TONSILLECTOMY AND ADENOIDECTOMY

Surgical Specialty:	Otolaryngology
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Background:

Definition:
Tonsils and adenoids participate in the immune response to bacterial and viral infections. Adenotonsillar hypertrophy is the enlargement of these structures and may occur for various reasons.

Causes:

- Multiple factors may lead to tonsillar hypertrophy
  - Secondhand smoke and air pollution exposure have been proposed as possible contributory factors.
  - Viral Infections- adenovirus, influenza virus, and herpes simplex virus
  - Bacterial infections -Neisseria gonorrhoeae, mycoplasma, and Hemophilus influenzae Type B.
  - Fungal or parasitic infections are less commonly implicated.

Symptoms:

Symptoms of tonsillitis

- Sore throat
- Painful swallowing
- Loss of appetite
- Bright red tonsils
- White or yellow film on the tonsils
- Fever
- Malodorous breath

Symptoms of enlarged adenoids

- Breathing through the mouth instead of the nose
- Constant rhinorrhea
- Snoring
- Sleep apnea
- Nasal speech
- Recurrent otitis media

Indications for Tonsillectomy and Adenoidectomy:

- Recurrent tonsillitis
  - 7 or more episodes in 1 year,
  - 5 or more episodes in a year for 2 consecutive years
  - 3 or more episodes in a year for 3 consecutive years
- Chronic tonsilitis
- Obstructive Sleep Apnea (OSA)[1] , increased in the African American population.
  - Clinical signs of OSA
    - Poor sleep
    - Insufficiently restful sleep
    - Frequent daytime napping
    - Attention-deficit hyperactivity disorder (ADHD)
    - Difficulty focusing
    - Enuresis
  - Outcomes of OSA, if untreated
    - Growth- failure to thrive
    - Cardiovascular- Cor pulmonale. ↓ right ventricular ejection fraction (reversible with T&A), and abnormal left ventricular geometry (seen in 40% of children with OSA and in 15% of children with isolated snoring).
    - CNS changes- Neurocognitive deficits, learning deficiencies, behavioral problems.
- Sleep-disordered breathing (SDB)
- Peritonsillar abscess
- Obesity
- Associated syndromes:
  - Trisomy 21[2], Hunter syndrome, Hurler syndrome (excess mucopolysaccharides), Tangier disease
  - Craniofacial disorders with micrognathia, high arched palate, adenoid facies- Pierre Robin sequence/ Complex (PRS), Stickler syndrome, Velocardiofacial syndrome, and Treacher-Collins syndrome

Surgical techniques for Tonsillectomy and Adenoidectomy:

- Tonsillectomy can be extracapsular or intracapsular. The choice of technique depends on the surgeon's experience and comfort level.
  - **“Hot” Electrocautery Technique**: Heat (typically, monopolar cautery) is used to remove the tonsils and stop any bleeding. It is the **most common technique used in the United States**.
  - **Cold knife (steel) dissection**: A scalpel is used to remove the tonsils, and electrocautery or sutures are used to obtain hemostasis.
  - **Snare tonsillectomy**: A snare with a thin wire loop at the end is used. Once the tonsil is freed, this device is placed around it to reduce bleeding.
  - **Harmonic scalpel**: Ultrasonic vibrations is used to remove the tonsils and stop bleeding at the same time.
  - Other methods include- **radiofrequency ablation** techniques, **carbon dioxide lasers**, and/or a **microdebrider** (which uses a combination of suction and cutting).
- Overall, the benefit of a particular technique depends on the cost, decreased complication rates (i.e., bleeding rates), time in the operating room, and postoperative pain.

