

## Challenges in Anaesthesia Management in Pediatric Patients

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### Abstract

Anesthetic management of pediatric patients is uniquely challenging. Approach to the pediatric patient must consider heightened preoperative anxiety and its postoperative behavioral and pain effects. Surgeries can range from simple ambulatory procedures to complex and extensive operations. A large part of the anesthetic care includes pain management, management of concomitant disease, and risk reduction for adverse events. Anesthetic perioperative concerns discuss various methods of pain control used during various surgical operation in pediatric patients is crucial. Frequent respiratory infections can complicate timing of surgery and anesthetic care. Perioperative pain management usually involves a multimodal pharmacologic approach with the goal of minimizing opioid requirements. Regional anesthesia is valuable for postoperative pain control. Safety of its use in the pediatric population has been confirmed in recent studies. This review provides insights on the different challenges in handling anaesthesia in padiatrics and pharmacologic and other way of managements for the same.

**Keywords:** PCOS, Diabetes Mellitus, BMI, Glucose, Lipid Profile, Insulin, Insulin Resistance, Hirsutism.

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### Introduction

Pediatric anesthesia as a subspecialty has evolved because the needs of infants and young children are fundamentally different from those of adults. The pediatric anesthesiologist should be aware of the child's cardiovascular, respiratory, renal, neuromuscular, and central nervous system responses to various drugs, as well as to physical and chemical stimuli, such as changes in blood oxygen and carbon dioxide tensions, pH, and body temperature. Their responses are different both qualitatively and quantitatively from those of adults and among different pediatric age groups. More important, the pediatric anesthesiologist should always consider the child's emotional needs and create an environment that minimizes or abolishes fear and distress. There have been many advances in the practice of anesthesia to improve the comfort of young patients. These advances include a relaxation of preoperative fluid restriction, more focused attention to

the child's psychological needs with more extensive use of preoperative sedation via the transmucosal route, the wide use of topical analgesia with EMLA cream before intravenous catheterization, and more generalized acceptance of parental presence during anesthetic induction and in the recovery room. Furthermore, a more diverse anesthetic approach has evolved through the combined use of regional analgesia, together with the advent of newer and less soluble volatile anesthetics, intravenous anesthetics, and shorter-acting synthetic opioids and muscle relaxants. Finally, the scope of pediatric anesthesia is expanding as pediatric anesthesiologists assume the role of pain management specialists beyond the boundary of perioperative care. The conduct of paediatric anaesthesia presents many unique challenges. One of the most striking is the variability of behaviour and responses of children and their parents at induction. Behavioural problems, the need for restraint, difficult IV access and co-morbidities add complexity and can make the art of maintaining a calm and smooth induction incredibly difficult. We are presenting the challenges that anaestheticians faced while handling the operations in the pediatric patients.

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**Challenge 1: Anxiety**

Children who are anxious at induction are more likely to experience distress on emergence, and into the post-operative period [1]. Known risk factors are the children with previous behavioural problems (e.g. distress or anxiety) during a health care or hospitalization[2]. Anxious parents are add on to the development of anxiety in child. Behavioural disorders including autistic spectrum disorder (ASD), attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD). The level of anxiety is varied depending on the age of patients. This can be managed by the non-pharmacological and pharmacological interventions.

**Non-pharmacological anxiolysis:** It is important to use age appropriate distraction techniques. Child interventions (Passive), child interventions (Interactive), child interventions (Mask introduction), parental presence, parental interventions are the some useful non-pharmacological practices[3,4].

**Pharmacological anxiolysis:** The practice of premedication is heterogeneous across institutions and can be dependent on institutional culture and patient populations. Key factors for safe and successful premedication are giving premedication enough time to work, ensuring availability adequate monitoring facilities and selection of appropriate agents based on previous experiences, severity of anxiety or behavioural disturbance and comorbidities.

