

The child with a runny nose!

Upper respiratory tract infection in children: impact on anaesthesia

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ABSTRACT

Some children have on average of six upper respiratory tract infections (URTI) per annum. There are strongly held opinions about the management of these children when they may present for surgery. Anaesthesia practice varies widely and is often based on anecdotal experience. This brief review offers guidelines to address this problem based on some of the recent literature.

Introduction

Children frequently have upper respiratory tract infections (URTI). It therefore stands to reason that they will present for surgery with an acute infection or soon after a recent URTI. The issue of whether to proceed with elective surgery on a child with an URTI has been a source of debate for many years.

Children may present with a broad spectrum of signs and symptoms. The dilemma of whether to cancel, proceed or postpone is one that the anaesthesiologist is faced with on a regular basis. All too often, particularly in day-case surgery, this decision is left to the anaesthesiologist. Anaesthetists frequently feel pressurised by the family or surgeon, or dictated to by medical insurance schemes, to make last-minute decisions prior to surgery – sometimes against their better judgement!

Defining the problem

In reviewing the literature, little uniformity could be found and no single definition of a URTI can be applied universally. Definitions vary from one publication to the next but, essentially, children fall into three categories.^{1,2}

Firstly, there are those who are clearly unwell and present with generalised symptoms that include fever, malaise, rhinorrhoea (clear or purulent), sore or scratchy throat, sneezing, nasal congestion, productive cough and chest signs, i.e. lower respiratory tract involvement. This group is simple to deal with and surgery *should be postponed* unless it is an emergency. This group is excluded from most studies.

The second group develops symptoms a day or two before the elective procedure, the parents call the surgeon or anaesthetist the night before, surgery is cancelled and they are rescheduled for *two weeks* later and the child returns with minimal or no symptoms. Alternatively, a conversation with the parents clarifies the severity of the symptoms and a decision is made to re-evaluate the child on the morning of surgery.¹

But the majority of children fall into the third category, i.e. they have had URTI symptoms for days or even weeks and are stable or improving. Most studies exclude the first and second group and only include those with mild URTI symptoms.

Many researchers select certain surgical procedures and times of the year to ensure maximal enrolment for their study. Two of the following

symptoms or signs are sought to satisfy inclusion criteria: fever $>38^{\circ}\text{C}$, malaise, rhinorrhoea (clear or purulent), sore or scratchy throat, sneezing, wheeze, nasal congestion, and cough with or without sputum. These have become the accepted signs and symptoms for most studies.^{3,4,5}

In reviewing the literature related to URTI, it is necessary to ask whether one viral infection can be compared with another, and whether all viral infections have the same symptoms. Some strains are clearly more virulent than others and some may have a greater effect on the outcome. Furthermore, there are many conditions other than viral infections that may have two or more of the symptoms described above.

Natural course of disease

Although URTI implies an upper airway problem, the upper and lower airways are almost always involved to a variable degree. Viral infections damage the ciliary apparatus and mucosal epithelium, exposing the underlying nerve endings. Consequently, the airway is sensitised to the irritant effect of inhalational agents and to secretions. Airway smooth muscle activity is enhanced. This is thought to be a vagally-mediated reflex.

Furthermore, ventilation-perfusion mismatch occurs, and closing volume increases with a reduction in functional residual capacity. These children are thus prone to episodes of desaturation. Although the clinical symptoms resolve, usually within two weeks, the airway irritability may persist for six to eight weeks. It is the severity of these subclinical changes that influences the decision to defer surgery.²

Potential anaesthetic problems

Airway-related events, which are the most common adverse anaesthetic problem, include airway obstruction bronchospasm, laryngospasm, breath-holding, post-extubation croup, stridor, cough, desaturation and bradycardia,^{2,8} Anecdotal reports of atelectasis, pneumonia and even deaths have been reported.