- Cold” tonsillectomy is thought to result in less postoperative pain, while some studies show “hot” tonsillectomy results in less intraoperative blood loss and surgical time.
- Intracapsular tonsillectomy has been associated with less pain than extracapsular tonsillectomy.[3]

Anesthetic Planning:

Pre-Anesthetic evaluation[4]

- Evaluate for OSA severity
    - Polysomnography (PSG) may or may not be available
- If PSG is available, look at obstructive apnea/hypopnea index (OAHI), Respiratory disturbance index (RDI) and McGill oximetry score
- **AHI** is a summation of the number of obstructive apnea and hypopnea events during the sleep period that are greater than 10 seconds
        - No sleep apnea 0-0.9
        - Mild apnea 1-4.9,
        - Moderate apnea 5-9.9
        - Severe apnea >10
    - Moderate to severe OSA is associated with increased perioperative complications, such as breath holding, laryngospasm, and desaturations.
    - If a moderate or severe OSA is suspected, then discuss with the surgeon/family regarding a possible overnight stay or Pediatric Intensive Care Unit (PICU) admission.
    - Intraoperative management of children with OSA consists of using opioids sparingly, short-acting opioids like fentanyl, and awake extubation where appropriate.
- **RDI** is similar to AHI, except that it also accounts for respiratory-effort-related arousals that disrupt sleep
    - RDI > 20 per hour is associated with breath holding during induction
    - RDI > 30 is associated with laryngospasm and desaturation during emergence from anesthesia
- **McGill oximetry score** corresponds to increasing severity of the desaturation nadir during sleep
    - A score of 1 is normal. and a desaturation of 92% is the cutoff for normal children.
    - Scores 2, 3, and 4 correspond to desaturation nadirs of <90%, <85%, and <80%, respectively.

Discussion with family:

- Discussion with surgeon/ family regarding overnight stay or monitoring should be based on the severity of OSA and other patient comorbidities.
- High-risk patients that will need overnight admission
    - Moderate OSA
    - Age <3 years
    - Bleeding disorders
    - Long distance, poor family support
- High-risk patients that may need PICU admission
    - Severe OSA
    - Severe OSA with complications- right ventricular hypertrophy (RVH), pulmonary hypertension
    - Severe Obesity
    - Cor-pulmonale

- Syndromic children with significant comorbidities

OSA and Opioids:

- Patients with moderate to severe OSA and syndromic children with complex medical issues may be more sensitive to the respiratory effects of opioids.
- A possible mechanism may be an increase in the density of mu-opioid receptors in the respiratory centers of the brain
- Children with nighttime desaturation nadirs of <85% are twice as sensitive to opioids and would require half the dose of opioids to achieve equivalent analgesia as compared to children with less severe OSA (>85% desaturation nadir).

Specific room setup

- Airway- Oropharyngeal airway (OPA), laryngoscope, oral RAE (Ring, Adair, Elwyn) endotracheal tube (ETT).
- Monitors- Standard ASA monitors- EKG, pulse oximeter, non-invasive blood pressure, skin temperature
- IV fluids- adequate hydration, 20-30mL/kg to reduce PONV and pain
- Drugs:
  - Propofol 1-2 mg/kg
  - Opioids
    - Fentanyl 1-2 mcg/kg- Start with **0.5mcg/kg** if moderate/severe OSA
    - Morphine (based on ideal body weight) use low dose- **10-20 mcg/kg** and titrate slowly if given to patients with moderate/severe OSA
    - Hydromorphone- **5 mcg/kg** to begin with and titrate slowly in patients with moderate/severe OSA.
    - **Apnea test**- if the patient experiences apnea after a small opioid dose, **do not give more**, advise post-anesthesia care unit (PACU) of reduced dose.
      - If respiration is unchanged, titrate the opioid to a full dose
  - PONV prophylaxis
    - Dexamethasone 0.25-0.5 mg/kg up to 10 mg max
    - Ondansetron 0.1-0.15 mg/kg
  - Dexmedetomidine 0.5-1 mcg/kg
    - Opioid sparing and may lower the risk of emergence delirium
  - Ketorolac 0.5 mg/kg max 30 mg
    - Discuss with the surgeon before administration, given the possible increased risk of bleeding in chronic tonsillitis patients.
  - Acetaminophen IV 12.5-15 mg/kg or per oral (preoperatively)
  - Glycopylorate (5-10 mcg/kg) may be given for excessive secretions
- Blood- Usually not needed
- PICU bed- If severe OSA, SDB, complex medical issues

