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Anatomy for Anaesthesia in Paediatric Patients

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ABSTRACT

Anesthesia for children is attenuated by the changes that occur during growth and development. The dose of the drug is affected by the size and maturation processes of purification, as well as by the changing body composition that occurs with age. All organ systems undergo these maturation changes and most are completed in the first years of life. Normal physiological variables in childhood and childhood are quite different from those of adults. The central nervous, cardiovascular and respiratory systems are particularly important. Brain immaturity and plasticity impact drug sensitivity, pain responses and behavior and increase the potential damage of apoptosis with anesthesia. The heart experiences a transition from fetal to adult circulation during the first weeks of life. Congenital defects not diagnosed are not uncommon. The newborn is very susceptible to conditions that trigger an increase in pulmonary vascular resistance, with reversion to fetal circulatory patterns. The anatomy and respiratory mechanics affect the apnea propensity, the maintenance of the airways, the artificial ventilation modalities, the absorption of inhalant agents and the size of the tracheal tubes. The metabolic rate and oxygen requirements increase with age. This physiology influences various aspects that include the desaturation rate during apnea, hypoglycemia during hunger, cardiac output, drug metabolism, fluid requirements and heat production or loss.

Key words: Physiology–respiratory system–Anatomy–bronchomotor tone–functional residual capacity–tracheobronchial tree–ventilationperfusion

1 INTRODUCTION

Infants undergoing emergency operations present several difficult challenges for the anesthesiologist. Many surgical emergencies in the infant endanger life and are often accompanied by failure of the multi-organ system. Communication and cooperation between the entire health care team, including surgeons, anesthesiologists and neonatologists, are of the utmost importance to ensure the best possible care of the newborn. [1] Efficient recognition and rapid management of the disease in the neonatal period can save lives. This review provides a systemic approach to the recognition, emergency stabilization and management of the most common newborn surgical emergencies.

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2 PAEDIATRIC ANAESTHESIA

Pediatric patients present unique anatomical and pharmacological considerations for the treatment of anesthesia in the presence of diseases that occur exclusively or more frequently in this age group. Newborns (up to 28 days of age) and babies comprise the age group in which differences with adults are more marked. Newborns are more likely to experience adverse perioperative cardiopulmonary events [1].

Pediatric patients deserve special considerations with respect to anatomic differences from adults.

3 ANATOMIC DIFFERENCES

Differences in the anatomy of the airways may increase the difficulties of the airways in infants than in adolescents or adults. The Infant route has five different routes, [1] Relatively large children's language in terms of oropharynx increases the likelihood of airway barriers and technical dif-

ficulties during laroscopy. [2] The larynx is located higher in the neck (at C4 level compared to C6 in adults) and, therefore, direct blades are more useful than curved blades. The ephemeral has a different shape, is short and chubby and is angled over the laryngeal inlet; Therefore, it is more difficult to control the laryngoscope blade. The vocal cords are angled, so you can blindly pass an endotracheal tube to easily deposit it in the external commission instead of entering the trachea and the children's larynx is formed by the funnel, the most narrowed by cricoid cartilage. In adults, the endocrine tube that passes over the vocal cords can easily become the trachea because the glottic opening is the narrowest part of the larynx. In infants or young children, an endocrine tube that passes over the vocal cords can easily tighten in the subglottic region caused by the invasion of the cricoid cartilage. For this reason, unfinished endotracheal tubes are generally better for patients older than 6 years.

These differences, that is, the large head and tongue, the movable epiglottis, and the anterior laryngeal position, characteristic of neonates, facilitate tracheal intubation with the newborn's head in a neutral or slightly bent position than with the hyperextended head. Babies are often described as mandatory nasal respirators; However, 8% of preterm infants and 40% of full-term newborns can become mouth breathing in the presence of nasal airway obstruction. Almost all babies can easily convert to mouth breathing at 5 months of age. Most babies can convert to mouth breathing if the obstruction lasts longer than 15 seconds.

4 PEDIATRIC AIRWAYS

We briefly discuss the functional features of developing airways, the impact of mechanical ventilation on airway function, and clinical evaluation of airway function in newborns and children.

Differences in the anatomy of the respiratory tract in children are associated with the convexity and size of the occipital bone, relative macrogloss, narrowing of the nasal passages and the anterior and head larynx (at the level of the C3-C4 vertebrae), as well as a larger, longer omega-shaped epiglottis. The cartilage (subglottic system) is the narrowest point of the respiratory tract in children under 5 years of age. Thus, 1 mm of edema will have a proportionally greater effect in children due to their smaller tracheal diameter. In addition, due to the shorter length of the trachea, endotracheal intubation and accidental head extubation are more common.

Due to the large occiput, a small pillow placed under the occiput will flex the head on the neck instead of extending it for the sniffing position. Thus it is preferable to place a pad under the neck and shoulders, with a large ring under the occiput to stabilize the head to help achieve the optimum head position for laryngoscopy.

