Induction Dilemmas in Pediatric Anesthesia Practice

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OBJECTIVES

Participants in this problem-based learning discussion will:

1. Identify some of the induction dilemmas associated with the difficult or compromised pediatric airway.
2. Discuss the psychosocial and clinical issues relevant to the care of the pediatric patient in the peri-induction period.
3. Develop strategies to address these issues and dilemmas in pediatric anesthesia practice.

STEM CASE - KEY QUESTIONS

Case # 1: A 12 year old male with Down Syndrome and a history of recurrent tonsillitis is scheduled for an elective T & A. His parents state he has always snored loudly at night but are uncertain if there have been episodes of apnea. Past history is significant for a VSD repair at the age of 15 months.

The same day surgery unit has called you because the child refuses to get undressed or allow vital signs to be taken. Wt. = 60 kg.

Is there additional information you would like about this patient? Studies?

What are your concerns in caring for this patient with Down syndrome? Possible obstructive sleep apnea?

Discuss your options for safely proceeding ahead with this elective surgical procedure? Premedication? Induction?

Case # 2: An 18 month old female is scheduled for an emergent laryngoscopy and bronchoscopy for removal of a foreign body in the trachea. Her father states his daughter was eating peanuts at the time of the aspiration.

In the holding room, the child is crying with a SaO_2 of 96%. Auscultation of the lungs reveals bilateral expiratory wheezing. Wt. = 12 kg.

Is there additional information you would like about this patient? Studies?

What are your concerns in caring for this patient with a foreign body in the airway? That is wheezing?

Discuss your options for safely proceeding ahead with this emergent surgical procedure? Premedication? Induction?

Case # 3: A 3 month old female is scheduled for an urgent exploratory laparotomy for suspected intussusception following a barium study. The child was an uncomplicated term delivery and has

been otherwise healthy. The mother says her child's pediatrician would like to obtain a genetic work-up in the near future.

On physical exam in the holding area, you note an infant with severe micrognathia and dysmorphic facial features. Wt. = 6 kg.

Is there additional information you would like about this patient? Studies?

What are your concerns in caring for this patient with intussusception? A potential genetic disorder? A possible difficult airway?

Discuss your options for safely proceeding ahead with this urgent surgical procedure? Premedication? Induction?

PROBLEM BASED LEARNING DISCUSSION

"Welcome to my Nightmare"

Anesthesiologists that care for children recognize the challenges of managing the psychosocial and clinical aspects of the peri-induction period. There is evidence that the risk of adverse perioperative events is higher for pediatric patients [1]. Many of these adverse events involve complications related to the airway and respiratory systems. While there are guidelines, such as the ASA Difficult Airway Algorithm, to assist in developing an approach to the airway management during induction, the airway anatomy and respiratory physiology of the pediatric patient can present unique challenges compared to their adult counterpart [2]. Often, the ability to perform an awake or sedated intubation is limited by the age and level of cooperation of the child, especially if the child is developmentally delayed. Hence, the usual difficult airway management scenarios may have to be creatively modified for the pediatric patient.

Children with a history of uncooperative behavior present a special challenge in planning for a safe, secure, and humane induction; especially, when paired with a significant co-morbidity such as obstructive sleep apnea or a difficult airway.

Down Syndrome, Premedication, and Obstructive Sleep Apnea

Down syndrome is one of the best-known genetic disorders. There is variable mental retardation; therefore, the demeanor and level of cooperation may also be quite variable. The airway abnormalities are known to most anesthesiologists and may include: macroglossia, mid-face hypoplasia, a high-arched palate, baseline tonsillar and adenoid hypertrophy, a short neck, and a relatively small trachea. In addition, the cervical spine can be a concern with a high incidence of atlanto-axial instability.

There is a higher incidence of obstructive sleep apnea in children with Down syndrome relative to the general population. One study has indicated that the prevalence of obstructive sleep apnea may be as high as 75-80 % in a random sampling of children with Down syndrome studied prospectively by polysomnography [3]. In a child with longstanding obstructive sleep apnea, a detailed history and physical exam should be performed to rule out potential cardiopulmonary

sequelae such as pulmonary hypertension. This preoperative assessment may also need to include an EKG, CXR, or echocardiogram.

While there is little doubt that children with obstructive sleep apnea are at increased risk for hypoventilation and acute airway obstruction related to the administration of a sedative/hypnotic, it is difficult to quantitate this risk for any given patient. Appropriate monitoring for signs of airway/respiratory compromise for any patient at risk should follow the administration of a premedication. Options for premedicating and managing the hard-to-control patient will be discussed during this PBLD.

