Anesthesia for Common Pediatric Surgical Emergencies: Are You Well Equipped?

Santhanam Suresh, MD, FAAP

The operating room (OR) is an environment where all cases are performed. Perhaps the most difficult ones are the pediatric emergencies. Most children and infants differ from adults in several aspects. (i) they do not, at most times, have a history of anesthetic exposure; (ii) they are generally healthy and do not have cardiopulmonary problems. This leads to a scenario where they are healthy yet have underlying pathology that leads to a potential for rapid deterioration in their conditions. This paper will deal with 4 major clinical pediatric emergency scenarios that are seen in most hospitals that may lead to rapid alteration in a child’s condition. (Table 1)

Preoperative preparation: It is important to understand a few common themes with all of these patients. This includes any family history of complications associated with anesthesia including, but not limited to, a history of malignant hyperthermia. In addition, a thorough history of experiences with anesthesia as well as any associated abnormalities including congenital heart disease and other congenital anomalies is important to obtain before providing anesthesia. Preoperative fasting guidelines are important, however, except for pyloromyotomy, most of these patients will have some degree of urgency and will require rapid anesthetic care. It is important to also keep in mind that the presence of trauma can decrease gastric emptying time. The main caveat in urgent versus emergent surgery is to recognize the nature of intervention needed and the condition of the patient.

Pyloric Stenosis: This is a fairly common emergency that can occur at most institutions. There is an incidence of 1:500 in all live births with a propensity to occur in first-born males. They are often healthy infants who otherwise have a recurrent history of vomiting and often present to the emergency department with significant dehydration. They often present with hypochloremic, hypokalemic metabolic alkalosis. However, there are studies that also observed a hyperkalemic state in some infants.

Preoperative preparation: It is crucial that the infant is well hydrated. These infants are generally significantly dehydrated with absent skin turgor and with a sunken fontanelle. In addition, due to significant vomiting, it is important to ensure that the child is also not hypoglycemic at the time of presentation. It is important to hydrate the child before induction of anesthesia. The surgery is urgent but never emergent.

Induction and maintenance of anesthesia: A rapid sequence induction is generally planned. It is important to ensure that the stomach is adequately suctioned before induction of anesthesia. Oxygen administration is important since these infants have a tendency to desaturate rapidly. The use of a small dose of hypnotic followed by a muscle relaxant will allow for adequate placement of the endotracheal tube. The debate of whether to use succinylcholine versus a nondepolarizing drug like rocuronium has been studied. The time to recovery may be slightly prolonged with the nondepolarizing drug. It is also important to assess the surgical technique for the procedure. In the event it is a laparoscopic procedure, careful attention has to be paid to the insufflation pressures for the abdomen. Higher pressures may lead to compression of the inferior vena cava leading to a further decrease in arterial blood pressures. A subumbilical approach has been compared to a laparoscopic technique, the laparoscopic technique may lead to a faster recovery and a shorter operating time. Total IV anesthetic (TIVA) versus inhaled anesthetics have been studied in this population demonstrating a rapid return to baseline with ultra-short-acting opioids like remifentanil. We have used transversus abdominal plane blocks for managing pain in the postoperative period thereby avoiding opioids for the surgery.

Emergence and postoperative care: Emergence from surgery and a fully awake patient. Maintaining an IV access is important for the infant to ensure absence of hypoglycemia in the immediate postoperative period. These children do very well and often have a rapid recovery to their normal state within hours of surgery.

Airway foreign body: Airway foreign body is perhaps the most common emergent procedure in children besides trauma. Most presentations of airway foreign bodies occur later than the actual ingestion of the foreign body. There is usually a history of cough or persistent wheezing, or an occasional history of ingestion. Very rarely there is stridor or significant desaturation. It is important to recognize “when, what and where” the aspiration happened. The common rule of thumb is (i) the foreign body is often organic; (ii) lodged in the bronchial tree; (iii) right side having a higher propensity than the left side; few are radio-opaque (11%); and they have a mortality of about 0.42%. Preoperative evaluation: A plain film of the chest may be obtained by the emergency department doctor before consultation of the ear-nose-throat service. This could reveal a foreign body (if radio-opaque) or may demonstrate collapse of the lung or hyperinflation. Generally organic material like peanuts may not be seen in a plain film. Historic information including the ingestion of organic material can usually be obtained and could give a clue to the foreign body. Often these children are toddlers, they are fussy and can be very difficult to console. Premedication is not usually warranted. We have taken parents to the OR to prevent the child from getting upset at the time of induction of anesthesia. Induction and maintenance of anesthesia: There are multiple methods reported in the literature regarding the anesthetic management of foreign body retrieval in children. The
three techniques include inhaled induction with spontaneous ventilation; TIVA using propofol and remifentanil; and using manual jet ventilation. If possible, IV access is usually obtained in the emergency. A smooth mask induction with spontaneous ventilation with sevoflurane and nitrous/oxygen is then performed. After securing the airway, it is crucial to allow for spontaneous ventilation since there is a potential for dislodging the foreign body during retrieval. Factors leading to hypoxemia include younger patient, plant seed as foreign body, long surgical duration, pneumonia during the procedure and in some instances spontaneous ventilation. Ventilatory modes, especially jet ventilation, may potentially benefit children. TIVA has been associated with breath holding, longer duration of emergence and potential for laryngospasm. Maintenance can be achieved using inhaled anesthetics or IV infusions.