Factors that have been shown to increase the risk of respiratory events occurring include children with more symptoms (particularly those with *nasal congestion* and *copious secretions*), airway instrumentation in children under five years, surgery involving the airway, a history of reactive airways or snoring, prematurity, parental confirmation of the presence of an URTI and passive smoking.^{2,4} Young infants under six months are at greatest risk.

A recent study using logistic regression established that no specific sign or symptom was associated with adverse respiratory events on emergence and thus could not be used to predict an adverse event.⁶ Their results suggested that a low-grade fever may even be protective, since fewer adverse events were recorded in those children with mild fever.⁶ The authors postulate that this may be due to the release of a mediator.

Viral myocarditis, a particularly difficult clinical problem to diagnose, has been described in a number of sudden deaths under anaesthesia.^{9,10,11,12} However, rare unsuspected myocarditis remains a major concern in the child with symptoms of a 'cold'. Viral myocarditis should be borne in mind, particularly in the presence of unexplained tachycardia or in the event that the child is slow, or fails to respond to resuscitation.

Other considerations

When assessing the child preoperatively it is important to determine whether the symptoms are related to an allergy (usually seasonal) or whether they are prodromal symptoms of an infectious disease (e.g. measles, mumps, chicken pox, rubella or meningococcal infection) that may put other patients or staff at risk. Children with symptomatic HIV invariably have an irritable airway, particularly those with an intercurrent infection.

Some syndromic children may have a persistent mucopurulent rhinitis (Downs, Hurler-Hunter syndrome, cleft palate) that may also influence the decision. In these children, rhinitis is common and it is important to establish whether there has been a change, which would suggest an acute or chronic infection. Unilateral rhinorrhoea suggests a unilateral nasal obstruction (foreign body, polyp).

When is it safe to anaesthetise?

The ideal time to reschedule surgery is far from settled. Airway hypersensitivity and reactivity persist for up to six weeks, particularly if the lower airway is involved (some authors suggest that the lower airways are always involved!) Children may have between three to eight URTIs per annum. In some instances, it could be conceivable that if surgery is delayed for four to six weeks after each episode there may be only a small window when the child is asymptomatic and 'fit' for surgery.

With modern anaesthetic agents it may not be necessary to delay surgery for as much as six weeks. Tait et al showed that the incidence of easily treatable airway complications was similar in the acutely symptomatic and in those who had symptoms for four weeks.⁴ In this study, which included 1 078 children (one month to 18 years) with *mild* URTI symptoms, they showed that children who presented for elective surgery with a recent URTI (within four weeks) fared as well as those with acute symptoms. They concluded that, as long as there is careful airway management, most of these children undergo elective procedures without increased morbidity or long-term sequelae. There was no statistically significant difference in the incidence of laryngospasm or bronchospasm in the children with acute or recent URTI with mild symptoms compared with the asymptomatic children. Although these children have an increased risk of adverse respiratory events (coughing, breath-holding, desaturation), these are easily treatable.

Schreiner *et al.* showed that nearly 2 000 cases would have to be cancelled to prevent 15 cases of laryngospasm.⁷ Delaying or cancelling the

procedure does not significantly alter the incidence of adverse respiratory events. Little is gained except to create an inconvenience for the family and all others concerned in order to prevent an easily treatable problem occurring in the minority of patients.

Predicting which child with URTI is likely to have an adverse event is not easy. This has only recently been analysed according to presenting symptoms only.⁶ Predicting outcome using preoperative tests has not been extensively studied. Testing pulmonary functions is an added expense and is difficult to perform, particularly in infants and younger children. Exhaled nitric oxide levels correlate with the severity of the airway reactivity during and after URTI. Exhaled carbon dioxide levels in asthmatics correlate with the severity of bronchospasm. Patient cooperation is required to obtain accurate results. In a prospective study, adverse events of URTI could not be predicted using exhaled carbon dioxide.

