

Adenotonsillectomy

Rebecca Evans

A four-year-old child presents over winter break for a tonsillectomy, adenoidectomy, and bilateral ear tubes. When interviewing the patient, mom reports her child "snores all night long, sometimes stops breathing, and has fallen asleep in her preschool class." She has no neurologic or developmental delays.

She has had a series of ear infections, with the most recent infection last month. A hearing test was performed, showing diminished hearing which is causing her to fall behind her peers with regard to speech development.

In the preoperative area, she had clear rhinorrhea, non-productive cough. She complains of left ear pain. Her temperature is 38.0°C and the perioperative nurse discusses case cancellation with you. Lung auscultation is clear bilaterally.

How Common Is Pediatric Obstructive Sleep Apnea (OSA) Syndrome?

Currently 1–4% of children carry a diagnosis of OSA and with improved diagnostic techniques, the prevalence will continue to increase.

What Is the Difference Between Sleep Disordered Breathing and OSA?

Sleep disordered breathing is a generalized term that encompasses all abnormalities associated with breathing during sleep, ranging from snoring to obstructive sleep apnea.

Obstructive sleep apnea is a form of sleep disordered breathing with specific criteria including the symptoms of snoring, increased respiratory effort, periodic obstructive apnea, and oxygen desaturation.

What Is the Gold Standard for Diagnosing OSA?

The most reliable and validated way to diagnose OSA is by an overnight polysomnogram.

The diagnostic criteria for OSA in children include a child with an apnea duration of two breaths, hypopnea desaturation >3%, hypopnea duration of two breaths and hypopnea nasal pressure drop >50%.

How Do You Determine the Severity of OSA?

The severity of OSA is based on four criteria:

- Apnea-hypopnea index (AHI), number of hypopnea/apnea events secondary to obstructive events during sleep for 60 min as observed during polysomnography
- Nadir of oxygen saturation
- Percentage of sleep time with a $P_{ETCO_2} > 50$ mmHg
- Respiratory arousal index (RAI): the number of respiratory arousals per hour of sleep

Severe obstructive sleep apnea has an AHI >10, nadir $SpO_2 < 80\%$, $P_{ETCO_2} > 50$ mm Hg >20% of the total sleep time, and RAI >8 per hour of total sleep time.

Commonly used severity classifications are the indices from the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea and the McGill Oximetry scoring system (Tables 31.1 and 31.2). In the absence of a sleep study, the clinical questionnaire OSA 18 can be used to determine the presence and severity of pediatric OSA.

What Are the Most Common Indications for Tonsillectomy in Children?

The most common indications for tonsillectomy include sleep-disordered breathing in younger age-group children and recurrent throat infections in older

children. Both of these conditions can negatively impact the quality of a child's health. In the United States, tonsillectomy is one of the most common surgical procedures. There are more than 530,000 cases performed annually in children younger than 15 years. Most cases of tonsillectomy for sleep disordered breathing or OSA are performed in conjunction with an adenoidectomy.

When Are Tonsillectomy or Adenoideectomy Performed Alone?

Isolated tonsillectomy is indicated for recurrent pharyngo-tonsillitis, chronic tonsillitis, hemorrhagic tonsillitis, peritonsillar abscess, streptococcal carriage, dysphagia, abnormal dento-facial growth, halitosis, and suspicion of malignant disease. Isolated adenoidectomy is performed for recurrent or chronic rhinosinusitis or adenoiditis, and sometimes along with myringotomy tubes to treat recurrent otitis media.

INTRAOPERATIVE

Does the Presence of Sleep Disordered Breathing Affect Your Induction Plan?

Children with sleep-disordered breathing may have nasal airway obstruction as well. Ensuring that the

Table 31.1 OSA severity scale by AHI between children and adults from the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea. AHI, apnea hypopnea index; OSA, obstructive sleep apnea

| OSA severity | AHI in children | AHI in adults |
|--------------|-----------------|---------------|
| None | 0 | 0–5 |
| Mild | 1–5 | 6–20 |
| Moderate | 6–10 | 21–40 |
| Severe | >10 | >40 |

Table 31.2 The McGill Oximetry Scoring System. The severity of OSA is determined by the SpO₂ nadir and by the number of desaturation events during nocturnal oximetry. OSA, obstructive sleep apnea

| Oximetry score | OSA classification | No. of desaturation events <90% SpO ₂ | No. of desaturation events <85% SpO ₂ | No. of desaturation events <80% SpO ₂ |
|----------------|--------------------|--|--|--|
| 1 | Normal | <3 | None | None |
| 2 | Mild | ≥3 | ≤3 | None |
| 3 | Moderate | ≥3 | >3 | ≤3 |
| 4 | Severe | ≥3 | >3 | >3 |

mouth remains open and the use of an oral airway with a CPAP of 5–10 cm H₂O may aid in maintaining airway patency during inhalational induction.

