

Perioperative Obstructive Sleep Apnea: Strategies to Reduce Perioperative Risk

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Prevalence of OSA in Surgical Populations

- Worldwide, 234 million major surgical procedures are undertaken annually.
- General surgical population:
 - 23-38% have moderate-severe OSA
 - 60-90% of patients are undiagnosed before evaluation
- Obese patients presenting for bariatric surgery: > 70% have some form of OSA
- Further complicating matters is a high prevalence of associated conditions such as obesity hypoventilation syndrome, and COPD

Finkel KJ. Sleep Med 2009; 10:753.
Singh M. Br J Anesth 2013; 110:629.

Educational Goals

- Discuss potential complications of OSA in the perioperative setting
- Review current practice recommendations
 - Society of Anesthesia and Sleep Medicine
 - American Society of Anesthesiologists

Before We Talk About OSA: Perioperative Pulmonary Complications

- Any postoperative pulmonary complication affecting the respiratory system after anesthesia and surgery:
 - Heterogeneous definition
 - Composite outcome measure

Perioperative Pulmonary Complications

- Respiratory infection
- Respiratory failure
- Pleural effusion
- Atelectasis
- Pneumothorax
- Bronchospasm
- Acute respiratory distress syndrome
- Pulmonary embolism
- +/- Postoperative hypoxia

Intraoperative Pulmonary Changes

- Adverse respiratory effects of general anesthesia occur begin as soon as the patient loses consciousness:
 - Central respiratory drive is depressed: central apnea ensues
 - Ventilatory responses to hypercapnia and hypoxia are blunted.

Intraoperative Pulmonary Changes

- Respiratory muscle function changes:
 - Airway obstruction occurs
 - Increased curvature of the thoracic spine
 - Cephalad movement of the diaphragm
 - Reduced cross-sectional area of the thorax
- FRC is reduced
- VQ alterations with areas of both high and low ratios resulting in impaired CO₂ elimination and impaired oxygenation

Postoperative Pulmonary Changes

- Hypoxia with desaturation:
 - Airway obstruction
 - Central respiratory depression d/t continued sedation
- Impaired genioglossus mm activity:
 - Residual effects of NMBD
 - Impaired coordination of the pharyngeal and upper esophageal mm: *aspiration risk*

Postoperative Pulmonary Changes

- Impairment of ventilatory response to hypercapnia and hypoxia
- Reduced FRC and impaired oxygenation typically returns to baseline within several hours after *minor* surgery, *but...*
- Following major surgery hypoxia is present in 90% of patients at 1 hour, 50% at 24 hours
 - Hypoxia worse w/ morbid obesity

Perioperative Pulmonary Changes: Beyond the PACU

- Restoration of AaDO₂ to normal may take several days:
 - After upper abdominal surgery the FRC is at its lowest at POD2
- In one study 53% of non-thoracic surgical patients had atelectasis on POD3
 - Effort-dependent PFTs reduced, especially with pain

Perioperative Pulmonary Changes Beyond the PACU

- Ventilatory responses to hypercapnia and hypoxia may take several weeks to recover beyond wound healing, med use, postoperative pain.
- The combination of reduced FRC, residual atelectasis, ineffective cough, abnormal respiratory control leads to perioperative complications.

The Concern

- In 2006, The Joint Commission sounds the alarm, warning of imminent changes to rules surrounding evaluation and management of patients with OSA were not made.
- As of July 2015, the Joint Commission had received 61 sentinel perioperative event reports in which a patient was diagnosed with or suspected of having OSA.

The Joint Commission cited the following concerns:

- Lack of training for health care professionals to screen for and recognize OSA;
- Failure to assess patients for OSA;
- Lack of guidelines for the care and treatment of individuals at risk for and those diagnosed with OSA;
- Failure to implement appropriate monitoring of patients with risk factors associated with OSA;
- Lack of communication among health care providers regarding patients with OSA or potential risk factors associated with OSA;
- Lack of postoperative evaluation and treatment for OSA.

Why is it important not to miss OSA patients?

- Meta analysis of 13 studies observational studies in non-cardiac surgery
- 3942 patients / Mean age 57.4 years / 59.6% male
 - Postoperative cardiac events (OR, 2.1; 95% CI, 1.2 to 3.5)
 - Acute respiratory failure (OR, 2.4; 95% CI, 1.3 to 4.4)
 - Postoperative desaturation (OR, 2.3; 95% CI, 1.2 to 4.3)
 - Intensive care unit transfer (OR, 2.8; 95% CI, 1.5 to 5.4)
 - Tendency to increased reintubation (OR, 2.1; 95% CI, 0.9 to 4.4).

Additional Postoperative Complications of OSA

- Postoperative pain and prolonged use of pain medications
- Delirium
- Poor wound healing
- Hospital readmission:
 - Pain control
 - Constipation
 - Atrial fibrillation
 - Wound infection

Sen CH. Wound Repair Regen 2009; 17:1.

Feng TR. J Clin Anesth 2019; 56:17.