Spontaneous vs Controlled Ventilation with a Foreign Body in the Airway

Children with foreign bodies in the airway need to be approached in an individualized manner consistent with the severity of the child's distress, the suspected location and type of foreign body in the tracheobronchial tree, and the experience of the anesthesiologist and surgeon. Advantages of an inhalational induction include maintenance of normal respiratory mechanics and breathing, avoidance of positive pressure ventilation advancing the foreign body more distally into the tracheobronchial tree, and prevention of a hypothetical ball-valve obstruction. Advantages of a rapid sequence intravenous induction with muscle relaxation include early protection of the airway, more rapid achievement of a relaxed, anesthetized patient for laryngoscopy/bronchoscopy, avoidance of possible laryngospasm and/or coughing during critical portions of the procedure, and avoidance of high doses of an inhalational anesthetic with the potential myocardial depression.

There is no evidence that one approach is associated with fewer adverse events than the other [4]. Determining the best approach based on the experience of the practitioner, the nature of the foreign body, and the child's presentation will be addressed during this PBLD.

Awake vs General for a Difficult Airway with a Full Stomach

A variety of techniques have been reported and described in the literature regarding the management of the difficult airway in children [5]. The basic principle of maintaining spontaneous ventilation, intact protective airway reflexes, and some level of cooperation until a difficult airway has been secure can be limited by a child's ability to understand and cooperate with this relatively traumatic experience.

Many genetic disorders are associated with a difficult airway as well as congenital heart defects [6]. The presence of maxillofacial abnormalities such as micrognathia, macroglossia, midface hypoplasia, high-arched palate, or a small mouth may be consistent with a difficult intubation. During the physical exam, signs of upper airway obstruction such as nasal flaring, noisy breathing, or chest retractions should be sought. These findings may indicate a tendency for upper airway obstruction during induction and mask ventilation. Fortunately, many children with maxillofacial abnormalities can be mask ventilated without difficulty. In the case of the child presenting with a full stomach, one must weigh the risks of prolonged exposure of an unprotected airway in a child at risk for aspiration with the potential risk of airway compromise. If possible, direct laryngoscopy should be considered prior to induction to assess the airway

anatomy. Many of the described approaches to the difficult pediatric airway are similar to those commonly used in the adult patient and will be discussed in greater detail during this PBLD.

”The Best Defense is a Good Offense”

While it is important to have a primary anesthetic plan (plan A) performed in an optimized setting, it is equally important to have a back-up plan (plan B) with the necessary personnel and equipment available on an emergent basis.

For many years, flexible fiberoptic laryngoscopy has been a mainstay of the management of the difficult airway. A fiberoptic technique is most successful when used initially under optimized conditions. The technique becomes much more difficult once the airway has been traumatized and conditions have become suboptimal. The use of an LMA has also become a part of most anesthesiologist’s difficult airway protocol. In addition, a LMA can be used as a guide and conduit when performing a challenging fiberoptic intubation in a sedated or anesthetized patient. Light wands, Bullard laryngoscopes, and retrograde techniques have been used electively with success in the difficult airway. However, securing an airway in an acutely distressed child may require a more invasive technique if adequate ventilation and oxygenation cannot be established quickly given the pediatric patient’s predisposition to desaturate rapidly. Someone skilled in the establishment of an airway through invasive techniques such as the placement of a cricothyroid catheter and jet ventilation or an emergency tracheotomy should be available. One may consider having an otolaryngologist available on standby in the event rigid bronchoscopy and/or a surgical airway is required.

Again, your plan A should be your best option that: 1) employs a technique with which you are experienced, 2) with personnel that know the plan and have been instructed how to assist you, 3) under the safest conditions you can create for the patient medically and psychologically. If possible, your plan B should fulfill all of the above criteria as well as being available on an emergent basis.

Note: A focus of this PBLD will be to discuss and develop a plan A and a plan B for each of the above case scenarios.

REFERENCES

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4. Litman RS. Anesthesia for tracheal or bronchial foreign body removal in children: an analysis of ninety-four cases. Anesth Analg 2000;91:1389-91
5. Rasch DK. Anaesthesia for Treacher Collins and Pierre Robin syndromes: a case report of three cases. Can Anaesth Soc J 1986;33:364-70
6. Butler MG. Specific genetic diseases at risk for sedation/anesthesia complications. Anesth Analg 2000;91:837-55

LEARNING SUMMARY

Participants in this problem-based learning discussion will discuss the management of the difficult or compromised pediatric airway in the peri-induction period. The induction dilemmas presented will include elective as well as emergent case scenarios.