Obstructive Sleep Apnea May Block the Path to a Positive Postoperative Outcome

Obstructive sleep apnea (OSA) is a common sleep disorder characterized by recurrent episodes of complete and partial airway collapse during sleep, resulting in apnea or hypoapnea. Apnea is defined as a complete cessation of breathing during sleep that lasts more than 10 seconds. Hypoapnea is defined as a complete cessation of breathing during sleep that lasts more than 10 seconds. The adverse effects of OSA include oxyhemoglobin desaturation, fluctuations in blood pressure and heart rate, increased sympathetic activity, cortical arousal, and sleep fragmentation. OSA affects an estimated 2 to 4% of the U.S. adult population. A prospective sleep cohort study conducted by the Medical College of Wisconsin suggests approximately 4% of women and 9% of men in the United States (ages 40 to 65 years) have moderate OSA.

Problem
Approximately 80 to 90% of OSA patients are undiagnosed. Some reasons may include practitioners’ inability to recognize sleep-related symptoms and lack of time and resources to perform the standard test, a polysomnogram, to diagnose OSA. Identifying these patients during the perioperative period may help reduce complications. The inherent problems of airway management during administration of general anesthesia and the large patient population with undiagnosed OSA increases the risk of developing respiratory and cardiopulmonary complications postoperatively, with reintubation and cardiac events identified as the most serious complications. Anesthesia providers may not be aware of the comorbidities and risk factors associated with OSA. Practitioners need to consider risks factors for OSA and the perioperative management of potential problems in each patient. Although there is no consensus regarding optimal perioperative management of patients with OSA, there are techniques that may minimize complications. Therefore, identification of patients at risk, appropriate preoperative assessment, intraoperative management, and postoperative care are critical elements in optimizing patient care and safety.

PA-PSRS has received more than 250 reports since June 2004 in which OSA is specified as a contributing factor. Approximately 20% of reports were classified as Serious Events associated with patient harm, including three deaths. The reports included medical and surgical patients in both ambulatory and acute care facilities. Sleep apnea was present in the medical history in the majority of reports. Examples of events reported as incidents include the following: extended length of stay in the postanesthesia care unit (PACU), postoperative reintubation, transfer to a higher level of care, postoperative transfer from ambulatory care centers to acute care for further treatment, falls without serious injury, need for reversal agents following narcotic administration, and increased hospital length of stay. These findings reflect similar complications cited in the literature and noted above. Examples reported to PA-PSRS include the following:

Patient was status post shoulder arthroscopy with rotator cuff repair. Patient was found to have undiagnosed sleep apnea. Oxygen saturation was unable to be maintained above 90%, and the patient was snoring. Anesthesia and surgeon determined the need for transfer and monitoring and respiratory care at hospital overnight.

Patient had cardiorespiratory arrest the night of surgery for gastric bypass. The patient was evaluated, and it was determined patient had severe sleep apnea. The patient was transferred to the [intensive care unit (ICU)].

A middle-aged patient was originally admitted with a septic joint post total knee replacement. He was obese and had a past medical history of diabetes, hypertension, obstructive sleep apnea, and hypercholesterolemia. He had been having respiratory problems with one failed attempt at intubation in OR to...
Obstructive Sleep Apnea May Block the Path to a Positive Postoperative Outcome (Continued)

drain knee wound. The patient was admitted to a monitored unit. He had a respiratory arrest and was successfully intubated and transferred to the ICU. During the ICU stay, on the evening shift, he extubated himself while staff rotated the patient on a specialty bed. He was unable to be reintubated. An emergent tracheostomy was done, but the resuscitation was unsuccessful.

This article presents the pathophysiology, etiology, risk factors, signs and symptoms, diagnosis, and treatment modalities for OSA. Additionally, strategies are discussed to improve the perioperative care of patients with suspected OSA to reduce the risk of adverse outcomes. These strategies can be applied to both inpatients and outpatients receiving sedation, analgesia, or anesthesia for diagnostic or therapeutic procedures and/or surgery.