Intraoperative Considerations:

- **Induction**
  - Premedication with oral midazolam, if needed
  - Mask vs. intravenous induction
  - Be alert for airway obstruction, especially with enlarged tonsils and adenoids
    - OPA may be needed.
  - Avoid neck hyper-extension, especially in patients with trisomy 21, glycogen storage disease, and achondroplasia due to potential atlantoaxial instability

    - Use a video laryngoscope with the neck in a neutral position and minimal manipulation for intubation
  - Establish IV if not already present
  - Facilitate intubation with propofol (1 to 2 mg/kg), short-acting opioids (Fentanyl 0.5mcg/kg), and short-acting muscle relaxants, if needed
  - Use an oral RAE TT and secure in the midline.
    - Allows for the use of Crow Davis gag for suspension by the surgeon.
  - Avoid neck hyperextension during surgical suspension in patients with trisomy 21, glycogen storage disease, and achondroplasia, since these patients are at risk for atlantoaxial instability.

- **Positioning**
  - The patient is supine and the operating table is typically turned 90 degrees for the procedure.

- **Maintenance**
  - Inhalation
    - Establish return of spontaneous ventilation as soon as possible, titrate narcotics to the respiratory rate
    - Patients with OSA may have upregulation of opioid receptors
      - Use low doses of short-acting opioids (fentanyl 0.05mcg/kg) and observe the effects on spontaneous ventilation.
    - Reduce the FiO_2 to 30% as the surgeon will use electrocautery.
    - PONV prophylaxis
      - Dexamethasone and ondansetron

- **Hemodynamic and physiological goals**
  - Maintain systolic BP within 10 to 15% of baseline.
  - Maintain euvolemia and consider administering 15-20 mL of isotonic crystalloid to replace fluid deficit from fasting
  - Monitor blood loss
    - Usually very low if electrocautery is used
  - Watch for kinking of ETT in the Crow Davis gag when suspending the patient

- **Emergence**
  - Deep extubation[5]
    - Patients with frequent tonsillitis
    - Mild OSA with no sleep apnea
    - ASA 1 and 2 patients
    - Gently suction oral pharynx
    - Consider placing an oral airway after extubation and transporting the patient in the left lateral decubitus (recovery) position.

  - Awake extubation
    - Patients with moderate to severe OSA on PSG
    - Severe OSA with complications- Cor pulmonale, RVH
    - Syndromic patients- Trisomy 21, cerebral palsy
    - Craniofacial defects
    - Hypotonic patients
    - Opioid-sensitive patients with breath-holding spells

    - Minimize coughing
    - Consider low-dose narcotics (Fentanyl 0.5mcg/kg) or dexmedetomidine 0.5mcg/kg after extubation to calm the patient before transport

- **Post-operative care**
    - In the PACU, continuous pulse oximetry should be used for 2 hours before the patient goes home. If the patient is to be admitted overnight, they should be monitored in the PACU for 1-2 hours before going to a monitored floor/ICU bed, per institutional policy.
    - Patients are usually prescribed alternating doses of acetaminophen and ibuprofen after discharge.
    - A reduced dose of long-acting opioids may be considered in older children (greater than 5-10 years).
    - If tylenol is used pre- or intraoperatively, let the family know when they can use the next dose to avoid overdosing.

Case-Specific Complications/Pitfalls

- Emergence delirium
    - Higher incidence during otolaryngologic surgeries
- Carotid vessel tear
- Electrocautery-induced fire
    - Precautions
        - Cuffed ETT
        - Moist throat pack,
        - Decrease FiO_2 to 30 %
- Slow emergence- OSA patients, opioid-sensitive children
- Laryngospasm
- Bleeding
    - Primary bleeding within 24 hours of surgery
        - Usually brisk
        - Most commonly occurs within 6 hrs of surgery
- Secondary bleeding 24 hrs to 10 days after surgery
    - Eschar on tonsils sloughs off
    - 0.1%-2.5% incidence of bleeding
- Post-Tonsillectomy Hemorrhage is addressed in this SPA Case Guide

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