Management of adverse airway events

The management of adverse respiratory events intra-operatively should evolve according to the particular circumstances, the cause, the drugs and the equipment available, and the child's underlying condition. Most events respond to simple manoeuvres, such as continuous positive airway pressure support (CPAP), and simple therapeutic measures, such as bronchodilators (best given intravenously). Suxamethonium 1 mg/kg, lignocaine 1 mg/kg, endotracheal intubation and short-term ventilation should all be considered and used as indicated. Deepening the anaesthesia without compromising the child may also bring resolution.

Is there an ideal anaesthetic?

Whether there is an ideal anaesthetic is also a matter of debate. Because of differences in study design and a lack of uniformity regarding the types of design and surgical procedures (and the duration thereof), the types of airway instrumentation as well as the choice of anaesthetic for the child with a URTI, there have been no real answers. The anaesthetic management should aim to reduce the stimulation of a potentially irritable airway. Propofol has major advantages over other agents. Isoflurane and desflurane, on the other hand, both cause significant airway irritability and should be avoided.²

Any airway instrumentation is associated with more adverse respiratory events.^{5,10} Using a face mask is considered the method of choice whenever possible.^{2,4,7} The laryngeal mask airway (LMA) has fewer complications^{2,6,13} than endotracheal intubation, which in some studies, is associated with as much as an 11-fold increase in adverse events.⁵ The mask airway is therefore considered the least likely to cause an adverse event, followed by an LMA and then endotracheal intubation.^{2,5,6} The risk of deep extubation is no different from awake extubation.

Prophylactic anticholinergic agents and bronchodilators have been suggested to reduce secretion-related respiratory events. The theory is that by reducing secretions, the risks would be less or the vagally-induced airway reflexes could be obtunded. In a recent study comparing glycopyrrolate with a placebo, no difference was detected between the two groups, suggesting that an anticholinergic provides no benefit.¹⁴ In fact, when laryngospasm did occur, children in the glycopyrrolate group were more likely to receive succinylcholine to overcome the spasm. Furthermore, children in the glycopyrrolate group complained of dry mouth,

flushing and dizziness. In a separate study, Ellwood et al. established that prophylactic bronchodilators (albuterol, ipratropium) also had little effect on adverse respiratory events.¹⁵

Does the decision to proceed affect outcome?

Most published studies include relatively minor surgical procedures. There is some evidence that the postoperative recovery and time to discharge are not affected by URTI. The course of the URTI may in fact be shortened by bilateral myringotomy and the placement of ventilating tubes (grommets).

Major surgery, such as cardiac surgery for congenital disorders, is often postponed in the face of a URTI. In many situations, however, a four- to six-week delay may be detrimental to the appropriate timing of surgery. A recent study showed that, with modern perioperative care, the outcome and length of hospital stay for paediatric cardiac patients were similar to those without URTI.¹⁶

Economic factors

In today's economic climate and managed healthcare environment, other factors may come into the equation. These include the distance travelled to the hospital, whether the parents have taken special leave, the attitude of the family, and the number of previous cancellations. The impact of cancellation upon the family can be substantial. Disruption of the operating schedule and the cost of staffing an operating room that goes unused are further considerations. These should not directly influence the decision – but realistically they often do! Ultimately, the safety of the child should be the primary consideration.

Conclusion

In the preoperative assessment of children with URTI, the anaesthetist should focus on signs and symptoms that quantify respiratory secretions. Parents are useful guides to the status of their child's condition and to any changes from baseline symptoms. Children with coexisting pulmonary disease, particularly reactive airway disease, and infants under six months of age with an active URTI are at greater risk.²

The final decision should rest with the individual anaesthesiologist and his or her ability, experience and comfort level in managing predictable

complications in a child with URTI. Clearly, those with more experience may be prepared to proceed with younger patients with or without additional pathology, while those with less experience may not. Whatever the decision, it should be respected, and the anaesthesiologist should not be pressured into a procedure that he/she is not prepared to undertake.

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