Pathophysiology

OSA is caused by repetitive upper airway obstruction during sleep as a result of narrowing of the respiratory passages. In obese patients, there is peripharyngeal infiltration of fat and/or increased size of the soft palate and tongue. Some patients have airway obstruction because of a receding jaw that does not allow sufficient room for the tongue. These anatomical abnormalities decrease the cross-sectional area of the upper airway. Decreased airway muscle tone during sleep and the pull of gravity in the supine position further decrease airway size and impede air flow during respiration. Initially, the obstruction is partial, but as tissues collapse and the patient rolls over onto his or her back during sleep, the airway may become completely obstructed. These obstructions lead to partial arousals from sleep as the patient struggles to breathe. These arousals often go unrecognized by the individual and may occur hundreds of times throughout the night. The muscle tone of the tongue and airway tissue increases with each arousal, but soon after the patient falls back to sleep, these muscles relax and cause partial or complete airway obstruction. The cycle continues throughout sleep.8

Sites of Airway Obstruction in Sleep Apnea

Airway obstruction may occur in the nasopharynx, oropharynx, and hypopharynx. There is controversy regarding the contributing factors of nasal polyps and septal deviation in airway obstruction. The most common site for obstruction is the oropharynx. Redundant peripharyngeal tissue reduces the size of the posterior airway and leads to obstruction. An elongated soft palate and enlarged uvula may further compromise the airway. The base of the tongue is a common site of hypopharyngeal obstruction, as seen in a patient with a small receding jaw. Occasionally, obstruction may be caused by an enlarged tongue, with the base of the tongue impinging on the airway just above the glottis.8 Additionally, OSA may be caused by less common medical problems, such as hypothyroidism, acromegaly, renal failure, post-polio syndrome, and restrictive lung disease from scoliosis.8

Risk Factors

Obesity is the most common risk factor associated with OSA.7 Family history of OSA also places an individual at greater risk.4 The prevalence of OSA increases with age, with a higher incidence in persons 65 years old and older.1

Craniofacial and upper-airway structures, such as the following, may impact the occurrence of OSA: a short, thick neck circumference (i.e., greater than 17 inches for men and greater than 16 inches for women); a large tongue; a small or receding chin; and an enlarged or elongated palate.5,7,9

OSA Characteristics

The patient with OSA may present with a variety of nighttime and daytime symptoms, including the following:

- **Nighttime symptoms:**
  - Loud snoring
  - Frequent awakening
  - Gasping and choking
  - Breathing pauses (apneas)

- **Daytime symptoms:**
  - Sleepiness
  - Fatigue, irritability
  - Deficits in attention and memory

Diagnosis

The “gold standard” diagnostic test is an attended, all-night sleep study or polysomnogram.3-5,8 During polysomnography, several physiologic variables are recorded while the patient sleeps, including brain electrical activity, eye movements, chin and leg activity, airflow, respiratory effort (i.e., chest and abdominal movement), oxygen saturation, and cardiac rhythm.5,8,10 The test should be performed for at least six hours to assure valid results.10

The U.S. Food and Drug Administration has approved a few devices for home diagnosis of OSA. Several home testing devices are available, and the instrumentation ranges from simple nocturnal oximetry to multichannel systems that monitor many of the same parameters as polysomnography. Home
Obstructive Sleep Apnea May Block the Path to a Positive Postoperative Outcome (Continued)

studies are less expensive and more convenient for patients. However, the role of home evaluation devices remains a matter of debate. A comprehensive review conducted jointly by the American Academy of Sleep Medicine (AASM), American College of Chest Physicians, and American Thoracic Society concluded there was insufficient evidence to support the use of home devices to confirm or rule out OSA.

Treatment of OSA
Treatment includes medical and surgical approaches. There is currently no successful pharmacological treatment for OSA. Continuous positive airway pressure (CPAP) is the preferred treatment for most patients with OSA. AASM recommends CPAP treatment based primarily on the respiratory disturbance index (RDI), which is defined as the total number of apneas and hypopneas per hour of sleep. Some laboratories use an RDI of 20 episodes per hour as the threshold for initiating CPAP treatment. Treatment may also be considered in patients with a relatively low RDI who have significant symptoms and other comorbidities. CPAP is most successful in patients with severe disease because they have prompt reversal of their symptoms.

Risk Reduction Strategies
Preoperative Evaluation
In many facilities, the preoperative screening process focuses on the diagnosis of heart and lung disease with little attention to breathing disorders like OSA. A critical element in reducing the risk of surgical complications for OSA patients is the initial preoperative screening evaluation.

The preoperative evaluation includes a review of the medical history and a physical examination. The anesthesia provider’s review of the patient’s medical record focuses on any previous airway difficulty with anesthetics, identifying comorbidities associated with OSA such as hypertension, right heart failure, pulmonary hypertension, diabetes, and arrhythmias. In addition, consider the results of any sleep studies, if available. The physical examination includes an evaluation of the airway, nasopharyngeal characteristics, neck circumference, tonsil size, and tongue volume.

