

- Mixed: Has obstructive component. Upper airway narrowing superimposed on coexistent abnormality of neurologic control or function of upper airway muscle tone or ventilatory control.
- Associated with obesity and nasal obstruction (polyps, rhinitis, deviated septum, acromegaly, hypothyroidism, Htn).

Usual Treatment

- CPAP or BiPAP; bring to hospital and OR/PACU.
- Tracheotomy and mechanical vent at night.
- Diaphragmatic pacing, especially at night.
- Surgery to remove obstruction

- For central/mixed apnea, additional medical treatment with protriptyline, progesterone.
- For mixed apnea, weight loss and physical aids.
- Avoid narcotics, benzodiazepines, and alcohol.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Obstructive apnea	Snoring, partner gives Hx of pt's awakening at night with grunts	Visualization of uvula and tonsillar pillars	
CV	Htn	Dyspnea at rest, DOE Poor exercise tolerance, angina	Cardiomegaly S ₃ /S ₄ murmur	ECG, ECHO
RESP	Right-sided heart dysfunction, snoring, respiratory dysfunction, DOE	Awakening at night with grunts	Venous engorgement Rapid respiratory rate Cardiomegaly	SaO ₂ supine ECG, CXR, ABG, Hct Polysomnogram, home sleep study
GI	Hepatic dysfunction Full stomach T2DM	Jaundice, bleeding disorders, ascites, heartburn, hiatus hernia, polydipsia, polyuria	Hepatomegaly, ascites, spider nevi, jaundice	LFTs, PT, PTT Fasting glucose
ENDO	Obesity Hypothyroidism Acromegaly		Mental function reflexes BMI	Free T ₄ estimate TSH, GH levels
HEME	Polycythemia		Plethora, clubbing, cyanosis	O ₂ sat, Hct
CNS	Disturbed sleep, impaired daytime performance, morning headache, memory problems, irritability	Daytime sleepiness, complaints of disrupted sleep Ask for encephalitis, autonomic neuropathy, brainstem damage		Polysomnogram, home sleep study

Key References: Ostermeier AM, Roizen MF, Hautkappe M, et al.: Three sudden postoperative arrests associated with epidural opioids in patients with sleep apnea, *Anesth Analg* 85(2):452–460, 1997; Somers VK, White DP, Amin R, et al.: Sleep apnea and cardiovascular disease: an American Heart Association/American College of Cardiology Foundation Scientific Statement from the American Heart Association Council for High Blood Pressure Research Professional Education Committee, Council on Clinical Cardiology, Stroke Council, and Council on Cardiovascular Nursing. In collaboration with the National Heart, Lung, and Blood Institute National Center on Sleep Disorders Research, *Circulation* 118(10):1080–1111, 2008; American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea, *Anesthesiology* 120(2):268–286, 2014.

Perioperative Implications

Preoperative Preparation

- Take sleep Hx, if possible, from bed partner.
- If a question of sleep apnea, use home sleep apnea tests (helmet or wrist; several distinct types now exist) as a screen. Sleep lab unnecessary for this screen. If positive, refer to sleep lab preop.
- Avoid preop sedation with benzodiazepines and narcotics.
- Examine airway carefully.
- Consider metoclopramide 10 mg, cimetidine 300 mg PO the night before and IV preop.
- Assess myocardial and volume status.
- Initiate CPAP or BiPAP therapy over periop period, and in recovery room.

Monitoring

- Routine; consider arterial line.
- UO, possible CVP or PA catheter, if volume status likely to be significantly altered.

Airway

- Airway control necessary if prominent central component and sedation mandatory.

- Awake, sitting, fiberoptic intubation may be indicated if difficulty anticipated.

Induction

- Pt may need to remain semisitting if SaO₂ drops when supine. Preoxygenation should be complete throughout lungs.

Maintenance

- Oxygenation may deteriorate with upper abdominal surgery or increased intraabdominal pressure.
- Consider the use of short-acting substances (e.g., propofol, remifentanyl).
- Minimize postop sedation.

Extubation

- Extubate as soon as pt maintains normocapnia and responds to command.
- Consider close monitoring after extubation.

Adjuvants

- Initial dose of induction agent and narcotics calculated on a mg/kg basis, and muscle relaxants calculated on estimated lean body mass.
- Subsequent doses of sedatives, hypnotics, relaxants, and narcotics calculated on estimated lean body mass.

- RA if physically possible and if pt can use accessory muscles to help with breathing.

Postoperative Period

- Pain control with opioids only when NSAIDs and/or RA is contraindicated and/or insufficient, as (sudden) complete pain relief may increase risk of respiratory arrest.
- Some think epidural or narcotics are indicated, and others think these are relatively contraindicated.
- Extended respiratory monitoring.
- Stabilize ABG to adequate levels.
- Pain control necessary; PCA acceptable in sleep apnea, but not in continuous mode.
- Consider DVT prophylaxis if pt is overweight.

Anticipated Problems/Concerns

- Respiratory insufficiency and pneumonia postop; use devices and/or CPAP in immediate and long-term preop and postop periods.
- Postop thromboembolic phenomena.
- If problems occur, inform pt before discharge with written instructions, especially for further anesthetic interventions.

Sleep Apnea, Obstructive

Michael F. Roizen | Charles Ahere | Claude Brunson

Risk

- Incidence in USA is 3–15% of the whole population (increased fourfold in last 15 y, presumably due to increase in obesity).
- M:F ratio: 2.5:1.
- Race with highest prevalence: Unknown.

Perioperative Risks

- Increased risk of pulm Htn, RV failure, and systemic Htn.
- Some pts may be polycythemic and have an increased risk of CVA.

