

# Associated medical conditions in children

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## Abstract

Children with acute and chronic associated medical conditions often present for surgical and radiological procedures. An understanding of the implications of these conditions for anaesthesia is important in preventing perioperative adverse events. In this article, we outline the relevant clinical features of some of the commonly encountered associated medical conditions and provide guidance on the current evidence for the perioperative anaesthetic management of these children.

**Keywords** Asthma; autism; cerebral palsy; children; diabetes mellitus; Down's syndrome; gastro-oesophageal reflux; obesity; obstructive sleep apnoea; preoperative assessment; sickle cell disease

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## Upper respiratory tract infection

Upper respiratory tract infections (URTIs) are prevalent among children (those under 4 years have on average eight URTIs per year) and they are the most common cause of elective surgery cancellation. They include rhinosinusitis (common cold), sinusitis, pharyngitis/tonsillitis, ear infections and laryngitis. Most studies define URTI as two or more of the following symptoms: rhinorrhoea, sore throat, sneezing, nasal congestion, malaise, cough or fever more than 38°C.

Airway hyper-reactivity is common after an URTI and can persist for up to 6 weeks. Children with URTIs or within 2–4 weeks of cessation of symptoms are at increased risk of perioperative respiratory adverse events. While the incidence of serious events is low, children have a 2- to 7-fold increased risk of laryngospasm, bronchospasm and hypoxaemia, 11-fold if their trachea is intubated. However, routine cancellation of every child with a URTI is impractical for both families and hospitals.

Factors that increase the risk of adverse events in children with URTI:

### URTI related:

- fever (>38°C)
- purulent and copious secretions
- malaise, lethargy, decreased appetite
- lower respiratory tract signs
- respiratory syncytial virus.

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## Learning objectives

After reading this article, you should be able to:

- identify the specific anaesthetic implications of children with upper respiratory tract infections, asthma, obstructive sleep apnoea, cystic fibrosis, sickle cell disease, anaemia, obesity, diabetes mellitus, renal failure, cerebral palsy, epilepsy, autism, Down syndrome, oncological diseases, latex allergy, pregnancy, gastro-oesophageal reflux and those on long-term steroids
- perform a focused preoperative assessment to establish the severity and current status of these children
- formulate an individualized anaesthetic plan for the safe perioperative management of children with these medical conditions

### Child factors:

- age <1 year
- history of prematurity
- sickle cell disease
- history of snoring
- history of reactive airway disease
- parent's perception of child 'having a cold'/'being sick'
- parental smoking.

### Anaesthesia and surgery factors:

- airway instrumentation (endotracheal tube (ETT) > supraglottic airway (SGA) > face mask)
- airway surgery
- inhalational induction
- major surgery
- anaesthetist with limited paediatric anaesthesia experience.

There is no evidence for the best timing of general anaesthesia in children with URTIs. Children with significant URTI symptoms, especially if they have any other risk factor, should have elective surgery deferred for at least 2 weeks if possible. Management decisions in these children should be individualized and involve a senior anaesthetist.

### Anaesthetic management

- Avoid use of benzodiazepine for premedication, if required consider using clonidine.
- Give preoperative inhaled salbutamol 10–30 minutes prior to surgery.
- Consider intravenous (IV) induction with propofol over inhalational induction in high-risk children.
- Avoid desflurane.
- Consider IV lignocaine to suppress laryngospasm but avoid topical lignocaine to vocal cords.
- A facemask or supraglottic airway (SGA) should be used in preference to an endotracheal tube (ETT) if appropriate.
- When using an ETT, use uncuffed instead of cuffed where possible.
- Suction the airway before extubation.
- Deep extubation/SGA removal might reduce the risk of respiratory adverse events but might increase the risk of airway obstruction.

- Airway problems must be anticipated on induction and emergence.

