Pre- and Post-Operative Monitoring of the OSA Patient

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Introduction:
Obstructive Sleep Apnea (OSA) is a sleep disorder associated with substantially increased adult post-surgical risks and complications (Poeran, 2019). Anesthesia-induced unconsciousness precipitates decreased muscle activation that predisposes the upper airway to collapse. To date, the largest study (Memtsoudis et al., 2011) from the National Inpatient Sample (data from 1998 to 2007) examined 65,774 patients with sleep apnea undergoing orthopedic procedures and 51,509 sleep apnea patients undergoing general surgical procedures for perioperative complications. Sleep apnea was associated with a significantly higher adjusted occurrence of developing pulmonary complications, including aspiration pneumonia, acute respiratory distress syndrome, and intubation/mechanical ventilation, after both orthopedic and general surgical procedures respectively (Memtsoudis et al, 2011).

To improve patient outcomes, both in outpatient and inpatient clinical pathways, it is recommended that sleep clinicians with expertise in OSA management be included as part of the health care team during the pre-operative and post-operative period. The following sections outline recommended management and rationale.

Common Terminology and Abbreviations:
- **Apnea**: Absence of airflow for ≥10 seconds
- **AHI**: Apnea/Hypopnea Index (a measure of the severity of Obstructive Sleep Apnea (OSA):
  < 5/hour (no OSA)
  ≥ 5 and <15/hour (mild OSA)
  ≥ 15 and ≤30/hour (moderate OSA)
  >30/hour (severe OSA)
- **BPAP:** Bilevel Positive Airway Pressure (pressure support)
- **BMI**: Body Mass Index, body tissue mass, weight divided by the square of the body height expressed in kg/m2
- **CPAP**: Continuous Positive Airway Pressure
- **cm H_2O**: centimeters of water pressure (prescribed setting for PAP)
- **HSAT**: Home Sleep Apnea Testing, a limited channel home sleep test to diagnose OSA
- **Hypopnea:** ≥30% airflow reduction with a reduction of oxyhemoglobin saturation by ~3-4% for ≥10 seconds
- **ICU**: Intensive Care Unit

- **O_2**: Oxygen
- **OSA**: Obstructive Sleep Apnea
- **ODI**: Oxygen Desaturation Index, number of oxyhemoglobin desaturations, typically ≥3 or ≥4%, per hour of sleep or monitoring
- **PACU**: Post Anesthesia Care Unit
- **PCA**: Patient Controlled Analgesia
- **PAP**: Positive Airway Pressure, first-line treatment for OSA
- **PSG**: Polysomnography, gold standard test to diagnose OSA

Guidelines:

I. Preoperative Evaluation

The recommended steps to assess a patient for history of OSA diagnosis or a high probability of OSA are guided by the American Society of Anesthesiologists Task Force (Corso, et al, 2014) and include review of the medical record, a patient interview to collect a detailed medical history, the use of standardized screening tools for OSA, and a physical examination to identify risk factors.

Pre-operative OSA screening recommendations include the following:

Inpatient pathway:

1. Medical record review and history should occur **upon ordering the preoperative anesthesia assessment** to assess the following considerations for patients at-risk:
    a. Does the surgical procedure involve the airway or thoracic cavity?
    b. Is a general anesthetic being utilized?
    c. Does patient have OSA or a family history of OSA (parent, sibling, child)?
    d. Does patient have a history of CHF (or ischemic heart disease or arrhythmias. example: A-fib)?
    e. Does patient have or suffer from overlap syndrome (COPD, asthma)? Preoperative risk stratification of patients with OSA should include identification of morbidities associated with and related to OSA including obesity hypoventilation, pulmonary hypertension, and chronic opioid therapy (Chung, 2011).
    f. Does patient have a history of cleft palate repair?
    g. Is the patient pregnant? Pregnant women experience changes to the upper airway, such as mucosal hyperemia, narrowing of the oropharyngeal diameter, and increased Mallampati score, as well as decreased functional residual capacity and increased oxygen consumption that can produce or exacerbate SDB.