Johnson QL. Mo Med 2015; 112:435.

Flink BJ. Anesthesiology 2012; 116:788.

Recent Legal Literature Review

- The most common complications were respiratory arrest in an unmonitored setting and difficulty in airway management.
- Immediate adverse outcomes included
 - death (45.6%)
 - anoxic brain injury (45.6%)
 - upper airway complications (8%)
- Use of opioids (38%) and general anesthetics (58%) cases
- Verdicts favored the plaintiffs in 58% of cases
- The average financial penalty was \$2.5 million

The Societies Respond

- American Society of Anesthesiologists
 - Anesthesiology 2014;120:268-86.
- Society of Anesthesia and Sleep Medicine
 - Anesth Analg 2016;123:452-73.

Types of OSA Patients Presenting for Surgery:

- Patients with known OSA who are adherent to CPAP
- Patients with known OSA who are nonadherent to CPAP *or* who are CPAP naïve.
- Suspected but undiagnosed OSA

Preoperative Evaluation

- Barriers: Patients who may have suspected OSA refuse to undergo testing for establishing an OSA diagnosis.
- Possible reasons:
 - Inconvenience of an overnight sleep testing
 - Short time available between evaluation and the actual date of surgery
 - Cost of evaluation
 - Underappreciation of the implications of undiagnosed and untreated OSA by patients and clinicians
 - Lack of understanding of the consequences of untreated OSA
 - Unwillingness to use CPAP if OSA discovered.

Preoperative Evaluation

- Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management

Preoperative Evaluation

- A preoperative evaluation should include:
 - (1) a comprehensive review of previous medical records (if available),
 - (2) an interview with the patient and/or family, and
 - (3) conducting a physical examination

STOP-BANG Tool

- **S** Does the patient snore?
- **T** Is the patient tired?
- **O** Have there been observed apneas?
- **P** Has blood pressure been found to be elevated?
- **B** Is BMI 35 or greater?
- **A** Is patient 50 years or older?
- **N** Is neck circumference 17 in. or greater in man, 16 in. or greater in woman?
- **G** Is the patient male?

A score of 3 or more coupled with a serum HCO_3 of 28 or greater yields specificity for moderate and severe OSA of 82% and 79% respectively.

Preoperative Evaluation

- If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to
 - (1) manage the patient perioperatively based on clinical criteria alone, or
 - (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery

Preoperative Evaluation

- If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery

Preoperative Evaluation

- The severity of the patient's OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA

Preoperative Evaluation

- The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient's perioperative course

Inpatient vs. Outpatient Surgery

- Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis

Preoperative Preparation

- Preoperative initiation of CPAP should be considered, particularly if OSA is severe
- For patients who do not respond adequately to CPAP, NIPPV should be considered

Preoperative Preparation

- The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible

Preoperative Preparation

- Patients with known or suspected OSA may have difficult airways and therefore should be managed according to recent guidelines emphasizing a team approach.

Types of OSA Patients Presenting for Surgery

Scenario 1: Patients with known OSA who are
adherent to CPAP

Perioperative Management:

Known OSA/CPAP Adherent

- Patients with a diagnosis of OSA should be considered to be at high risk for perioperative complications

Perioperative Management:

Known OSA/CPAP Adherent

- In patients with diagnosed OSA who are adherent to PAP therapy, the patient, surgeon, anesthesiologist, and the healthcare team should be aware before the procedure that the patient carries a diagnosis of OSA, which may increase morbidity associated with surgery

Perioperative Management:

Known OSA/CPAP Adherent

- Facilities should consider having PAP equipment for perioperative use available or have the patient bring their own PAP equipment to the surgical facility.

Perioperative Management:

Known OSA/CPAP Adherent

- Patients should wear their PAP device at appropriate times during their stay in the hospital, both preoperatively and postoperatively

Types of OSA Patients Presenting for Surgery

Scenario 2: Patients with known OSA who are nonadherent to CPAP *or* who are CPAP naïve.

Perioperative Management:

Known OSA/CPAP Nonadherent

- In patients with diagnosed OSA who decline surgery or are poorly adherent to PAP, additional evaluation(s) for cardiopulmonary optimization be considered in patients who have a known diagnosis of OSA and are nonadherent or poorly adherent to PAP therapy and where there is indication of uncontrolled systemic conditions or additional problems with ventilation or gas exchange, including but not limited to hypoventilation syndromes, severe pulmonary hypertension, and resting hypoxia not attributable to other cardiopulmonary disease.

Perioperative Management:

Known OSA/CPAP Nonadherent

- Untreated OSA patients with optimized comorbid conditions may proceed with surgery provided strategies for mitigation of postoperative complications are implemented.
- The risks and the benefits of the decision should include consultation and discussion with the surgeon and the patient.

Perioperative Management:

Known OSA/CPAP Nonadherent

- Patients should be encouraged to wear their PAP device at appropriate times during their stay in the hospital, both preoperatively and postoperatively.