The following clinical signs and symptoms may be indicative of OSA: Body mass index greater than 35 kg/m², Neck circumference in excess of 17 inches for men or 16 inches for women, Craniofacial abnormalities affecting the airway, Anatomical nasal obstruction, Tonsils nearly touching or touching in the midline, Inability to visualize the soft palate.

During the patient and/or family interview, use of a screening tool aimed at identifying patients with undiagnosed OSA would seem reasonable, although no such tool has been validated for use in the preoperative setting. (A sample screening tool is available online and can be adapted for use during preoperative evaluation at your facility; see the sidebar on page 6 for more information.) In the absence of a sleep study, a presumptive diagnosis of OSA may be made based on past medical history, physical assessment, and clinical symptoms identified during the interview process or by a screening tool. If OSA is suspected, the anesthesiologist and the surgeon should jointly decide whether to treat the patient as though he or she has OSA.

To assure optimal outcomes, anesthesia providers may wish to consider the following: severity of OSA disease, invasiveness of the procedure, and the requirements for postoperative analgesics. Another consideration for OSA patients is whether surgery is performed on an in- or outpatient basis. Determining factors include facial anatomical abnormalities, comorbidities, type of surgery, type of anesthesia, need for postoperative opioids, patient age, outpatient facility capabilities, and discharge planning.

Patients with documented or suspected OSA may be candidates for outpatient surgery, as identified by the American Society of Anesthesiologists (ASA) Task Force on Perioperative Management of Obstructive Sleep Apnea, if they have OSA that does not require CPAP, will undergo a minimally invasive procedure, will only be administered a local anesthetic, and have a limited need for narcotic analgesia.
Obstructive Sleep Apnea May Block the Path to Positive Postoperative Outcome (Continued)

Patients may be candidates for inpatient care, as identified by the ASA task force, if they
- have OSA requiring use of CPAP at home,
- will undergo an abdominal or other major surgery,
- will be administered general anesthesia, or
- are anticipated to need a significant amount of pain medication.

The patient and his/her family should be informed of the potential complications associated with suspected OSA and involved in decisions regarding when and where to perform surgery. A preoperative screening tool may help avoid cancellations, as demonstrated in the following report submitted to PA-PSRS.

The patient was admitted to preop [holding area]. Oxygen saturation at rest was 92% and 89% with activity. Patient had a probable history of sleep apnea. The case was cancelled. Recommendation was issued to reschedule patient as an inpatient and follow-up for 24 hours post surgery. The patient was discharged to home.

Intraoperative Care

Once the decision to proceed with the procedure or surgery is determined, the anesthesia care provider designs an intraoperative plan of care to reduce the risk of complications for patients with known or suspected OSA. Intraoperative concerns include airway management, choice of anesthetic, patient monitoring, and use of sedatives and opioids.

Airway management considerations include the use of CPAP or noninvasive positive pressure ventilation (NIPPV) in the perioperative period to lessen upper airway edema. Patients with OSA are at increased risk for difficult mask ventilation and difficult tracheal intubation. Techniques for optimal intubation include the following:
- Placing patient in the sniffing position (i.e., head extension with cervical flexion introduced)
- Inserting an oropharyngeal airway to hold the base of the tongue out of the airway for mask ventilation
- Using a fiberoptic bronchoscope and other airway rescue devices

OSA patients are especially susceptible to the respiratory depressant and airway effects of sedatives, opioids, and inhaled anesthetics. Avoiding the use of sedative and opioid medications in the intra- and postoperative period may reduce complications. In the event sedatives or opioids are administered, reduce the dose and titrate the drug slowly. The following report demonstrates how sedatives negatively affected a patient's respiratory status.

The patient had large tonsils in addition to sleep apnea. Versed dosage was ordered by the anesthesiologist. It was noted that child was large for age. Correct dosage was given. After 45 minutes, the patient experienced obstructive breathing. O₂ saturation was 60. O₂ was given per nasal cannula, an IV was started, and the patient was given reversal agent (Romazicon® times two doses). The operation proceeded.

Consider the type of anesthesia in relation to the surgical procedure. Anesthesiologists may consider alternatives to general anesthesia with OSA patients; for example, administration of a local anesthetic or peripheral nerve blocks for superficial procedures and administration of spinal or epidural anesthesia for peripheral and intra-abdominal surgery.