Regarding the physiology of the respiratory system, the respiratory rate in children is three times higher than in adults, alveolar ventilation is high (double that in adults) and functional residual capacity (FRC) is lower. The oxygen consumption in the newborn is almost double the value of the adult (newborn 4–6 ml / kg per minute, adult 2 ml / kg per minute). This is seen as an increase in ventilation per minute (200 ml / kg per minute) in the newborn compared to 100 ml / kg per minute at puberty. As the tidal volume remains constant at 7 ml / kg during life, there is an increase in ventilation due to an increase in respiratory rate, which is approximately 30 per minute at birth, gradually decreasing to adult values in adolescence. In young children, the FRC during complete relaxation (central apnea, general anesthesia, use of muscle relaxants) decreases to 10-15% of total lung capacity. This low FRC is caused by a low closing capacity and produces atelectasis, ventilation / perfusion imbalance and hemoglobin desaturation.

The small diameter of the airways results in high resistance. Infant airways are highly compliant and poorly supported by the surrounding structures. The chest wall is also highly compliant, so that the ribs provide little support to the lungs. Therefore negative intrathoracic pressure is poorly maintained so breathing work is approximately three times that in the adult.

Another difference concerns the composition of the respiratory muscles: type I muscle fibers which are fatigue-resistant and able to perform repeated exercise are deficient in the newborn and infant. Adult fiber configuration is reached only by approximately 2 years of age. So any factor increasing the work of breathing contributes to early fatigue of the respiratory muscles. The fatigue can lead to apnea or carbon dioxide retention and respiratory failure.

Premature infants, particularly those with a history of apnea, are at risk (from 20 to 40%) of developing postoperative apnea. Apnea occurs mainly during the first 12 hours of the postoperative period, particularly in the presence of some risk factors that include post-conceptual age <60 weeks, prematurity, anemia and continuous apnea. Finally, the central coordination of the respiratory function is completed only after 3-5 months of extrauterine life. Neither hypoxic nor hypercapnic ventilatory drive is well developed in infants and newborns.

Unripe respiratory control combined with increased susceptibility to respiratory muscle fatigue may be responsible for the increased risk of postoperative apnea, especially in preterm infants with a gestational age of less than 46 weeks. For all these reasons, the respiratory reserve and apnea tolerance are greatly reduced and hypoxia can appear suddenly and worsen rapidly.

5 PAEDIATRIC ANESTHETIC PHARMACOLOGY

The term and preterm neonates perceive pain and should be anesthetized with the same considerations used for adult patients. [3] The neonatal catabolic response to surgery is similar to the adult, and surgical outcomes are improved when adequate anesthesia is provided. Recent studies have demonstrated that even the fetus per- ceives pain. [4] Fetal

procedural interventions such as cannulation of intrahepatic vein for exchange transfusions elicit stress responses as manifested by alterations in stress hormone levels and increased cerebrovascular pulsatility. Fetal intravenous fentanyl administration effectively blunts the stress response.

5.1 *Inhalational Anesthetics*

All commonly used inhalant anesthetics, halogen, isoflurane, sevoflurane and desflurane, have been used successfully for pediatric anesthesia. However, newborns and infants exhibit higher degrees of hypertension in response to anesthetics. [5, 6] This important phenomenon is related to myocardial depression, vasodilation, reduced heart rate and compensatory reflex mechanisms. Isolated preparations of myocardial tissue have shown that the depressant effects of anesthetics in the neonatal myocardium are greater than those of the adult myocardium. [7, 8] The activity of baroreceptors in newborn animals is reduced and inhalation anesthetics depress barorespones in humans and newborn animals to a greater extent than adults. For the above reasons, the safety margin for anesthetics in newborns and young babies is narrow compared to the older child or the adult. However, compared to other inhaled agents, sevoflurane causes less bradycardia and myocardial depression. In newborns with congenital heart disease, hemodynamic parameters remain reasonably well during induction with sevoflurane. However, in severely compromised newborns. , an opioid-based anesthetic technique will provide greater hemodynamic stability.

Because children are fearful of needle sticks, induction of anesthesia is commonly performed by facemask. Halothane has enjoyed wide popularity in pediatric anesthesia for almost five decades, is nonirritating to the airway, has a relatively pleasant odor, and is well suited for inducing anesthesia via facemask. The newer agent sevoflurane shares the most desirable property of halo- thane, the lack of airway irritation, but its low blood gas partition coefficient facilitates a much more rapid induction and emergence. Unlike halothane, sevoflurane is associated with a significant incidence of postanesthetic delirium. [9]

5.2 *Intravenous Anesthetics*

In most children, well-conducted pharmacokinetic and pharmacodynamic studies are lacking. As a consequence, click recommendations are extrapolated from adult data. However, it must be understood that the neonate has unique pharmacokinetic and pharmacodynamic characteristics. The "Best Pharmaceutical Products for Children Act of 2002" is expected to help improve our understanding of drug use and response in children. The computer-derived " allometric power model" has been found to be a useful tool in determining the physiological and pharmacokinetic variables that allow an accurate dosage of pediatric anesthesia. [10]

