Anaesthetic management of paediatric adenotonsillectomy

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Keywords: anaesthetic, management, paediatric adenotonsillectomy

Abstract

Tonsillectomy with or without adenoidectomy is one of the most frequent surgical procedures that are carried out globally. Although these children are often fit, anaesthesia for such cases can be associated with significant morbidity and mortality, and should not be undertaken lightly. An approach to the anaesthetic management of paediatric adenotonsillectomy is presented.

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Introduction

Tonsillectomy with or without adenoidectomy is one of the most frequent surgical procedures that are carried out globally. There has been an increase in the rate of adenotonsillectomies in recent years.

The two most common indications for tonsillectomy are recurrent throat infections and pharyngeal obstruction causing sleep-disordered breathing. In the USA today, 77% of adenotonsillectomies are performed for pharyngeal obstruction, compared to 88% of cases conducted for recurrent infection[1] in 1970.

Although it is a common procedure, it presents risks and challenges for both the surgeon and the anaesthetist. From a risk-benefit perspective, tonsillectomy is an elective procedure with more than average mortality. This is estimated to be approximately 1 per 10-20 000 cases.[2]

Although these children are often fit, anaesthesia for such cases can be associated with significant morbidity and mortality, and should not be undertaken lightly.

Lethal haemorrhage following adenotonsillectomy does occur, but less than one third of tonsillectomy mortality is attributed to bleeding.

Compared with adults, children had a twofold higher incidence of fatal respiratory events in the postoperative period, following adenotonsillectomy.[1]

Table I lists the frequency of death or profound brain injury from airway and bleeding complications following adenotonsillectomy.[1]

Potential problems with adenotonsillectomy can be minimised by careful preoperative assessment.

The main considerations in anaesthetic technique are:

- Preparation and premedication
- Providing good surgical access and "sharing the airway"

Table I: Frequency of death or profound brain injury from airway and bleeding complications following adenotonsillectomy[1]

Patient	Death or brain injury (%)
Children (n = 25)	
Airway (intraoperative)	4 (16)
Airway (postoperative)	11 (44)
Post-tonsillectomy and adenoidectomy haemorrhage	8 (32)
Adult (n = 11)	
Airway (intraoperative)	2 (18)
Airway (postoperative)	2 (18)
Post-tonsillectomy and adenoidectomy haemorrhage	4 (36)

- Optimising perioperative analgesia
- Preventing postoperative nausea and vomiting
- Airway management in recovery
- Awareness of the risk of postoperative haemorrhage.

Day-care tonsillectomy involves careful patient selection and good communication with families regarding the postoperative phase and potential complications.

Criteria for suitability include:

- Uncomplicated medical history
- Acceptable social circumstances, including ease of access to transport, and the ability to return to the hospital within one hour
- Preoperative information for parents.

Risk factors for respiratory complications following adenotonsillectomy include:

- Obstructive sleep apnoea syndrome
- Young age
- Medical co-morbidity.

The overall risk is the product, not the sum, of the independent risk factors.

Preoperative assessment and premedication

In addition to the standard components of a preoperative assessment, recent upper-respiratory infection, upper-airway obstruction during sleep, bleeding diatheses and co-existing syndromes are particularly pertinent.

A history of active or recently resolved upper-respiratory tract infection is commonly elicited in children scheduled for adenotonsillectomy.

Fitness for anaesthesia should be assessed on a case-by-case basis. Generally, a child with clear nasal secretions who is systemically well, with no associated fever or chest signs, is considered to be fit for anaesthesia. A cough is a sign of increased airway irritability, and portends an elevated risk of airway complications, such as breath-holding, laryngospasm and desaturation.

A history of increased bruising or easy bleeding should be sought and investigated.

Children scheduled for adenotonsillectomy typically experience varying degrees of upper-airway obstruction when sleeping. Sleep-disordered breathing and obstructive sleep apnoea syndrome will be discussed in more detail in a separate section.

