

# Paediatric anaesthesia update

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There are several insights and publications that have changed the face of paediatric anaesthesia around the world in recent years. In particular, preventing respiratory adverse events and hypoxic episodes remains a primary goal, given their persistent occurrence in day to day practice. Small adaptations to the conduct of anaesthesia will assist with both recognising high risk patients and also preventing adverse events. In addition to this, the nuance of providing safe and high-quality anaesthesia care includes improving how we communicate with children, and a critical look at the choice of induction technique – mask is not always best!

## 1. APRICOT – Incidence of severe critical events in paediatric anaesthesia: a prospective multicentre observational study in 261 hospitals in Europe

Despite being four years old, this publication in the Lancet continues to be heavily referenced in any discussion about modern paediatric anaesthesia. Five years ago, an update such as this would almost certainly have included a section on our current understanding of neurotoxicity and its relevance. Our concerns in this regard are now significantly lessened, instead we now know the conduct of our anaesthesia is the most important factor. This study was designed to look at the incidence and nature of severe critical events in children undergoing anaesthesia. Children from birth to 15 years were recruited in 261 European hospitals across 33 countries in Europe. The incidence of severe critical events was 5.2% - a surprisingly high number. Roughly 5% of these had an immediately poor outcome and most were respiratory in nature - we know respiratory adverse events remain more common than we care to believe. Key takeaways from the APRICOT group were that the experience of the anaesthetist had a bearing on the risk of severe critical events, the rate of respiratory and cardiovascular events reduced with anaesthetist experience (1% and 2% reduction respectively for each additional year of experience). Also, respiratory adverse events reduced by 12% with each additional year of age. A history of prematurity roughly doubled the risk. Understanding the causes and risk factors for adverse events becomes important when planning the conduct of anaesthesia.

### Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe

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**Summary**  
Background Little is known about the incidence of severe critical events in children undergoing general anaesthesia in Europe. We aimed to identify the incidence, nature, and outcome of severe critical events in children undergoing anaesthesia, and the associated potential risk factors.

**Methods** The APRICOT study was a prospective observational multicentre cohort study of children from birth to 15 years of age undergoing elective or urgent anaesthesia for diagnostic or surgical procedures. Children were eligible for inclusion during a 2-week period determined prospectively by each centre. There were 261 participating centres across 33 European countries. The primary endpoint was the occurrence of perioperative severe critical events requiring immediate intervention. A severe critical event was defined as the occurrence of respiratory, cardiac, allergic, or neurological complications requiring immediate intervention and that led (or could have led) to major disability or death. This study is registered with ClinicalTrials.gov, number NCT01878706.

**Findings** Between April 1, 2014, and Jan 31, 2015, 31 127 anaesthetic procedures in 10 874 children with a mean age of 4.35 years (SD 4.50) were included. The incidence of perioperative severe critical events was 5.2% (95% CI 5.0–5.5) with an incidence of respiratory critical events of 3.1% (2.9–3.3). Cardiovascular instability occurred in 1.9% (1.7–2.1), with an immediate poor outcome in 5.4% (3.7–7.5) of these cases. The all-cause 30-day in-hospital mortality rate was 10 in 10 000. This was independent of type of anaesthesia. Age (relative risk 0.88, 95% CI 0.86–0.90; p<0.0001), medical history, and physical condition (1.60, 1.40–1.82; p<0.0001) were the major risk factors for a serious critical event. Multivariate analysis revealed evidence for the beneficial effect of years of experience of the most senior anaesthetist team member (0.99, 0.983–0.997; p<0.0048 for respiratory critical events, and 0.98, 0.974–0.99; p<0.0039 for cardiovascular critical events), rather than the type of health institution or providers.

**Interpretation** This study highlights a relatively high rate of severe critical events during the anaesthesia management of children for a variety of reasons. It is essential to assess variables in the service of paediatric

## 2. Difficult airway and videolaryngoscopy in children

We are often lead to believe that difficult airways are rare in children. To a certain extent this is true, however difficult airways will be encountered – where are we at in our recommendations on management?

### a. Avoid multiple attempts at tracheal intubation

As far back as 2011 NAP4 included 13 paediatric cases, 9 of which were under age 4. Harm was

recorded due to repeated intubation attempts. They recommended calling for help early, involving ENT early, and to avoid repeatedly using a technique that has already failed.

Following this the PeDI Registry recorded significant increase in complications where there were >2 intubation attempts (including cardiac arrest and severe airway trauma). Complications went up with each subsequent attempt, with smaller children being at the greatest risk. Again they recommended there should be no more than two attempts at direct laryngoscopy before proceeding to videolaryngoscopy.

Despite these two studies being well known and reported, the Apricot Group also showed that in 38 of the difficult intubations reported, 28 failed to receive an alternative technique, proving that “*old habits die hard*”, and despite the evidence there is still a problem with adhering to guidelines.

Rather than continuing to try what has already failed, change technique.

*b. Videolaryngoscopy has become a well-established part of paediatric practice*

The PeDI registry demonstrated significantly greater first time and eventual success with videolaryngoscopy (VL) vs direct laryngoscopy (DL), which was logical given the study specifically looked at children with known difficult direct laryngoscopy. The question of which VL to use however remains a difficult one to answer, given the plethora of different devices now available.

Further data from this registry was published in BJA in 2020. Authors postulated that hyperangulated blades would be more successful than standard curvature. In fact, what they found was that in children over 5kg they performed the same, but in smaller infants (<5kg) the hyperangulated blades performed worse. The take-home point, however, is that any videolaryngoscope may work, and do not fret about the right one. Rather, focus on changing your technique when you have failed.

