

Myringotomy and Ear Tube Placement/Upper Respiratory Infection

Rebecca Evans and William D. Ryan

A two-year-old girl presents for myringotomy and ear tube placement. Over the past few days, she has had clear rhinorrhea and a nonproductive cough. On arrival her oral temperature is 38.0°C and the perioperative nurse discusses case cancellation with you. Lung auscultation is clear bilaterally.

What Are the Indications for Myringotomy and Ear Tubes?

Children with frequent ear infections (three ear infections in a six-month period or four ear infections within one year) should receive myringotomy and ear tubes to prevent chronic hearing loss and/or a cholesteatoma as a result of the accumulation of fluid in the middle ear with subsequent infection. The criteria can be shortened if the child has demonstrated diminished hearing.

What Will Your Anesthetic Plan Be for This Child?

Myringotomy and ear tube placement is a relatively minor and short procedure. Nearly all anesthetics consist of mask anesthesia with sevoflurane, without intravenous catheter placement, unless there are additional patient factors that warrant a more invasive strategy. Some children will awaken with severe ear pain that typically lasts an hour or two. Pain management varies between centers, and ranges from oral to intramuscular use of opioids and/or nonsteroidal antiinflammatory agents.

A study by Stricker et al. suggested that a combination of intramuscular fentanyl (1.5 mcg/kg) and ketorolac (1.0 mcg/kg) was associated with optimal outcomes with respect to analgesia and postoperative nausea and vomiting.

What Are the Implications of This Patient's Respiratory Symptoms?

Viral upper respiratory tract infections (URIs) are frequent in children, especially during the winter months. Typical symptoms include rhinorrhea, congestion, cough, fever, and malaise. Subclinical manifestations may include upper and lower airway edema, increased respiratory tract secretions, pneumonia, and bronchial irritability.

What Are the Increased Anesthetic Risks in Children with a URI?

Intraoperative airway complications during general anesthesia appear to be more common in children with a URI. These include coughing, laryngospasm, bronchospasm, and hypoxemia. Infants under 12 months of age tend to have more intraoperative complications than older children, and use of an endotracheal tube as compared with a facemask or laryngeal mask airway (LMA) increases the risk of these complications, but even LMA placement may be associated with complications in children with a URI. Passive exposure to cigarette smoke and a history of atopy are additional risk factors.

Transient postoperative hypoxemia, postintubation croup, and postoperative pneumonia are probably more likely to occur in children with a URI. Long-term complications and true outcomes are difficult to define and quantify and may not differ between normal children and those with a current or recent URI.

In infants and children with a URI, apneic oxygenation is less effective; thus oxyhemoglobin desaturation may occur when, during rapid sequence induction, the child is not receiving positive-pressure ventilation.

Should This Case Be Postponed Until a Later Date?

When a child presents with a URI, it is intuitive that an elective procedure requiring general anesthesia should be postponed until the child is well. But, because so many children have a concurrent URI at the time of their scheduled surgery, and long-term negative outcomes have not been demonstrated, this decision process is complex. How, then, should the anesthesiologist decide when to cancel an elective procedure in a child with a URI? First, one should assess the severity of the child's illness. The child with a runny nose without additional findings may be suffering from vasomotor or allergic rhinitis, which is usually not associated with perioperative airway complications. The following factors are associated with an increase in perioperative complications:

- Significant coexisting medical disease (especially cardiac, pulmonary, or severe neuromuscular disease);
- History of prematurity;
- Lower respiratory tract signs (e.g., wheezing, rales);
- High fever ($>38.8^{\circ}\text{C}$);
- Productive cough;
- Major airway, abdominal, or thoracic surgery.

If any of these risk factors are present, it may be prudent to perform the procedure at a later date when the child is in better health.

On the other hand, there are a variety of additional factors that may influence your decision to proceed with surgery or cancel the case. The most common reason for proceeding with a case even though risk factors are present is the presence of a URI that will likely continue without surgical intervention. This occurs when children require adenoidectomy or myringotomy to relieve chronic middle ear fluid collections. Nonmedical factors that might sway you in favor of proceeding with the case are logistical family concerns, such as the parents taking a day off from work, difficulty obtaining day care, traveling a long distance at a great inconvenience to the family, etc. Since outcomes are not proven to be worse after surgery in children with a URI, these factors may play a role in the decision of whether or not to proceed. Most children who present with a URI have neither extremely mild symptoms nor severe symptoms. For these in-between children we must

use our judgment to determine the proper course of action based on what we believe is best for the child.

How Would You Alter the Anesthetic Management of the Child with a URI Compared with a Healthy Child?

Anesthetic management of the child with an active or recent URI should be tailored to minimize airway irritability. Administration of a neuromuscular blocker to facilitate tracheal intubation will prevent laryngospasm. Humidification of airway gases may prevent the thickening of secretions that is commonly encountered in these children. Some pediatric anesthesiologists will administer an anticholinergic agent, such as atropine or glycopyrrolate, to attenuate vagally mediated airway complications; however, this remains untested. When feasible, facemask or LMA anesthesia is preferred over endotracheal intubation.

Some clues to the risks of URI can be gleaned by the results of a 2010 study in over 9,000 patients. A positive respiratory history (nocturnal dry cough, wheezing during exercise, wheezing more than three times in the past 12 months, or a history of present or past eczema) in a child with a URI was associated with an increased risk for intraoperative bronchospasm, laryngospasm, and perioperative cough, desaturation, or airway obstruction. In addition, a history of at least two family members having asthma, atopy, or smoking increased the risk for perioperative respiratory adverse events. In 2019, the REACT trial suggests a reduced incidence of peri-operative adverse events in children undergoing adenotonsillectomy following pre-treatment with albuterol. Those children having received pre-treatment with albuterol had reduced incidence of laryngospasm, coughing, and oxygen desaturation.

If You Decide to Postpone the Case, When Is It Safe to Proceed with This Procedure?

There is no consensus when to schedule elective surgery following an acute URI. In a 1979 publication that described the development of lower respiratory symptoms during general anesthesia in children with a URI, McGill and colleagues from DC Children's Hospital wrote: "the optimal period of recovery from the URI

that should be allowed prior to considering the patient a candidate for an elective surgical procedure has not been defined.” Nearly 40 years later, this is still true. Subclinical pathology, such as airway edema, atelectasis, and bronchial reactivity may remain for up to

several weeks after the symptoms of the acute URI have resolved, depending on the specific type of viral agent. Three to four weeks seems to be a reasonable waiting time, but for many children this merely represents the period between successive illnesses.

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(2):283–5. PMID: 11506096.
- Stricker PA, Muhly WT, Jantzen EC, et al. Intramuscular fentanyl and ketorolac associated with superior pain control after pediatric bilateral myringotomy and tube placement surgery: a retrospective cohort study. *Anesth Analg*. 2017;124(1):245–53. PMID: 27861435.
- 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.
- von Ungern-Sternberg BS, Sommerfield D, Slevin L, et al. Effect of albuterol premedication vs placebo on the occurrence of respiratory adverse events in children undergoing tonsillectomies: The REACT randomized clinical trial. *JAMA Pediatr*. 2019 Apr 22. [Epub ahead of print] PMID: 31009034.