It is often appropriate to give premedication in the form of a sedative drug to ensure a calm child at induction. Midazolam 0.5 mg/kg per os (maximum 20 mg) is the most frequently prescribed agent. Sedation is contraindicated in a child with evidence of upper-airway obstruction or symptoms of obstructive sleep apnoea.

Analgesia in the form of paracetamol and a nonsteroidal anti-inflammatory drug (NSAID) may also be given as premedication to ensure that plasma levels are adequate by the end of surgery.

Surgical access and "sharing the airway"

The gold standard for securing a child's airway is a tracheal tube. A preformed south-facing tube is preferable. A large number of tonsillectomies have been undertaken with a laryngeal mask airway (LMA). However, there is a learning curve associated with the use of LMA in tonsillectomies, and it is usual to use a reinforced LMA. When the Boyle Davis mouth gag is inserted, it is crucial that the airway remains unobstructed, and that the endotracheal tube is still correctly positioned.

Perioperative analgesia

Analgesia post-adenotonsillectomy is notoriously difficult to manage. However, it is important to manage the pain effectively, not only for humane reasons, but also to permit an early return to eating and drinking ,which both reduce the risk of postoperative bleeding and infection.

After tonsillectomy, children experience significant pain and severe functional limitation for seven days after surgery. For many children, pain and functional limitation persists throughout the second postoperative week.[3] Pain medication postoperatively should be given as a regular schedule, rather than waiting for the child to complain of pain.

The SASA South African Acute Pain Guidelines recommendations for tonsillectomy[4]

Good practice point

As significant levels of pain, behavioural disturbance, sleep disruption, and altered activity, can persist for five to eight days following tonsillectomy, regular administration of paracetamol and a NSAID may be necessary during this period. Information for families about pain assessment and medication use following discharge is particularly important.

Recommendations

A combination of individually titrated opioids and regularly administered mild analgesics (a NSAID and/or paracetamol) is required for the management of tonsillectomy pain.

Local anaesthetic injection in the tonsillar fossa may improve pain scores, reduce time to first oral intake, and reduce the incidence of referred ear pain following tonsillectomy.

Tramadol can produce similar analgesia to morphine or pethidine.

Intraoperative intravenous ketamine does not provide significant postoperative advantage, compared with an opioid.

Implementation of standardised protocols, including intraoperative opioid ± antiemetic, a perioperative NSAID (diclofenac or ibuprofen) and paracetamol, are associated with acceptable pain relief and low rates of postoperative nausea and vomiting.

The use of NSAIDS in adenotonsillectomy has been the subject of ongoing debate. A Cochrane review of this issue concluded that there is no evidence that NSAIDs, with the exception of ketorolac, cause bleeding that increases the need to return to theatre, and that moreover, postoperative nausea and vomiting is reduced when NSAIDs are used. Post-tonsillectomy haemorrhage rates with ketorolac range from 4.4-18%. Therefore, the use of ketorolac should be avoided.

Prevention of postoperative nausea and vomiting

One of the most important morbidities associated with paediatric adenotonsillectomy is postoperative nausea and vomiting. This occurs in up to 70% of children who do not receive prophylactic antiemetics.[5] Postoperative nausea and vomiting is acutely distressing to the patient,

and may necessitate overnight hospital admission. It is associated with decreased patient satisfaction, and increased use of resources. A systematic review from the Cochrane Collaboration showed that children receiving dexamethasone were less likely to vomit in the first 24 hours, than those receiving placebo.[6] In addition to having a beneficial effect on postoperative nausea and vomiting, dexamethasone also decreases throat pain after tonsillectomy, and time to resumption of oral intake. Varying doses have been used, but a dose of dexamethasone 0.15 mg/kg seems to be efficacious.