What Are Some Signs of Obstruction During Inhalation Induction?

Signs of respiratory obstruction include tachypnea; intercostal, sternal, and suprasternal retractions; grunting; nasal flaring; and oxygen desaturation.

How May You Adjust Your Pain Management Plan in a Patient Diagnosed with OSA?

The use of nonopioid adjunct pain medications will aid in ensuring a balance of pain control with appropriate respiratory ventilation in the postoperative period. Short-acting opioids such as fentanyl are easy to titrate to effect with less concern for respiratory depression in the post-anesthetic care unit (PACU). Patients with obstructive sleep apnea were found to require less pain medication than patients without obstructive sleep apnea who were undergoing a tonsillectomy and adenoidectomy. Some physicians prefer to administer approximately half of their normal opioid dosing regimen to patients with obstructive sleep apnea.

Other adjuncts such as acetaminophen, dexmedetomidine and high doses (1 mg/kg up to a total of 25 mg) of dexamethasone reduce postoperative pain without decreasing respiratory drive.

The use of NSAIDs, such as ketorolac, remains controversial. A meta-analysis revealed an increased number of patients returning to the operating room for postoperative bleeding in the setting of NSAID use. However, the study design was plagued by small sample sizes. Further meta-analyses revealed no

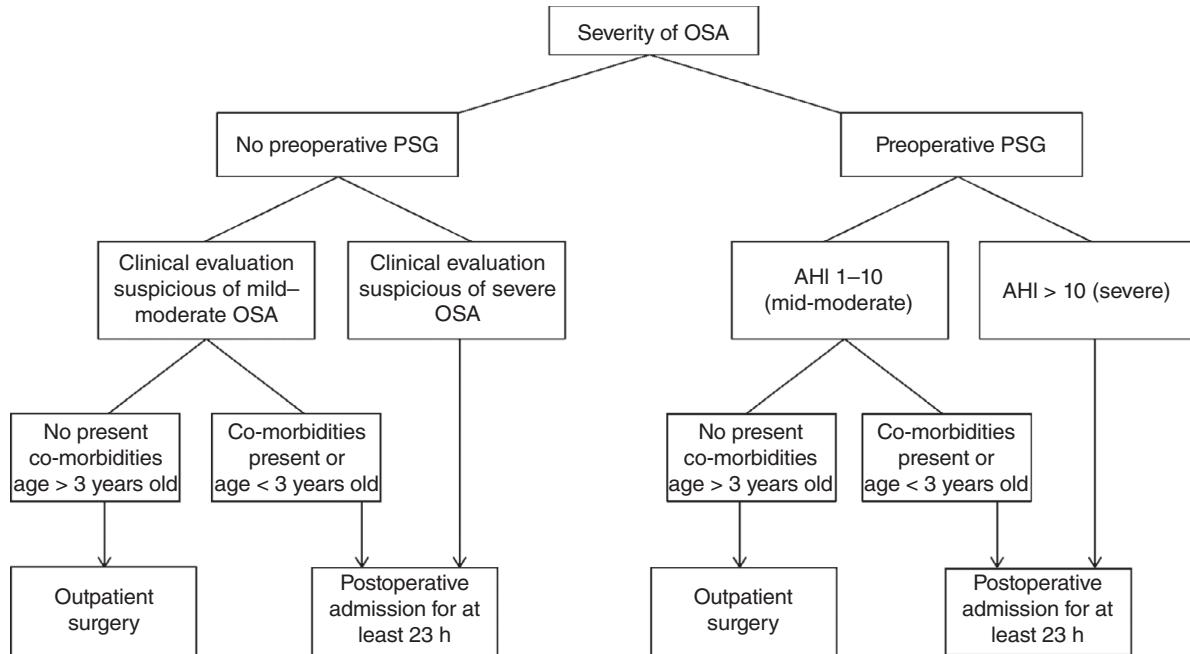


Figure 31.1 Postadenotonsillectomy disposition for children with OSA. PSG=polysomnography, AHI=apnea/hypopnea index. Reproduced with permission of Elsevier from: Patino M, et al. *Br J Anaesth* 2013;111 Suppl 1:i83–95. Copyright © 2012 M. Patino, S. Sadhasivam, M. Mahmoud.

increase in the risk of postoperative bleeding in the setting of NSAID use. Current practice varies among institutions.

POSTOPERATIVE

Which Patients Undergoing a Tonsillectomy and Adenoidecomy Should Remain in the Hospital Overnight for Observation?