Intraoperative patient monitoring should focus on airway management and include the following:
- Respiratory rate
- Oxygen saturation
- Capnography (i.e., measurement of carbon dioxide [CO₂])

Postoperative Care

The most important interventions to increase patient safety and reduce complications occur during the postoperative period. The most critical time is the first 24 hours. However, deaths from complications have occurred beyond 24 hours, and patients may be at risk for 3 to 5 days post procedure. Postoperative risk reduction strategies begin in the PACU; for example, monitoring patients for obstructed airways so that early detection leads to prompt treatment. Other risk reduction strategies include the following:
- Positioning the patient in a lateral or semi upright position—not supine
Obstructive Sleep Apnea May Block the Path to a Positive Postoperative Outcome (Continued)

- Extubating the patient when he or she is fully awake\(^1,21\)
- Attaching CPAP or NIPPV after extubation, especially for a patient who has undergone major abdominal surgery\(^7\)
- Observing the patient for periods of apnea while he or she is sleeping\(^7\)
- Monitoring the patient’s pulse oximetry every 15 minutes for at least 3 times on room air\(^7\)
- Obtaining an arterial blood gas (ABG) for periods of apnea and or pulse oximetry less than 90%\(^7,14\)

The importance of close observation in the PACU is demonstrated in the following PA-PSRS report:

*Patient did not report significant history of sleep apnea prior to surgery, although retrospective review indicated reference [to sleep apnea] in the notes of a previous admission. Review of body systems through history and physical, nursing admission assessment, and preoperative anesthesia assessment did not identify any history of respiratory problems. After 45 minutes in PACU, the anesthesiologist assessed the patient and determined the patient was stable. The anesthesiologist left the facility. Later, the PACU nurse assessed there was a change in condition including reduced level of consciousness and shallow respirations. Although on-call resident was not available, the physician on site responded. Anesthesiologist was notified of change in condition and he returned to hospital. The patient required a jaw lift, ventilation with Ambu bag, and administration of Narcan®.*

PACU. The patient’s clinical course in PACU can guide practitioners in determining the optimal care area for the patient’s recovery. Patients with apneic periods and pulse oximetry less than 90% on room air with associated arterial blood gases indicating CO\(_2\) retention should remain in PACU for further monitoring or be transferred to the intensive ICU for closer monitoring.\(^14\) Other factors to consider in determining the appropriate care area include past medical history and the amount and type of analgesia the patient may require.\(^7\) The availability of emergency airway equipment dictates the standard of care regardless of the care area to which the patient is admitted.\(^17\) The safe transportation of the postoperative OSA patient includes consideration of proper patient position (see above), administration of oxygen, and continuous monitoring of pulse oximetry. The handoff communication includes patient history; surgical procedure performed; and summary of PACU care, including airway management and medications administered during the intra- and postoperative periods.\(^5,7\)

**After PACU and nursing care.** This is a critical period because of the lingering effects of general anesthesia and sedative/opioid analgesics on the upper airway.\(^18,20\) Complications may include hypertension, cardiac dysrhythmias, oxygen desaturation, airway obstruction, and reintubation.\(^15\) Consider the use of standardized order sets aimed at pain control, airway management, and early detection and prevention, such as the following:

- Properly positioning the patient (i.e., lateral, semi-upright)\(^7\)
- If the patient is on CPAP or NIPPV at home, continuing until discharge\(^7\)
- Administering supplemental oxygen to maintain pulse oximetry above 90%\(^7\)
- Maintaining continuous pulse oximetry with alarm system at central nurses station\(^7\)
- Frequent monitoring of vital signs, especially respiratory rate and pattern\(^7,17,22\)
- If periods of apnea or desaturation are observed, notifying the attending and obtaining arterial blood gas\(^7\)
- Providing regional anesthesia for pain control\(^7\)
- Avoiding benzodiazepines due to effects minor tranquilizers may have on respirations\(^7,15\)
- Treating with nonsteriodals whenever possible\(^7,15\)
- Preferably, administering opioids via epidural or regional catheter instead of intravenous or intramuscular routes\(^7\)
- Monitoring patients who have been administered narcotics\(^7,15\)
Obstructive Sleep Apnea May Block the Path to a Positive Postoperative Outcome (Continued)

The following reports demonstrate the importance of monitoring patients with OSA that have been administered narcotics and sedatives as well as considering closer monitoring of these patients in ICU setting.