Other methods used to reduce this unpleasant side-effect include:

- Premedication, e.g. trimeprazine 2-3 mg/kg
- Propofol for induction and maintenance
- Avoidance of nitrous oxide
- Routine antiemetic administration, e.g. ondansetron 0.15 mg/kg
- Use of intravenous fluids 20 ml/kg
- Opioid-sparing techniques, e.g. local anaesthetic infiltration, NSAIDs.

Airway management in recovery

It is important to ensure that the pharynx is clear of blood and secretions before extubation. This is best carried out under direct vision, making sure there is no clot at the back of the nasopharynx. The use of local decongestant drops, e.g. oxymetazoline drops, in the nose intraoperatively, promotes patent nasal passages postoperatively. This enhances patient comfort in the early recovery period, and decreases the sensation of claustrophobia. Both "deep" and awake extubation is acceptable. Each method has pros and cons. Extubation is best performed in the left lateral position, with a slight head down tilt, to facilitate safe drainage of any blood.

There is a close association with the type of surgery and laryngospasm. Tonsillectomy and adenoidectomy have the highest incidence of laryngospasm (21-26%).[7]

Although most cases of laryngospasm are self-limiting, it may persist, and if not appropriately treated, may result in serious complications that could be life-threatening. Morbidity from laryngospasm includes cardiac arrest, post-obstructive negative pressure pulmonary oedema, pulmonary aspiration, bradycardia and oxygen desaturation. Various strategies have been suggested to reduce the incidence of laryngospasm on extubation. Topical lignocaine 2% sprayed to the glottis at 4 mg/kg, or 2% intravenous lignocaine given at 1 mg/kg five minutes before extubation are fairly effective in preventing laryngospasm following adenotonsillectomy. Magnesium sulphate 15 mg/kg in 30 ml 0.9% NaCl over 20 minutes after tracheal intubation has also been suggested to reduce the incidence of laryngospasm post-adenotonsillectomy. Propofol 0.25-0.5 mg/kg intravenously prior to extubation has also been shown to be effective.[7]

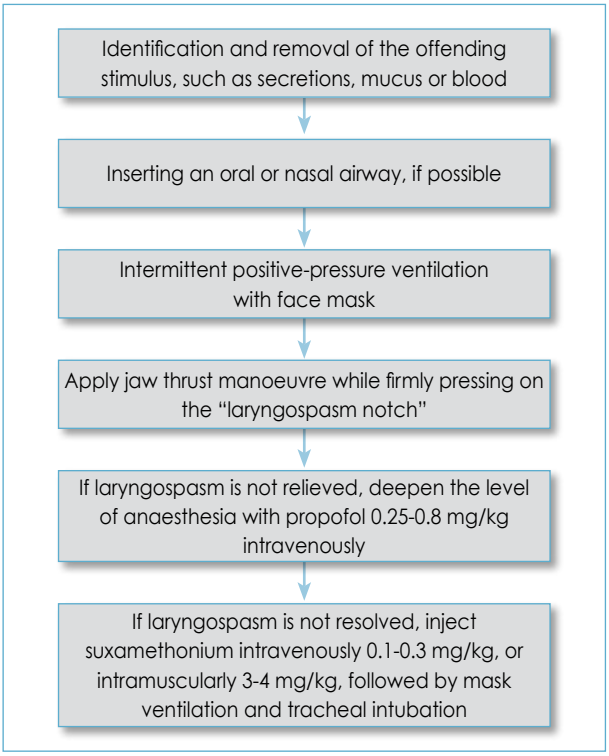

Figure 1: A simplified algorithm for the treatment of laryngospasm[7]

Figure 1 provides a simplified algorithm for the treatment of laryngospasm.[7]

Postoperative haemorrhage

Post-tonsillectomy haemorrhage is an infrequent, yet serious, complication. Primary bleeding, usually defined as occurring within the first 24 hours, occurs in < 1% of patients. Secondary bleeding, with an incidence of up to 4%, usually occurs 5-12 days following the initial procedure.[8]

The anaesthetic management of these cases is challenging, and can be fraught with hazards. Children undergoing emergency surgery for post-tonsillectomy haemorrhage represent a unique group of patients at risk of life-threatening complications which can be minimised with proper preparation for airway management and blood-volume resuscitation.