2. Screening for OSA using the STOP-Bang questionnaire is recommended **upon ordering the preoperative anesthesia assessment.** STOP-BANG is a sensitive and relatively

specific test (if a score of ≥ 4 is used as a cutoff for increased risk) that correlates well with PSG results. (Chung, 2016)

3. It is recommended that a physical examination that includes the following parameters be performed **upon ordering the preoperative anesthesia assessment** to assess at-risk patients.
    a. Mallampati classification (categories 3 and 4 are indicative of higher risk)
    b. Measurement of neck size (> 16 inches in females, > 17 inches in males = higher risk)
    c. Retro/micrognathia (yes = higher risk)
    d. Scalloping of tongue (moderate to severe = higher risk) https://onlinelibrary.wiley.com/doi/pdf/10.1111/joor.12526
    e. Nasal obstruction (yes = higher risk) https://erj.ersjournals.com/content/30/6/1208
    f. Heart sounds
        i. Accentuated P2 heart sounds (Pulmonary HTN)
        ii. S3 heart sound (CHF)
    g. Lower extremity edema (heart failure)
    h. Does patient have missing teeth or have dentures?

Prevalence of high-risk for OSA was as follows: 25 % greater in those missing 5–8 teeth; 36% greater in those missing 9–31 teeth; and 61% greater in the edentulous (Sanders, 2016).

4. It is recommended that the Sleep Navigator write a summary report based on medical history, patient interview, screening tools, and physical examination, and include a recommendation for a physician order for a sleep consultation or sleep diagnostic testing if appropriate.
    a. Diagnostic testing is appropriate for patients identified as high risk by screening.
    b. Recommended diagnostic testing for the inpatient clinical pathway is via portable monitoring using Type II, III or IV devices (CPT 95800, 95801, 95806) and initiation of PAP if appropriate.
    c. It is important to follow up to ensure diagnostic testing has been completed for high risk patients and results reviewed.
    d. Alternatively, in high-risk patients identified by screening questionnaire but unable or unwilling to undergo preoperative PSG, a presumptive diagnosis can be made, an anesthetic plan can be tailored to the presumed diagnosis, and PAP therapy can be initiated postoperatively (8-12cm H_2O) if necessary (Chung, 2011).

Outpatient Pathway:

1. Medical record review and history should occur **during the surgical clearance with the primary care physician or during preoperative anesthesia** to assess the following considerations for patients at-risk:
    a. Does the surgical procedure involve the airway or thoracic cavity?

b. Is a general anesthetic being utilized?
c. Does patient have OSA or a family history of OSA (parent, sibling, and child)?
d. Does patient have a history of CHF (or ischemic heart disease or arrhythmias. example: A-fib)?
e. Does patient have or suffer from overlap syndrome (COPD, asthma)? Preoperative risk stratification of patients with OSA should include identification of morbidities associated with and related to OSA including obesity hypoventilation, pulmonary hypertension, and chronic opioid therapy (Chung, 2011).
f. Does patient have a history of cleft palate repair?
g. Is the patient pregnant? Pregnant women experience changes to the upper airway, such as mucosal hyperemia, narrowing of the oropharyngeal diameter, and increased Mallampati score, as well as decreased functional residual capacity and increased oxygen consumption that can produce or exacerbate SDB.

2. Screening for OSA using the STOP-Bang questionnaire is recommended **during the surgical clearance with the primary care physician or during preoperative anesthesia**. STOP-BANG is a sensitive and relatively specific test (if a score of ≥ 4 is used as a cutoff for increased risk) that correlates well with PSG results (Chung, 2016).

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f. Heart sounds
    i. Accentuated P2 heart sounds (Pulmonary HTN)
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g. Lower extremity edema (heart failure)
h. Does patient have missing teeth or have dentures? Prevalence of high-risk for OSA was as follows: 25 % greater in those missing 5–8 teeth; 36 % greater in those missing 9–31 teeth; and 61 % greater in the edentulous (Sanders, 2016).

4. It is recommended that the Sleep Navigator or other clinician write a summary report based on medical history, patient interview, screening tools, and physical examination, and include a recommendation for a physician order for a sleep consultation or sleep diagnostic testing if appropriate.
a. Diagnostic testing is appropriate for patients identified as high risk by screening.

b. **Recommended diagnostic testing for the outpatient clinical pathway is via timely preoperative diagnostic PSG (CPT 95807) and initiation of PAP if appropriate.**
c. It is important to follow up to ensure diagnostic testing has been completed for high risk patients and results reviewed.
d. Alternatively, in high-risk patients identified by screening questionnaire but unable or unwilling to undergo preoperative PSG, a presumptive diagnosis can be made, an anesthetic plan can be tailored to the presumed diagnosis, and PAP therapy can be initiated postoperatively (8-12cm H2O) if necessary (Chung, 2011).

