

Continuing Medical Education

Anesthetic management of pediatric adenotonsillectomy

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ADENOTONSILLECTOMY remains one of the commonest surgical procedures carried out in children. Historically, the chief indication was recurrent infection; however more and more children are now presenting with obstructive symptoms, and in the most severe of these cases, patients have frank obstructive sleep apnea syndrome (OSAS). The purpose of this Continuing Medical Education (CME) module is to discuss the management of a typical young child, with moderately severe OSAS, presenting for elective adenotonsillectomy. Specific issues relating to anesthesia for this situation will be addressed, as well as the general management of the child requiring anesthesia.

Obstructive sleep apnea syndrome (OSAS)

Clinical features

The prevalence of OSAS is 1–3% in children, and is one of the main indications for adenotonsillectomy in children.¹ In this population, surgery is generally a curative treatment for OSAS, which is demonstrated by an improvement in both symptoms and polysomnographic data.¹ Pediatric adenotonsillectomy is carried out in a variety of settings, which, in Canada, includes specialized pediatric hospitals, major academic centres and smaller community hospitals. Children with OSAS undergoing adenotonsillectomy are at significant risk of respiratory and cardiovascular complications, with a reported incidence up to 20%.^{1,2} Children at particular risk are the very young (< 2 yr) and those with significant co-morbidity.³

Diagnosis

Symptoms of OSAS in young children differ from those that are typical in adults. Daytime somnolence

and obesity, common with adult OSAS, are rare features in young children, who may present with failure to thrive, behavioural problems, and poor school performance.^{1,4} Symptoms are not reliable predictors of the severity of OSAS. However more definitive investigations, such as polysomnography (PSG), are not routinely available in all centres. Overnight oximetry provides some evidence as to the severity of OSAS, and this is a simpler, cheaper option than a full PSG.⁵ If the history is suggestive of OSAS, surgery might be recommended without further testing, and the patient has to be assumed to be at higher risk for perioperative complications.

Upper respiratory infection

Proceed or postpone?

Upper respiratory infections (URIs) are common in children, with most children experiencing six to eight episodes per year. There is evidence that airway reactivity persists for several weeks after an infection. The window of opportunity for providing anesthesia when the child is totally free of the effects of a URI is therefore small, so it is often appropriate to proceed with anesthesia if the infection is mild in nature. There appears to be a higher incidence of respiratory complications in the presence of a URI, however there appears to be very little residual morbidity. These studies are thoroughly reviewed by Tait *et al.*⁶ and recommendations are formulated regarding the circumstances when one should proceed with a case or postpone it. Independent risk factors for adverse respiratory events in children with active URIs include use of an endotracheal tube (ETT) in a child < 5 yr old, prematurity, reactive airway disease, paternal smoking, airway surgery, copious secretions, and nasal conges-

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tion.⁷ These data are reviewed by Tait *et al.*⁶ Often the wishes of the family, and social and geographic factors also need to be considered.

Anesthesia technique

Tait *et al.*⁶ present evidence that choice of anesthesia technique in the presence of a URI may improve outcomes. There is evidence that a laryngeal mask airway may be superior to an ETT,⁸ but the laryngeal mask airway has not been universally adopted for adenotonsillectomy. Agents with low potential for airway irritation, e.g., propofol and sevoflurane, appear preferable to more irritating agents, e.g., thiopental and desflurane. There is some evidence that anticholinergics may be useful in reducing airway reactivity in the presence of a URI, but definitive data are lacking in this area.⁶ Interestingly, there is no consensus that deep or awake extubation influences the incidence of adverse respiratory events in the presence of a URI.^{6,7}

Preoperative anxiety

Preoperative and induction anxiety is common in the pediatric population. According to a recent study, the factors most clearly associated with anxiety were younger age, anxious parents, previous behaviour problems at health-care attendances, a procedure longer than 30 min, and being admitted to hospital more than five times previously.⁹ Perhaps the best studied intervention to alleviate this anxiety has been premedication with oral midazolam, which has been shown in an evidence-based review¹⁰ to be safe and reliable. Other preoperative medications, such as clonidine,¹¹ may be effective but midazolam remains the gold standard. Any sedating agent may be hazardous in the presence of OSAS, so close monitoring must be employed after premedication is given. Parental presence at induction has not been shown consistently to have any benefit in terms of reducing anxiety in the child,¹² unless an intensive family-centered preparatory program is undertaken.¹³ Such programs are not generally available at present, and they do not appear to be better than midazolam.¹³ Several other, less conventional methods such as hypnosis¹⁴ may also be effective.

Anesthesia for adenotonsillectomy in a child with OSAS

Prophylaxis for pain, nausea and vomiting

There is no particular recommended anesthetic technique in the setting of adenotonsillectomy and OSAS. Operating early in the day appears to be associated with less postoperative oxygen desaturation.¹⁵ Young children with severe OSAS have a reduced require-

ments for opioid analgesia,¹⁶ so reducing the dose of opioid is entirely appropriate. Postoperative nausea and vomiting (PONV) is very common after pediatric adenotonsillectomy, with an incidence of 70% being reported. A recent meta-analysis showed that the optimal pharmacological approach in this population is the use of dexamethasone and an anti-serotonergic agent.¹⁷ Fluid loading may have a beneficial anti-emetic effect, although the pivotal publication that addressed this strategy in children was on patients undergoing strabismus surgery.¹⁸