## Asthma

Asthma is one of the most common chronic diseases and a leading cause of morbidity in children worldwide. The median age of onset is 4 years, and in pre-pubertal children males are more affected than females. Children are at a higher risk of asthma-related morbidity and mortality compared with adults. Symptoms of asthma in children include recurrent episodes of wheezing, dry cough, chest tightness and dyspnoea. The disease is characterized by reversible airway hyper-reactivity, inflammation and obstruction. Airway obstruction can be more severe in children, for a given severity of illness, due to their smaller airway diameter. Risk factors include atopy, allergens, infection, obesity and exposure to tobacco smoke. Asthma may be precipitated by URTI, aeroallergens, exercise, emotion and cold air. The severity of asthma can be established by the level of treatment required to control symptoms. Children with a history of reactive airway disease and atopy are at increased risk of perioperative bronchospasm. There are three mechanisms of perioperative bronchospasm: mechanical, anaphylactoid and anaphylactic, with the most common being mechanical. In line with this, the periods of highest risk are during intubation and extubation. In a recent study, the rate of perioperative respiratory adverse events in school aged children was 12%. The majority of these events occurring in the emergence and recovery phases.

## Preoperative assessment

When evaluating a child with asthma it is important to establish whether their asthma is well controlled (Table 1). If poorly controlled, consideration should be given to referral back to their primary care physician or respiratory specialist for optimization prior to surgery. History should focus on the frequency and severity of symptoms, activity level, current medication including steroids, emergency attendances, hospital and intensive care admissions, recent URTIs, previous reactions to anaesthesia and tolerance of non-steroidal anti-inflammatory drugs (NSAIDs). Physical examination should be comprehensive, assessing the presence of tachypnoea, cyanosis, wheeze, crepitations and increased work of breathing (tracheal, intercostal and subcostal recession, prolonged expiratory phase, and use of accessory muscles). Up to 15% of asthma sufferers have nasal polyps and this should be considered when nasal intubation may be required. Routine peak expiratory flow rate (PEFR) testing in children with well-controlled asthma is unnecessary, difficult to perform in children under 5, and does not correlate with severity of illness or degree of hypoxia.

All asthma medications should be administered on the day of surgery to ensure optimal treatment prior to surgery. Premedication with oral midazolam 0.5 mg/kg (maximum 20 mg) reduces anxiety-related bronchospasm. Preoperative inhaled or nebulized bronchodilator 1–2 hours before surgery improves lung function and attenuates the increased airway resistance associated with tracheal intubation. Where surgery is urgent and asthma is considered poorly controlled, oral prednisolone 1 mg/kg/day for 3–5 days or IV methylprednisolone 1 mg/kg should be considered.

## Assessing asthma control (Global Initiative for Asthma)

Asthma symptoms	Level of asthma symptom control		
	Well controlled	Partly controlled	Uncontrolled
In the last 4 weeks, has the patient had:	None	1–2	3–4
• Daytime asthma symptoms > twice a week?			
• Nocturnal waking due to asthma?			
• Reliever need for symptoms > twice a week?			
• Any activity limitation due to asthma?			

Table 1

## Anaesthetic management

- In patients with severe asthma, avoid histamine-releasing drugs such as atracurium, mivacurium, thiopentone, morphine and suxamethonium. Propofol, ketamine, vecuronium, rocuronium and fentanyl are preferable.
- Poorly controlled asthmatics should be treated by an experienced paediatric anaesthetist.
- Intubation should be avoided if possible. If necessary, ensure adequate depth of anaesthesia, and ensure the ETT is not close to the carina as this is a potent trigger of bronchospasm.
- In controlled ventilation, aim to avoid hyperinflation, air trapping and barotrauma by prolonging expiration, adjust I:E ratio to prevent breath stacking, keep respiratory rate near or below physiologic range, and use a PEEP of 3–5 cmH<sub>2</sub>O.
- Topical lignocaine increases the risk of perioperative respiratory events.
- Desflurane increases airway resistance and should be avoided. Sevoflurane is preferred.
- Reversal agents such as neostigmine increase bronchial secretions and airway reactivity, but this is attenuated if administered with glycopyrrolate. There is little evidence on the use of sugammadex in children with asthma; however, a single centre study showed a 2.6% increase in bronchospasm in adults with pulmonary disease.
- If the child has been on regular oral steroids or on high-dose inhaled steroids within the past two months, (greater than 800 mcg beclomethasone or equivalent) supplementary intravenous steroids need to be administered perioperatively (i.e. hydrocortisone 2 mg/kg at induction).
- NSAIDs should only be avoided in children with severe or brittle asthma, nasal polyps, and in those with history of previous adverse reactions to NSAIDs.
- Nebulized bronchodilators should be prescribed post-operatively if children unable to use metered dose inhalers (e.g. abdominal surgery).

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