II. Intraoperative Management

- Consider regional anesthesia or peripheral nerve block with minimal sedation **if appropriate**.
- Prepare for difficult airway management. Consider CPAP and **25-degree head position prior to induction to** improve functional residual capacity (FRC). Use **short-acting anesthetic, opioid, or sedative medications**.
- Consider invasive monitoring for respiratory and hemodynamic management.
- Extubate trachea after patient is completely awake and neuromuscular **blocking drugs reversed**.

III. Postoperative Anesthesia Recovery Management

- Careful observation of oxygen saturation and hemodynamics in the post anesthesia recovery room.
- Observe at **30-degree head-up position and /or lateral position for a minimum of 2 hours in most patients**.
- Consider use of non-opioid analgesics, opioid **adjuncts, and regional anesthesia. Use opioids judiciously**.
- Use PAP early in case of oxygen desaturation

IV. Postoperative Management

The perioperative time represents the highest risk for patients with OSA because of the adverse effects of anesthesia, narcotics and sedatives (Wolfe, 2016). Aggravating factors for postoperative respiratory depression include the underlying severity of the sleep apnea, systemic administration of opioids, use of sedatives, site and invasiveness of surgical procedure, and the potential for apnea during rapid eye movement (REM) sleep on the third or fourth postoperative day (i.e. “REM rebound”), as normalized sleep patterns are reestablished.

Immediate postoperative interventions to manage OSA patients who may be susceptible to the above risks should focus on the following clinical decisions: (1) postoperative analgesia, (2) oxygenation, (3) patient positioning, and (4) monitoring (American Society of Anesthesiologists

Task Force, 2014). A recent medical legal review of postoperative cases in patients with OSA revealed that "Slightly over half of the complications reported occurred in an unmonitored setting, and a substantial minority involved the use of opioids. These cases were most likely to be associated with death as the outcome" (Wolfe, 2016).

The American Society of Anesthesiology recommends a median of 3 hours longer postoperative monitoring in patients with OSA after ambulatory surgery and 7 hours of post-operative monitoring after the last episode of airway obstruction or hypoxemia while breathing room air in an unstimulated environment prior to discharge (Chung, 2011). Adult patients deemed as having a high probability of OSA should be managed according to the ASA guidelines (Wolfe, 2016) (Figure 1--Adesanya, 2010).

Inpatient Pathway:
The risk of OSA may not normalize for several nights postoperatively, with the greatest risk on postoperative night three. Other postoperative issues can also last for several days, which may include sleep disruptions resulting in REM rebound and lingering anesthesia effects. Other considerations for the initial postoperative period include:

- Cautious opioid use
- Limited sedation use
- Upper airway surgery swelling
- Chest/abdominal surgery restricting deep breathing
- Supine recovery limiting non-supine position adjustments
- Complications due to difficult intubation or extubation, use of Endotracheal (ET) tube vs.Laryngeal Mask Airway (LMA)
- Sensitive airway due to other high risk factors (with or without stridor)

Discharge Management:

- Follow up with sleep medicine specialist for diagnostic PSG testing or PAP management.

Inpatient & Outpatient Pathway:
Education about the impact of SDB on comorbid conditions, PAP therapy and compliance should be provided following the AAST standardized Patient Education Curriculum guidelines. Emphasis should be placed on general patient education. Prior to discharge, patients with known OSA on PAP therapy and their caregivers should be educated to use their PAP therapy whenever sleeping. If the patient has a history of non-compliance, education should be provided regarding the risks of untreated OSA and barriers that resulted in non-compliance should be identified and addressed.

Before discharge, an OSA treatment plan should be in place for timely follow up care by a board certified sleep specialist and/or clinical sleep health educator. This plan should inform the patient of next steps for effective treatment and compliance with PAP therapy. Note that PAP therapy used during the post-op period will generally not be reimbursed unless a formal diagnosis of OSA is established and compliance is monitored.