Analgesics

Pain can be severe after adenotonsillectomy, and relief is commonly achieved by opioids, but other drugs and modalities should be considered. Clonidine is an effective analgesic in this situation,^{11,19} although over-sedation would be a concern in patients with OSAS. Preoperative acetaminophen seems to be a useful intervention for minor procedures such as myringotomy.²⁰ Additionally, a morphine-sparing effect of acetaminophen has been demonstrated in pediatric day-case surgery.²¹ Dexamethasone, in addition to its anti-emetic effect, is also effective in reducing post-tonsillectomy pain,²² and improves the return to a normal diet.²³ Infiltration with local anesthetic, although commonly used, is not supported by the available evidence.²⁴

Anti-inflammatory drugs

The use of non-steroidal anti-inflammatory drugs (NSAIDs) is controversial. There is no doubt that these drugs are effective analgesics, however fear of hemorrhage has limited their use, particularly in North America. A 1996 Canadian study,²⁵ showed that ketorolac was associated with a higher incidence of postoperative hemorrhage compared with codeine, and led many anesthesiologists to avoid this drug for adenotonsillectomy. A recent Cochrane Review,²⁶ however, showed that there is no increase in the incidence of hemorrhage compared with placebo, but many of the studies reviewed were small. Moreover, another quantitative review²⁷ stated that "the evidence for NSAIDs to increase the incidence of bleeding after tonsillectomy remains ambiguous" and a meta-analysis²⁸ concluded that "conventional NSAIDs ... increases the risk of reoperation for hemostasis...".

Airway

Traditionally the airway has been secured with an ETT during pediatric adenotonsillectomy, however the laryngeal mask airway has its advocates and there is some evidence that the incidence of airway com-

plications is lower than with an ETT.^{29,30} As well, the laryngeal mask airway may confer advantages in the presence of a URI.⁸ Most anesthesiologists, however, prefer the intraoperative security of an ETT.³¹ The studies that have examined “awake” vs “deep” extubations^{32,33} are somewhat dated, and the controversy is reviewed by Tait *et al.*⁶ A more recent study showed that if children are extubated deeply after adenotonsillectomy, the airway complication rate is less with sevoflurane compared to desflurane.³⁴

Laryngospasm

One of the most common complications after extubation after tonsillectomy is laryngospasm. Apart from the choice of airway device and anesthetic agents, other interventions have been suggested to help prevent this complication. During emergence from anesthesia, propofol (0.5 mg·kg⁻¹) has been shown to reduce the incidence of laryngospasm.³⁵ Lidocaine has showed varying effects in this regard, with some studies seeming to show a benefit,³⁶ and others failing to show this effect.³⁷

Postoperative management

Emergence agitation

The introduction of the newer agents, notably sevoflurane, has provided advantages in terms of airway stability and rapid awakening, but emergence agitation has become more prevalent. An in depth discussion of the problem is presented by Vljakovic *et al.*³⁸ Certain factors appear to increase the risk for this phenomenon. Apart from the choice of anesthetic agent (sevoflurane and desflurane being the main offenders), patient and surgical factors may be involved, notably young age, intense preoperative anxiety, and painful procedures.^{38,39} Although many areas of uncertainty remain,³⁸ various strategies have been proposed to lower the incidence of emergence agitation, such as using propofol rather than sevoflurane,⁴⁰ administering appropriate analgesia,⁴¹ and providing premedication with clonidine.^{11,42} Interestingly, premedication with midazolam does not seem to consistently reduce emergence agitation.¹⁰

Tracheal extubation

Airway events in the postanesthetic care unit (PACU) are more common after this procedure than most others. Whether the child’s trachea is extubated “awake” or “deep”, or whether the child has an ETT or laryngeal mask airway, there is still a requirement for experienced, skilled nursing staff in the PACU, and an ability to obtain help rapidly from an anesthesiologist. How long the patient should be monitored in hospi-

tal, and with what level of monitoring, is the subject of much debate. What is clear, however, is that the child is not cured of OSAS the moment the tonsils are removed. Nixon *et al.*⁴³ have shown clearly that there may be significant respiratory compromise during the first postoperative night following this procedure. A child with OSAS would meet the accepted criteria for overnight admission. Brown asks,¹ however, if otherwise healthy children with a diagnosis of OSAS may be appropriate candidates for day surgery, and points out that firm data are lacking in this area. Pending the arrival of such data, most centres would be wise to admit and monitor such patients who are currently deemed to be at high risk.

Hemorrhage

Managing the child with a hemorrhage post-tonsillectomy is a topic in its own right, and this complication has been reported up to 18 days postoperatively.⁴⁴ Massive delayed hemorrhage, although rare in children, may be fatal, and treatment is aimed at resuscitation and surgical control of the bleeding.

Pediatric module objectives

1. To review the anesthetic management of children with OSAS undergoing adenotonsillectomy, including preoperative assessment, choice of anesthetic agents, airway management, analgesia, and prevention of PONV.
2. To incorporate general issues relating to anesthesia for children, including preoperative anxiety reduction, and emergence delirium.
3. To understand the evidence with respect to management of a child presenting for tonsillectomy with an upper respiratory infection.
4. To formulate an appropriate plan for postoperative care, including admission criteria.

Instructions for completing the continuing medical education module

1. Read the key references (highlighted in **bold**) below. Additional material on the topic may also be found in the non-highlighted references.
2. Log in at: www.cja-jca.org to answer the multiple-choice questions related to this module. Only individual subscribers will be able to log in.
3. Check the expert’s explanation for the suggested correct answer.
4. After completing all the questions, compare your results with those participants who have already completed the module.

This program is accredited for ten hours (20 credits) under category 3 of the Royal College of Physicians and Surgeons of Canada Continuing Medical Education program.

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Required reading for this CME activity appears in bold.

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