The Lancet also published an RCT in 2020 demonstrating the benefits of videolaryngoscopes in infants, and highlights their benefit for both teaching and routine use.

*c. Apnoeic oxygenation is now emphasized for airway management.*

Hypoxaemia during intubation is a common occurrence. Nasal cannula oxygenation even at low flows for pre-oxygenation, but also during routine intubation, ensures adequate oxygenation even during prolonged airway manipulation or difficult intubation. At Starship Hospital we are moving towards having nasal cannulae routinely attached to the machines in theatre to encourage and facilitate this practice. High flow oxygen also has a place where the practitioner is familiar with its use.

### 3. Preventing respiratory events in the age of RSV

2021 has seen a huge uptick in the number of RSV infections in our communities. This has translated into a significant burden of inpatient admissions, and also highlights the increased risk of anaesthesia in the child with an URTI or viral infection. Top tips include:

*a. Pre-op salbutamol*

Salbutamol has long been used pre-emptively prior to surgery in patients deemed at risk of bronchospasm. There has been conflicting evidence as to whether it conveys benefit, however the

RSV virus outbreak: 'Record-breaking' numbers flock to after hours and emergency departments as winter illness takes hold



REACT trial published in JAMA Paediatric in 2019 demonstrated a reduction in respiratory adverse events in children undergoing tonsillectomy who had pre-op salbutamol. This is a clinically significant finding, especially given the volume of tonsillectomies performed, and also the high rate of respiratory adverse events observed during this procedure. Salbutamol should be considered in all these patients, particularly if there is moderate-severe OSA or any other respiratory risk factors.

*b. Consider an IV induction*

Inhalational induction of anaesthesia has been the predominant mode of induction in children in New Zealand over the last two decades. This is largely historical and institutional. At Starship Hospital we have actively tried to change our culture to support more IV inductions. One major benefit of this is a probable reduced rate of respiratory adverse events when propofol is used rather than sevoflurane, as well as the inherent safety of having IV access prior to embarking on induction.

**PERIOPERATIVE MEDICINE**

**Inhalational versus Intravenous Induction of Anesthesia in Children with a High Risk of Perioperative Respiratory Adverse Events**

*A Randomized Controlled Trial*

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**ABSTRACT**

**Background:** Limited evidence suggests that children have a lower incidence of perioperative respiratory adverse events when intravenous propofol is used compared with inhalational sevoflurane for the anesthesia induction. Limiting these events can improve recovery time as well as decreasing surgery waitlist and healthcare costs. This single center open-label randomized controlled trial assessed the impact of the anesthesia induction technique on the occurrence of perioperative respiratory adverse events in children at high risk of those events.

**Methods:** Children (N = 500; 0 to 8 yr) with at least two clinically relevant risk factors for perioperative respiratory adverse events and deemed suitable for either technique of anesthesia induction were recruited and randomized to either intravenous propofol or inhalational sevoflurane. The primary outcome was the difference in the rate of occurrence of perioperative respiratory adverse events between children receiving intravenous induction and those receiving inhalation induction of anesthesia.

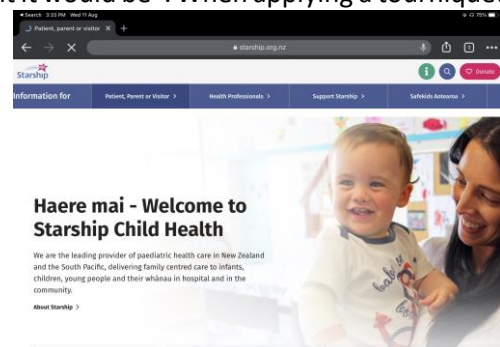
**Results:** Children receiving intravenous propofol were significantly less likely to experience perioperative respiratory adverse events compared with those who received inhalational induction of anesthesia.

**4. Talking to patients and whanau about anaesthesia**

We are living in an age of anxiety, where anxiety in children is increasingly prevalent, particularly in relation to hospital encounters. Induction of anaesthesia has been found to be a particular source of anxiety, with up to 80% of children experiencing this. Increased anxiety can lead to increased perception of pain, increased analgesia requirement, increased length of stay and prolonged behavioural disturbance post-operatively. The language we use to communicate our plans and our roles have a significant bearing on how a child will experience their trip to theatre.

When talking to children be sure to introduce yourself and build rapport and engage them by talking about their interests. Aim to seed positive suggestions and avoid minimising language (“just a little needle”). Direct conversation to the child and not their parents, and avoid nocebo words (sharp, needle, pinch, sore). Substitute positive or neutral explanations such as “you will have a special straw to give you medicine to help you feel relaxed and sleepy and comfortable”. Elicit and reframe concerns e.g. “most children find it was much easier than they thought it would be”. When applying a tourniquet do not describe it as a “tight band” instead tell them they may notice their arm feeling heavy and like they can’t feel it properly any more. The active imaginations that children have mean the words we use can have a significant bearing on their experience of any given medical intervention.

Please refer to the Starship pre-operative information now publicly available on the Starship website.



**5. More on IV inductions**

Starship is now trying to change our environment to support more intravenous induction of anaesthesia. Benefits include: possible reduction in respiratory adverse events, inherent safety, likely less post-operative behavioural disturbance, a faster and smoother induction, a reduction in mask phobia and distress associated with being restrained. The short-lived anxiety about IV insertion is considerably less than the prolonged distress that will occur when restraining an older child to

facilitate a mask induction. It's also perfect for TIVA! (My preferred anaesthetic in children)

*References:*

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