Combination therapies using lower dose ranges of oral ketamine (3 mg/kg) plus midazolam (0.3 mg/kg), oral ketamine 3mg/kg and clonidine 3mcg/kg are useful. While medication, possible contraindications such as unfasted, difficult airway, critically unwell, end organ dysfunction such as liver or renal failure must need to consider[5,6].

**Challenge 2: Behavioral disorder**

Some children may not have a specific diagnosis such as ASD, ADD and ADHD, but parental reporting of difficulties with behaviour should also be considered when planning in the perioperative period. Parents or carers form a vital part of a smooth perioperative pathway. Discussion with the parents regarding behaviour and compliance is important to assess likelihood of peri-operative co-operation. It is also important to consider the implications of therapy on anaesthetic practice. Children with ASD, ADD and ADHD can be medicated with a wide range of psychoactive drugs and stimulants. There have been case reports of increased drug requirements for sedation and anaesthesia, and various haemodynamic effects e.g. refractory hypotension with risperidone [7,8].

**Challenge 3: Resistant child**

Children are often reluctant to have a stranger hold a mask on their face (mask acceptance) or insert an intravenous cannula. There are a limited number of specific guidelines on restraint in paediatrics. Local policies should be consulted to ensure local protocols are adhered to[9,10].

**Challenge 4: Unfasting**

Some clinical circumstances require anesthesia to commence prior to adequate fasting. Children are also more prone to gastric stasis with minimal trauma, opioid analgesia, and pain[11]. The place of paediatric rapid sequence induction remains controversial. At times, even when a rapid sequence induction is indicated, performance is impossible e.g. difficult IV access or non-compliance with pre-oxygenation[11]. In this setting attempts should be made either to site an IV prior to induction or minimize disturbing the patient during an inhalational induction (e.g. movements or cannulation when 'light'). It is important to have suction available and voice concerns about potential aspiration to other staff. The anaesthetist should also ensure airway assistant is comfortable performing cricoid pressure.

**Challenge 5: Access difficulty**

Careful assessment of venous options prior to any attempts will allow selection of the best site. Application of a topical local anaesthetic agent can be used to reduce pain associated with cannulation without negatively impacting on success rates.<sup>12</sup> Parental application (e.g. at home prior to presenting to hospital) of these agents has also been shown to be effective[12]. If an IV induction is planned it is reasonable to use topical local anaesthetic agents when able.

**Challenge 6: Airway differences –Infant Vs Adult**

Airway anatomy make the potential for technical airway difficulties greater in infants than in teenagers or adults. The airway of infants differs in five ways

1. The relatively large size of the infant's tongue in relation to the oropharynx increases the likelihood of airway obstruction and technical difficulties during laryngoscopy
2. The larynx is located higher (more cephalic) in the neck, thus making straight blades more useful than curved blades
3. The epiglottis is shaped differently, being short, stubby, omega shaped, and angled over the laryngeal inlet; control with the laryngoscope blade is therefore more difficult
4. The vocal cords are angled, so a "blindly" passed endotracheal tube may easily lodge in the anterior commissure rather than slide into the trachea

5. The infant larynx is funnel shaped, the narrowest portion occurring at the cricoid cartilage. Adult larynx is cylindrical and the infant larynx is funnel shaped. In infants or young children, an endotracheal tube that easily passes the vocal cords may be tight in the subglottic region because of the relatively greater proportional narrowing at the level of the cricoid cartilage. For this reason, that uncuffed endotracheal tubes have generally been preferred for children younger than 6 years.

#### General challenges

Equal consideration should be given to patient extubation to minimize the droplet and aerosol generation, with a comparable or higher risk of respiratory complications as compared to intubation [13]. Although it is unclear whether there is a benefit to deep extubation of patients, it has been predicted as protective for aerosol generation [14]. One meta-analysis has shown that deep extubation in pediatric patients may be protective against coughing and desaturation but may lead to increased airway obstruction [15], and second study showed that deep extubation was associated with an increased risk of severe respiratory critical events [16]. Adjunctive medications to minimize coughing after extubation can also be considered, including dexmedetomidine, remifentanyl, fentanyl, or lidocaine [17]. Although nonspecific, patients with severe COVID-19 have substantially higher inflammatory markers (CRP, procalcitonin), as compared to those with mild disease, which may provide predictive value for postoperative complications [17]. Preoperative intravenous fluid resuscitation should be considered as dehydration and malnutrition were recurrent patient related issues.