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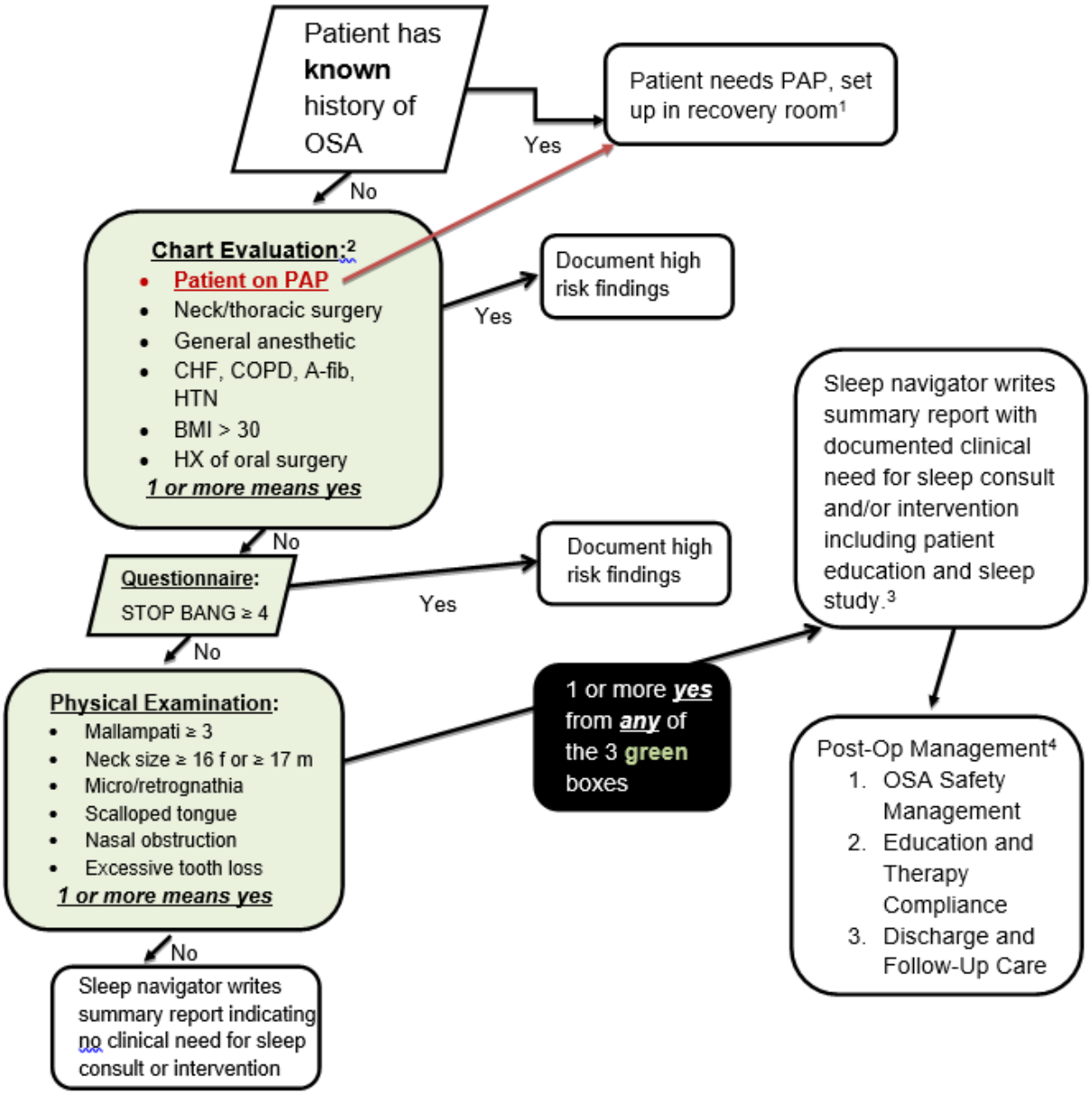
Additional Resources:

- Society of Anesthesia and Sleep Medicine (SASM) – Literature updates March 2019.
- Non-opioid analgesic modes of pain management are associated with reduced postoperative complications and resource utilisation: a retrospective study of obstructive sleep apnoea patients undergoing elective joint arthroplasty. British Journal of Anaesthesia
- The effect of obstructive sleep apnea on readmissions and atrial fibrillation after cardiac surgery. Journal of Clinical Anesthesia
- Chung et al. Society of Anesthesia and Sleep Medicine Guidelines on Preoperative Screening and Assessment of Adult Patients With Obstructive Sleep Apnea

Flowsheet: Pathway for Pre- and Post-Operative OSA Management



1. Obtain sleep study report and current PAP settings. Obtain PAP order for set-up.
2. **Inpatient:** Chart can be reviewed at the facility.
   Outpatient: Required information can be obtained during pre-surgical testing.
   Note: EMR can be utilized for risk/notification as appropriate to follow best practice advisory.
3. **Inpatient:** recommend an in-hospital portable study (type II or IV), and initiation of PAP, if appropriate.
   Outpatient: recommend a timely preoperative diagnostic PSG, and initiation of PAP, if appropriate.
4. Refer to: ***AAST Technical Guidelines for Pre- and Post-Operative Monitoring of the OSA Patient.***