Types of OSA Patients Presenting for Surgery

Scenario 3: Suspected but undiagnosed OSA

Perioperative Management:

Undiagnosed/High Risk OSA

- In undiagnosed patient with a high clinical suspicion of having OSA, the patient, surgeon, anesthesiologist should be aware before the procedure that the patient has a high probability of having OSA, which may increase morbidity associated with surgery.

Perioperative Management: Undiagnosed/High Risk OSA

- In undiagnosed patient with a high clinical suspicion of having OSA, additional evaluation for preoperative cardiopulmonary optimization be considered in patients who have a known diagnosis of OSA and where there is indication of uncontrolled systemic conditions or additional problems with ventilation or gas exchange, including but not limited to hypoventilation syndromes, severe pulmonary hypertension, and resting hypoxia not attributable to other cardiopulmonary disease.

Perioperative Management: Undiagnosed/High Risk OSA

- Patients who have a high probability of having OSA may proceed to surgery in the same manner as those with a confirmed diagnosis, provided strategies for mitigation of postoperative complications are implemented. Alternatively, they may be referred for further evaluation and treatment. The risks and benefits of the decision should include consultation and discussion with the surgeon and the patient.

Intraoperative Management

- Intraoperative management considerations include the choice of anesthesia techniques, airway management and patient monitoring.
- The potential for postoperative respiratory compromise should be considered in selecting intraoperative medications

Intraoperative Management

- Postoperative management considerations include fluid management, postoperative analgesia, oxygenation, patient positioning and monitoring.
- Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities

Intraoperative Management

- General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway
- Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures

Intraoperative Management

- Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake
- Full reversal of neuromuscular block should be verified before extubation
- When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine positions

Postoperative Management

- Criteria for discharge to an unmonitored setting depends upon respiratory status, analgesic method(s), pain control and sedation scores, type of surgery, presurgical morbidity

Postoperative Management

- Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA

Postoperative Management

- If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone

Postoperative Management

- If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution
- To reduce opioid requirements, NSAID agents and other modalities (*e.g.*, ice, transcutaneous electrical nerve stimulation) should be considered if appropriate

Postoperative Management

- Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air

Postoperative Management

- When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure

Postoperative Management

- If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process

Postoperative Management

- Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room

Postoperative Management

- Continuous monitoring should be maintained as long as patients remain at increased risk
- If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered

Postoperative Management

- To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep

Postoperative Management

- Criteria for continued monitoring include
 - Recurrent respiratory events
 - High concurrent pain and sedation scores
 - Moderate or severe OSA either known or suspected
 - OHS/OSA overlap syndrome
 - Major invasive surgery, significant comorbidities
 - Use of medications that worsen OSA status

Postoperative Discharge Planning

- Be aware that the incidence postoperative delirium is increased, especially in older adults.
- OSA severity worsens on postoperative days 3-5.
- Be aware that some patients without preoperative OSA will develop OSA in the postoperative period.

Postoperative REM-Rebound

- Sleep efficiency, REM sleep and slow-wave sleep were decreased over postoperative night 1
- Increased AHI at postoperative night 3

Postoperative REM-Rebound

- Many postoperative patients assume the supine position for comfort.
- In REM sleep, irregular respiratory pattern and marked motor inhibition resulting in:
 - Hypotonia/atonía of somatic musculature
 - Depression of upper airway dilator muscle activity
- Net yield is:
 - Reduction in airflow
 - Upper airway obstruction
 - Worsening of OSA in affected individuals.

OSA Worsens Postoperatively: Hypopneas

OSA Worsens Postoperatively: Desats

Perioperative use of APAP in surgical patients

177 patients

Baseline OSA assessment

APAP (4-20 chH₂O) vs routine care postop

45% of APAP patients used it through POD5

Only 26-48% used APAP >4h

Lio P. Anesthesiology 2013; 119: 837.

Postoperative Complications

Postoperative Discharge Planning

- Patients should be advised to notify their primary medical provider that they were found to have a high probability of having OSA, thus allowing for further evaluation.

Summary

- An economic and logistic burden is placed on health care providers and institutions when patients with OSA undergo surgery.
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- Despite the lack of scientific evidence, organizations concerned with perioperative safety, such as the ASA and SASM have put forth recommendations for the perioperative care of patients with OSA.
- Ideally, PCPs, anesthesiologists and surgeons should share responsibility for *early* identification of OSA allowing time for a preoperative risk assessment.

Summary

- Although patients identified to be at high risk for OSA have been shown to have increased perioperative complications:
 - Only a small proportion of them will be affected as current screening tools identify as “at risk” patients who may not have the disease.
 - Not all patients w/ OSA will be at increased risk beyond emergence from anesthesia because of a low-risk procedure.
 - The OSA phenotype and the severity of OSA may play a role.

Summary

- Ultimate goal is to minimize risk of postoperative complications as much as feasible by identifying all patients
- Such an approach will result in a challenging logistical, economic, and clinical burden for healthcare providers.
- A balance must be struck between the desire to minimize postoperative complications and the responsible use of resources.

Thanks for your attention!