#### Type of Anesthesia

- Available appropriate anesthetic agents should be used in weight related doses
  - The anesthesia technique should be aimed at fast-track surgery with early extubation in operating room
  - Regional blocks such as paravertebral and caudal should be considered for perioperative pain control
- Cardiology, surgical, perfusion, and intensive care training was undertaken simultaneously by other team members. Different anaesthetic agents used for the pediatric patients is summarized in the table 1, adapted from Kelly et al., 2017 [13].

#### Developmental Considerations

1. A preterm infant is one born before 37 weeks gestation; a postmature infant is one born after 42 weeks gestation.
2. Any infant born at less than 2500 g is considered a low-birth-weight infant.

3. Plotting weight against gestational age allows classification into three general categories: a) small for gestational age, b) appropriate for gestational age c) large for gestational age.

4. Infants who are small or large for gestational age often have developmental problems or difficulties associated with maternal disease.

5. Careful physical and neurologic examination at birth allows a fairly accurate estimate of gestational age.

6. The anesthesiologist should be aware of this type of evaluation so that potential problems can be anticipated.

7. Obtaining a perinatal history of problems during pregnancy (e.g., maternal drug abuse, maternal infection, eclampsia, diabetes) or during and after delivery (e.g., fetal distress, meconium aspiration, prematurity, postdelivery intubation) is also valuable for assessing possible anesthetic implications that may require

#### The induction of general anesthesia in children

Parental presence at induction is routinely used as a method to reduce the anxiety at the induction of anesthesia in children; however, the practice increases the use of PPE supply and potentially increases health-care provider virus exposure from the caregiver [14]. Sedative premedication is recommended to minimize anxiety and the risk of crying with subsequent aerosol generation. If no intravenous route for sedation is available, other routes of administration (oral or intranasal) may require a careful assessment of risks and benefits. Intranasal administration has been cautioned against because of concerns for induced coughing, although this complication is relatively rare [18]. It is important to highlight that bitter-tasting oral solutions containing midazolam will also induce responses such as spitting, coughing, and crying [16]. A unique consideration for pediatric anesthesia is the usual practice of performing inhalational inductions in patients presenting without intravenous access. Although an intravenous technique may be preferred to minimize aerosol generation during induction<sup>14</sup>, especially in children with a high risk for perioperative respiratory event, the process of securing intravenous access preoperatively in children could itself cause crying and generate aerosols and droplets. However, the excitation phase of inhalational induction can also induce coughing or breath holding, necessitating bag mask ventilation, which itself generates further aerosols. The decision of the method of induction will therefore be patient- and anesthesiologist-dependent after a balance of the risks and benefits in each specific situation [17]. When proceeding with an inhalational

induction, there is suggestion that the induction time can be shortened using a higher initial concentration of sevoflurane, with no significant increase in undesirable effects such as cough, laryngospasm, or breath holding[18]. A tight seal with the facemask and avoiding high gas flows may be beneficial to minimize any exposure to personnel in the room.

#### Insights on challenges

Establishing local sustainable pediatric care in developing countries providing both initial and continued training may produce impact on reducing mortality rates and increasing success rate in pediatric surgeries. Anesthesia technique is a global challenge. The main focus of visiting anesthetic team should be to reduce total perioperative and anesthetic-related mortality with evidence-based best practice. Simplification of the care should be the primary anesthetic technique for pediatric anaesthetic procedures. Regional blocks such as paravertebral and caudal should be considered for perioperative pain control. Behavioral counselling is major factor for the success of pediatric surgery.

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