Foreign Body removal: The foreign body can be removed using several techniques. The common technique is to use a rigid ventilating bronchoscope with a forceps to retrieve the foreign body. More recently, fiberoptic bronchoscopes have been used to retrieve the foreign body. The main problem is when the foreign body is lost while in the process of retrieval especially if lodged in the main trachea. The most important and potentially life-saving technique would be to advance the foreign body to one of the bronchi and ventilate the child through the other lung. Children tend to desaturate rather rapidly and the situation could become dangerous. It is important to prevent coughing and bucking, some anesthesiologists use 1% lidocaine spray for the cords before airway instrumentation.

Postoperative complications: These include laryngeal edema, bronchospasm, hypoxic cardiac arrest, pneumothorax, pneumo-mediastinum, tracheal and bronchial laceration. It is imperative that there is communication with the surgeon before and during the procedure. The outcome of the child is based on proper communication as well as the superb skills of the surgeon and the anesthesiologist.

Bleeding Tonsils: This is an unfortunate event after a routine tonsillectomy in children. There are many factors that may lead to bleeding including poor hemostasis, bleeding diathesis including von Willebrand disease that is not diagnosed, infection, and foreign body irritation. Tonsillar bleeding occurs in 2 phases, an early phase that is associated with poor hemostasis or bleeding issues, and a secondary bleed that occurs in the first week, which is associated with secondary infection. Sixty-six percent of bleeding occurs in the tonsillar bed, 27% in the nasopharynx and 7% where it is combined. The incidence was about 2.15% in a large retrospective analysis. In addition, there is a Cochrane analysis that has demonstrated that there is a bleeding association with the use of nonsteroidal antiinflammatory drugs.

Preoperative preparation: Although this seems like an emergency, it is imperative to stabilize the patient before induction of anesthesia. Patients are often dehydrated and may have a low hemoglobin count. It is imperative that the fluid status is first assessed. In addition, it is important to remember that the child is anxious and nervous. Intravenous catheter placement is important before the induction of anesthesia. As mentioned earlier, it is important to make sure that the patient is well hydrated. Checking arterial blood pressures and pulse pressures may be useful to determine if they are compromised. In addition, looking for skin turgor as well as checking for orthostatic hypotension especially in the older child may point to an acute hypovolemic state. Blood should be sent for type and crossmatch and if it is an emergency, and if the child looks quite hypovolemic, it may be necessary to have blood available in the OR before induction of anesthesia.

Induction of anesthesia: The child is likely to be anxious. It is important to hydrate the patient before induction of anesthesia. The child is likely to also have a full stomach as they potentially could have swallowed a large amount of blood from the oropharynx. Attempts to keep the child with its face turned to the side may be helpful in keeping blood from being aspirated. An IV rapid sequence induction is usually planned with either propofol or ketamine (if the child is unstable) and succinylcholine or high dose rocuronium. A stylet is used for the endotracheal tube. After securing the airway, the surgeon should be ready to look for active bleeders. In the event there is no active bleeder that is visualized, there should be further investigations including a bleeding profile as well as an international normalized ratio. This may reveal a potential for a bleeding diathesis. We prefer giving some antiemetic before tracheal extubation since these patients have a propensity to vomit after surgery.

Postoperative period: This is one of those instances where a routine outpatient procedure can change to an inpatient admission. It is important to observe these patients for at least 6 hours after surgery.

Supracondylar fracture reduction: This is a common presentation to an emergency department in the Summer months. Most of these children are healthy and have sustained an injury while in a playground or at school. They present with significant pain and may require immediate surgery.

Preoperative preparation: NPO time is important. The presence of a traumatic event can lead to a decrease in gastric emptying thereby leading to a potential full-stomach patient. In addition, it is important for the surgeon to determine if there is a need for checking the vascular supply or the potential for nerve damage. There are simple tests for checking the integrity of the radial nerve (thumbs up sign), ulnar nerve (crossing the fingers); and median nerve (completing a circle with the index finger and thumb).

Anesthesia induction: Since most of these patients are not emergent but urgent, they are generally scheduled during working hours except if there is any significant loss or absent pulses or if there is a propensity for compartment syndrome. A laryngeal mask airway is generally acceptable. After reduction of the fracture, we place an indwelling IV catheter in the supraclavicular area using saline to highlight the area of needle placement. Once the child is awake and alert, we do the neurocheck before injection of local anesthetic solution.
Conclusions: Pediatric emergencies are generally more difficult than adult situations due to the need to calm the child as well as provide an optimal scenario for providing care. As more noninvasive techniques are being designed, surgery may become more relevant in certain cases than others.

REFERENCES