: A Case-Control Study. *Mayo Clin Proc,* 76, 897-905.

Herder, C.D., Schmeck, J., Appleboom, J.K., & de Vries, D.V. (2004). Risks of General Anesthesia in People with Obstructive Sleep Apnea. *British Medical Journal,* 329, 955-959.

Hargett, D. (2004). *Anesthesia and the Apnea Patient.* Retrieved November 11, 2004, from University of North Dakota, Harley French Medical Library Web Site: http://harley.med.und.nodak.edu.

Hillman, D.R., Platt, P.R., & Eastwood, P.R. (2003). The upper airway during anesthesia. *British Journal of Anesthesia,* 91, 31-39.

Loadsman, J.A., & Hillman, D.R. (2001). Anesthesia and Sleep Apnea. *British Journal of Anesthesia,* 2, 254-266.

Lucille Packard Children's Hospital (2001-2004). www.lpch.org/DiseaseHealth Info/HealthLibrary/respire/apnea.html.

Meoli, A., Rosen, C., Kristo, D., Kohrman, M., Gooneratne, N., & Aguillard, N. (2003).

Upper Airway Management of the Adult Patient with Obstructive Sleep Apnea in the Perioperative Period- Avoiding Complications. *Sleep*, 26, 1060-1065.

Moos, D.D., Prasch, M., Cantral, D.E., Huls, B., & Cuddeford, J.D. (2005). Are Patients With Obstructive Sleep Apnea Syndrome Appropriate Candidates For The Ambulatory Surgical Center? *AANA Journal,* 73, 197-205.

Morgan, G.E., Jr. Mikhail, M,S., & Murray, M.J. (2002). Clinical Anesthesiology (3rd ed.). McGraw-Hill.

Schroeder, B.M. (2002). *Obstructive Sleep Apnea Syndrome in Children.* Retrieved March 14, 2005, fromUniversity of North Dakota, Harley French Medical Library Web site: http://harley.med.und.nodak.edu.

Sephton, S. (2000). *OSA Can Complicate Anesthesia Delivery.* American Sleep Apnea Association, http://www.sleepapnea.org/osa-article.html.

Smith, M.K. (1996; 1999) 'Andragogy', *the encyclopedia of informal education,* http://www.infed.org/lifelonglearning/b-andra.htm.

Stalford, C.B. (2004). The Starling resistor: A model for explaining and treating obstructive sleep apnea. *AANA Journal,* 72, 133-138.

Warwick, J.P., & Mason, D.G. (1998). *Obstructive sleep apnea syndrome in children.* Retrieved March 12, 2005, from University of North Dakota, Harley French Medical Library Web site: http://harley.med.und.nodak.edu

Table 1

Symptoms associated with sleep apnea

Adults	Children
• Heavy Snoring	Snoring
• Excessive daytime sleepiness	Restless sleeping
• Witnessed apneas	Somnolence
• Sudden awakenings with 'choking	Aggression/behavioral problems
• Accidents related to sleepiness	Hyperactivity
• Delirium	Odd sleeping postures
• Poor memory/concentration	Frequent coughs/colds
• Gastro-esophageal reflux	
• Mood/personality changes	
• Nocturnal sweating	
• Restlessness during sleep	
• Nocturia	
• Enuresis (uncommon)	
• Dry mouth	
• Nocturnal or morning headache	
• Impotence	
• Nocturnal epilepsy	

Appendix

Educational awareness outline on obstructive sleep apnea presented to Nurse Anesthetists

1. History, definition of sleep apnea and other definitions.
2. The many deleterious sequela that may accompany an individual with sleep apnea.
3. Individuals that may experience sleep apnea.
4. Pathophysiology of OSA
    a. Anatomical
    b. Systemic effects
5. Pre-operative aspects of OSA
    a. Anesthesia providers role
6. Peri-operative aspects
    a. Drugs to be aware of with OSA patients pre-operatively
    b. Equipment needed for difficult airway
    c. Guidelines for extubation for patient with OSA
7. Post-operative aspects
8. Appropriateness of caring for patients with OSA in an Ambulatory Surgical Center (ASC)
9. Children and sleep apnea

Self –Assessment of Knowledge

Anesthesia Care for the Obstructive Sleep Apnea Patient

1. Obstructive sleep apnea has only recently been diagnosed (within the last fifty years) to afflict individuals **T F Don't know**

2. Individuals with obstructive sleep apnea experience just a few (less than ten) interruptions in sleep throughout the night. **T F Don't know**

3. Only adults experience sleep apnea. **T F Don't know**

4. Obese children and children with special needs make up the majority of obstructive sleep apneas afflicting children. **T F Don't know**

5. There are a variety of potential harmful effects to the body of an individual who suffers from sleep apnea. **T F Don't know**

6. Nurse Anesthetists do not play a key role in early recognition of undiagnosed obstructive sleep apnea individuals. **T F Don't know**

7. Patients with obstructive sleep apnea are more sensitive than a non-sleep apnea patient to sedatives. **T F Don't know**

8. Pain is thought to be a benefit when caring for the patient with obstructive sleep apnea. **T F Don't know**

9. It is best to provide a general anesthetic to all patients with obstructive sleep apnea. **T F Don't know**

10. There are no special considerations for individuals who suffer from obstructive sleep apnea when dealing with Ambulatory Surgical Centers (ASC). **T F Don't know**