Patient developed respiratory failure felt to be secondary to narcotics (OxyContin) and underlying lung disease and/or obstructive sleep apnea. The patient required bipap for respiratory support. The patient was transferred to the medical intensive care unit for observation.

Patient was admitted for umbilical hernia repair. Medical clearance was obtained from primary care practitioner, but referral was made for sleep apnea evaluation. Patient had uneventful procedure, and following short stay in PACU, went to care area on O2 via nasal cannula at 4 p.m. Patient was morbidly obese; consequently, pulse oximetry was ordered. Patient on patient-controlled analgesia pump 1 mg with 8 minute lockout with good pain control. Saturations were 91 to 94%. Short periods of O2 desaturation were noted late evening. Respiratory therapy consulted and O2 was increased to 60% face tent. The patient frequently removed the tent. Supplemental O2 was added in the next hour. Physician was not notified of this change. Nurse received new admission two hours later at which time the patient’s pulse oximetry alarm sounded. Patient was found unresponsive. Patient had removed all O2 and no pulse or respiration was observed. The [code] blue team followed the advanced cardiac life support protocol. Patient was difficult to intubate, then vomited and aspirated. The patient went into PEA and cardiac standstill. Code was called. Postmortem is pending.

In summary, patients with known or suspected OSA are at increased risk for anesthetic and sedative complications, including life-threatening cardiorespiratory complications. A standardized approach to the management of these patients may reduce harm. The first step involves incorporating a screening tool into the preoperative period to identify patients with OSA. Finally, implement strategies to provide safe, quality care in the intra- and postoperative periods.

Notes
Obstructive Sleep Apnea May Block the Path to a Positive Postoperative Outcome (Continued)


Self-Assessment Questions

1. Which one of the following indicates clinical symptoms of obstructive sleep apnea (OSA)?
   A. Muscle cramps and twitching
   B. Decreased libido
   C. Frequent awakening associated with gasping and choking
   D. Diaphoresis, frequent urination

2. To identify OSA during preoperative evaluations of surgical patients, it is important for anesthesia providers to obtain patient information including all EXCEPT which one of the following?
   A. Previous difficulties with anesthesia
   B. Large neck circumference, body mass index greater than 35kg/m², and nasopharyngeal characteristics
   C. Loud, excessive snoring, daytime fatigue, and irritability
   D. Swallow test and electroencephalogram results

3. Intraoperative treatment for the patient with suspected OSA may include which one of the following:
   A. Insertion of an oropharyngeal airway, use of fiber optic intubation
   B. Use of sedatives in the preoperative period
   C. Bolus administration of large doses of sedatives and opioids
   D. Use of general anesthesia for all procedures

4. Patients with OSA require more time in the postanesthesia care unit to assess and maintain airway stability.
   A. True
   B. False

5. Which one of the following risk reduction strategies applies to the postoperative OSA patient?
   A. Exubating early
   B. Positioning the patient in a lateral or semi upright position
   C. Obtaining blood gas
   D. Monitoring vital signs and pulse oximetry every four hours

The Patient Safety Authority works with the Pennsylvania Medical Society to offer AMA PRA Category 1 Credits™ for selected portions of the PA-PSRS Patient Safety Advisory through the online publication Studies in Patient Safety: Online CME Cases. Go to http://www.pamedsoc.org/studies to find out more about patient safety CME opportunities.
The Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error ("Mcare") Act. Consistent with Act 13, ECRI Institute, as contractor for the PA-PSRS program, is issuing this publication to advise medical facilities of immediate changes that can be instituted to reduce Serious Events and Incidents. For more information about the PA-PSRS program or the Patient Safety Authority, see the Authority’s Web site at www.psa.state.pa.us.

ECRI Institute, a nonprofit organization, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for nearly 40 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research. More than 5,000 healthcare organizations worldwide rely on ECRI Institute’s expertise in patient safety improvement, risk and quality management, and healthcare processes, devices, procedures and drug technology.

The Institute for Safe Medication Practices (ISMP) is an independent, nonprofit organization dedicated solely to medication error prevention and safe medication use. ISMP provides recommendations for the safe use of medications to the healthcare community including healthcare professionals, government agencies, accrediting organizations, and consumers. ISMP’s efforts are built on a non-punitive approach and systems-based solutions.