The American Academy of Pediatrics (AAP) guidelines recommend postoperative admission for children with OSA who are under three years of age, are obese, or have serious comorbidities or severe OSA ($AHI > 24/h$, SpO_2 nadir $<80\%$, or peak $PCO_2 \geq 60$ mm Hg).

Definitive studies have not yet determined set criteria for hospitalization and are generally based on expert consensus. However, most physicians use the following data as indication for hospitalization: children under three years old, diagnosis of severe OSA via polysomnogram, and/or presence of additional

comorbidities such as hypotonia, obesity, failure to thrive, and/or severe structural airway abnormalities.

An excellent schematic for determining postoperative disposition may be found in Figure 31.1.

What Postoperative Complications Are Associated with Tonsillectomies and Adenoidecomies?

Complications can be divided into respiratory and non-respiratory:

Respiratory

- Hypoxemia and/or prolonged oxygen requirements
- Hypercapnia
- Postoperative pulmonary edema, which may require interventions such as intubation
- Anesthetic complications

Nonrespiratory Complications

- Pain
- Poor oral intake and dehydration
- Nausea and vomiting
- Airway hemorrhage

What Is the Incidence of Postoperative Tonsillar Bleeding? When Is It Most Likely to Occur?

Approximately 3–4% of tonsillectomies (16,000 cases) performed in the United States are associated with postoperative tonsillar bleeding.

A bimodal distribution of the onset of tonsillar bleeding is observed. The first 24 hours may be associated with a brisk, postoperative tonsillar bleed often associated with poor hemostasis or in a patient with an unknown bleeding disorder. The next most common time for a patient to present with a postoperative tonsillar bleed is 7–10 days postprocedure when the healing eschar falls off the tonsillar bed.

What Are the Anesthetic Considerations for a Postoperative Tonsillar Bleed?

Post-tonsillar bleeds can be separated into the acute and significant bleed and the slow oozing type bleed. A brisk and potentially arterial bleed can be a life threatening emergency with numerous cases of patients exsanguinating from bleeding tonsillar pillars. Slow and progressive bleeds are often venous in nature and should be dealt with in a semi-emergent manner. In either case, patients should be considered to have a full stomach. IV induction is most appropriate with or without rapid sequence type intubation. The evidence on having a type and cross, especially for slow oozing bleeding, is lacking, as the incidence of

transfusion in these patients is low. Certainly, for brisk and arterial bleed, a type and cross-match is advisable; however, an emergent case should not be delayed to wait for type specific blood.

When May the Parents Begin to Notice a Difference in Their Child's Breathing after a Tonsillectomy and Adenoidectomy Performed for Sleep Disordered Breathing or OSA?

Children often have increased airway obstruction in the immediate postoperative period. The reduction in obstruction during sleeping is often not appreciated for approximately two to four weeks postoperatively.

What Are Some Common Complications Associated with Children after General Anesthesia Who Have a Predisposition to Anxiety?

Children who were anxious in the preoperative period were found to have more postoperative pain, require more pain medications while hospitalized and during their first three days at home, and have a greater incidence of emergence delirium, postoperative anxiety, behavioral changes (apathy, withdrawal, enuresis, temper tantrums, eating disturbances), and sleep disturbances (see Chapter 6).

Suggested Reading

Cohen MM, Cameron CB. Should you cancel the operation when a child has an upper respiratory tract infection? *Anesth Analg.* 1991;72(3):282–8. PMID: 1994755.

Cote CJ. The upper respiratory tract infection (URI) dilemma: fear of a complication or litigation? *Anesthesiology.* 2001;95:283–5. PMID: 11506096.

Marcus CL, Brooks LJ, Draper KA, et al. Diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics.* 2012;130(3):576–84. PMID: 22926173.

Patino M, Sadhasivam S, Mahmoud M. Obstructive sleep apnoea in children: perioperative considerations. *Br J Anaesth.* 2013;111 Suppl 1:i83–95. PMID: 24335402.

Raghavendran S, Bagry H, Dethieux G, et al. An anesthetic management protocol to decrease respiratory complications after adenotonsillectomy in children with severe sleep apnea. *Anesth Analg.* 2010;110(4):1093–101. PMID: 20142343.

Tait AR, Malviya S, Voepel-Lewis T, et al. Risk factors for perioperative adverse respiratory events in

children with upper respiratory tract infections. *Anesthesiology.* 2001;95:299–306. PMID: 11506098.

Thongyam A, Marcus CL, Lockman JL, et al. Predictors of perioperative complications in higher risk children after adenotonsillectomy for obstructive sleep apnea: a prospective study. *Otolaryngol Head Neck Surg.* 2014;151(6):1046–54. PMID: 25301788.

Uliel S, Tauman R, Greenfeld M, et al. Normal polysomnographic respiratory values in children and adolescents. *Chest.* 2004;125(3):872–8. PMID: 15006944.