- Complications associated with obesity and craniofacial and upper airway soft tissue abnormality.
- Increased risk in supine position of sudden arrest postop.

Worry About

- Airway obstruction with sedating drugs; need for awake, sitting intubation without sedation if obstruction occurs when supine.
- Increased sensitivity to sedating drugs.
- Difficult airway management; mask ventilation and intubation.
- Aspiration risk in the morbidly obese.
- Postop airway obstruction or resp depression.
- Nasal obstruction from NG tubes (e.g., may lead to resp compromise).
- Have pt bring CPAP or other apparatus with them to hospital and to OR/PACU.

Overview

- Apnea refers to cessation of airflow at the mouth for >10 sec.
- Sleep apnea refers to repetitive episodes of upper airway occlusion during sleep, often with O₂ sat to 85%

and nearly always associated with loud snoring. Episodes of apnea often terminate with a snort or gasp.

- Upper airway obstruction from relaxation of muscles of oropharynx.
- Frequent periods of apnea lead to hypoxia and hypercarbia, which could lead to cor pulmonale.
- Polycythemia may result from chronic hypoxia.
- Nocturnal cardiac arrhythmias are common.
- Monitor depth and quality of sleep along with cardiopulmonary variables in those with severe symptoms.
- Another name is Pickwickian syndrome, associated with morbid obesity (see also Morbid Obesity).

Etiology

- Cessation of airflow due to complete obstruction of upper airway.
- Narrowing due to enlarged tonsils, adenoids, uvula, low soft palate, or craniofacial abn superimposed on coexistent abn of upper airway muscle tone and/or neurologic control.

- Obesity exacerbates upper airway obstruction.
- Structural abnormality such as tonsillar hypertrophy, enlarged tongue, and micrognathia may contribute to airway obstruction.

Usual Treatment

- Weight loss in overweight pts
- Tobacco cessation
- Avoidance of alcohol and sedatives before sleep; avoidance of sleep deprivation
- Nasal CPAP; BiPAP
- Physical aids such as devices to detect and prevent snoring; keep pt off back while sleeping (e.g., tennis ball sewn on nightshirt)
- Nasopharyngeal or oropharyngeal airway and oral appliance therapy.
- Uvulopalatopharyngoplasty
- Tracheotomy in extreme cases
- Electrophrenic pacing for central sleep apnea

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Obstructive apnea	Snoring, partner gives Hx of pt's awakening with grunts at night	Visualization of uvula and tonsillar pillars	
CV	Htn	Dyspnea at rest and on exertion Poor exercise tolerance	Rapid resp rate Increased BP, cardiomegaly	ECG, ECHO
RESP	Right-sided heart dysfunction Restrictive dysfunction	Snoring, partner gives Hx of pt's awakening with grunts at night DOE	Venous engorgement, rales, S ₃ and S ₄ , cardiomegaly	Pulse oximetry on room air while supine ECG, CXR, ABG, Hct, polysomnogram, overnight sleep study
GI	Hepatic dysfunction Full stomach T2DM	Angina Jaundice, bleeding disorders, ascites Heartburn, hiatus hernia Polydipsia, polyuria	Hepatomegaly, ascites, spider angio- mas, jaundice	LFTs, PT, PTT Fasting glucose
ENDO	Obesity Hypothyroidism Acromegaly		Mental function Reflexes BMI	Free T ₄ estimate TSH level, GH level
HEME	Polycythemia		Plethoric clubbing, cyanosis	Hypoxemia Hct
CNS	Disturbed sleep Memory problems Irritability	Daytime sleepiness Complaints of disrupted sleep		Polysomnogram Overnight sleep study

Key References: Fletcher EC, Proctor M, Yu J, et al.: Pulmonary edema develops after recurrent obstructive apneas, *Am J Respir Crit Care Med* 160(5 Pt 1):1688–1696, 1999; American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea, *Anesthesiology* 120(2):268–286, 2014.

Perioperative Implications

Preoperative Preparation

- Avoid sedatives.
- Assess CV status.
- Histamine H₂ blockers, metoclopramide, and antacids for morbidly obese pts.
- Have pt bring CPAP, BiPAP, or other apparatus with them to hospital and to OR/PACU.

Monitoring

- Routine.
- Volume status if RV dysfunction present.
- Consider arterial cath if BP cuff does not fit or takes too long to inflate.

Airway

- Airway obstruction with induction; see HEENT in the Assessment Points table.

- Awake intubation in those with potentially difficult airway.
- Consider elevating shoulders on bolsters.

Induction

- Airway obstruction
- Exacerbation of pulm Htn by hypoxemia and hypercarbia

Maintenance

- Volume status may change precipitously with position change.
- Oxygenation may deteriorate with upper abdominal surgery or increased abdominal pressure.

Extubation

- Only when pt is fully awake.
- Airway obstruction from residual anesthetics.
- Avoid opioids and sedatives.
- Monitor for airway obstruction and apnea.

Adjuvants

- Very sensitive to CNS-depressant drugs.
- CPAP, BiPAP, or other apparatus for use in PACU and hospital or home recovery periods.

Anticipated Problems/Concerns

- Airway obstruction at induction and after extubation.
- 13% risk of periop complications, especially of pneumonia; avoid by minimal sedation, appropriate pain control, and early ambulation.
- Worsening pulm Htn and right-sided heart failure.
- Aspiration risk in the morbidly obese.
- Postop thromboembolism; consider routine 162 mg of aspirin beginning preop, or other methods to prevent DVT.
- Poor motivation resulting in poor ambulation. Avoid by intensive preop teaching and postop coaching.