The main factors to consider are:

- The child may be hypovolaemic.
- The stomach may be full of swallowed blood.
- Repeat anaesthetic.
- A potentially difficult airway.

Circulatory compensation is remarkable until about 40% of the blood volume has been lost, and hypovolaemia is thus often masked. Signs that should be looked for are increased swallowing, pallor, and an unexplained tachycardia. A full blood count, clotting screen and cross-match should be taken, and the child adequately resuscitated prior to commencement of anaesthesia.

The previous anaesthetic chart should be reviewed for the size of endotracheal tube used, and drugs given. Skilled assistance and good suction are vital.

Either a rapid-sequence intubation, or an inhalational induction, with the child in the left-lateral, head-down position, is acceptable. The anaesthetist should choose the method with which he or she is most familiar and comfortable. A range of different sized endotracheal tubes needs to be available in case of airway oedema. After intubation, a large-bore nasogastric tube should be placed, and the stomach emptied. Opioid analgesia, given previously, should be taken into account if further doses are deemed necessary. An awake extubation should be carried out.

Obstructive sleep apnoea

Sleep-disordered breathing (SDB) represents a spectrum of disorders ranging in severity from primary snoring to obstructive sleep apnoea (OSA). The prevalence of OSA in the paediatric population is 1-3%. As many as 5-27% of children have primary benign snoring.[1]

SDB is characterised by recurrent, partial, or complete upper-airway obstruction during sleep, resulting in disruption of normal ventilatory and sleep patterns. The diagnosis of SDB in children may be based on history, a physical examination, audio or video taping, pulse oximetry, or limited or full-night polysomnography (PSN). The presence or absence of snoring neither includes nor excludes SDB, as not all children who snore have SDB. The diagnosis is usually informal and subjective, based on parental reports. In a minority of patients, objective information will be available in the form of results from overnight pulse oximetry or formal PSN.

Table II details the signs and symptoms of sleep-disordered breathing in children.[9]

Table II: Signs and symptoms of sleep-disordered breathing in children[9]

Night-time symptoms	Daytime symptoms	Signs
Snoring Apnoea Arousals or wakening Enuresis Night sweats Difficult to rouse in the morning	Daytime sleepiness Hyperactivity Poor concentration	Obesity Tonsillar hyper-trophy mouth breathing Failure to thrive

Risk factors for postoperative complications in children with OSA undergoing adenotonsillectomy are:[9]

- Age younger than three years old
- Cardiac complications of OSA
- Failure to thrive
- Obesity
- Prematurity
- Recent respiratory infection
- Craniofacial anomalies
- Neuromuscular disorders.

Children with OSA are more prone to develop airway obstruction in the postoperative period. The development of idiopathic pulmonary oedema following the relief of upper-airway obstruction has also been reported. In severe OSA, the hypoxaemia and hypercarbia that result from the cyclical obstruction-hypoventilation-arousal sleep pattern in these children can produce a compensated respiratory acidosis and pulmonary hypertension. In end-stage disease, cor pulmonale and cardiac arrhythmias can result.

Sedative premedication is relatively contraindicated in patients with OSA, as it may compound upper-airway obstruction during, or even before, induction. If children with significant OSA have a compensated respiratory acidosis, ventilating such patients to normocapnia will delay the return to spontaneous ventilation at the end of the procedure. Children with OSA are very sensitive to the sedative effects of premedication, general anaesthetic agents and opioids. Postoperative observation in a high-care unit or intensive care unit is obligatory.

Conclusion

Overall, the approach to the child needing adenotonsillectomy requires a comprehensive awareness of multiple, sometimes conflicting concerns, and challenges the anaesthetist to balance risks with reality.

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