Most commonly used intravenous anesthetic drugs (thiopental, propofol, ketamine, and the opioids, fentanyl and remifentanil) have been safely used in infants with careful dosing adjustments. Propofol is a very short- acting drug and is generally administered by infusion for maintenance of anesthesia. Long-term infusion of propofol for sedation in pediatric patients in the intensive care unit setting has resulted in metabolic acidosis and fatal myocardial failure. It is recommended that propofol should not be used for long-term sedation in children. [11]

Ketamine releases catecholamines, which minimally depresses cardiovascular function, and is a very useful induction drug for patients with a compromised hemodynamic state. Ketamine has regained popularity due to the theoretical concept of preventive analgesia. If administered in small doses, 0.5 mg / kg before surgical stimulation, ketamine has potent analgesic properties and may be a postoperative requirement of opioids. [10] Fentanyl has minimal cardiovascular depressant effects and is often used as a major component of the anesthetic technique for critically ill infants. Commonly used doses vary from 12 μg / kg for abdominal surgery 63 to 50 μg / kg for thoracic surgery. Fentanyl has a profound respiratory depressive effect and its use in large doses may require postoperative mechanical ventilation. Remifentanil is a very short-acting opioid that is metabolized by erythrocyte esterase and is useful for stimulating procedures in which extubation at the end of surgery is desirable. [8, 9] Remifentanil has a very high clearance, which results in a short recovery time of about 2 to 3 min, even in infants. Large doses may occasionally cause bradycardia, which will negatively affect the cardiac output in the newborn.

6 MUSCLE RELAXANTS

Succinylcholine, a depolarizing muscle relaxant, is characterized by rapid onset, reliable intubating conditions, and short duration of action, and remains a very useful drug for emergency situations. Because its cholinergic effects are pronounced in infants, its administr tion should be preceded b y atropine to prevent bradycardia. Administration of succinylcholine to patients with undiagnosed occult myopathies has resulted in hyperkalemic cardiac arrest and its routine use in pediatric patients is no longer recommended.

Non-depolarizing muscle relaxants are often used in children. Neuromuscular transmission is immature at birth, but reaches adult maturity levels at 2 or 3 months of age. [12, 13] The newborn's response to non-depolarizing muscle relaxants is characterized by wide variability. Clinically , the baby seems to be more sensitive to non-depolarizing muscle relaxants, and the administration of these drugs should be carefully adjusted to the desired effect. The newest benzylisoquinin muscle relaxants (mivacurium, cisatracurium) have a more predictable duration of action, provided that the infant is normothermic and lacks significant cardiovascular side effects. The duration of the action of cisatracurium and mivacurium in neonates and infants is similar or less than that of children. In contrast, vecuronium and rocuronium have a prolonged duration of action in infants. [12] Rocuronium has a rapid onset of action when

used in larger doses and can be used as an alternative to succinylcholine for intubation of fast sequence However, when used in this way in the newborn, rocuronium has a prolonged duration of action.

7 PREPERATIVE ASSESSMENT

Most of the surgeries performed in the newborn are of an urgent, if not emergent, nature. Congenital anomalies Reoperative surgery often has other associated anomalies. In an effort to estimate maturation and the presence of concomitant diseases, the factors that will influence anesthesia care, a detailed history and a physical examination are an integral part of the pre-anesthetic evaluation.

The history should include gestational age, significant events at birth (e.g., asphyxiation, meconium aspiration, Ap -score score), maternal history (diabetes, alcohol, substance abuse) and neonatal ventilatory support (apnea, periodic breathing , oxygen administration and mechanical ventilation). The physical examination should include the assessment of hydration status and coexisting diseases (congenital heart disease, hyaline membrane disease). The state of hydration can be guaranteed through turgid skin, mucous membranes, fullness of the fontanel and urine production. A blood pressure below 50 mmHg, a heart rate above 160 and a urine output below 1 ml / kg / h, all suggest hypovolemia and should be treated before the operation.

The laboratory test should include a recent hematocrit, glucose and calcium. Because these babies are prone to hypoglycemia and hypocalcemia, [14, 15] intraoperative fluids must contain glucose and calcium. Intravenous sinus sites should be examined for permeability. If rapid blood replacement is warranted, ionized calcium should be controlled as the elimination of neonatal citrate is reduced. Rapid blood hypocalcaemia will negatively affect myocardial contractility. If ionized calcium cannot be measured, the empirical administration of 1 mg of calcium gluconate should be administered per milliliter of blood product.

8 NECROTIZING ENTEROCOLITS

Necrotizing enterocolitis occurs in approximately 10% of infants of birth weight less than 1500 g, and has a mortality of between 10% and 30%.79 Surgical intervention is indicated for bowel necrosis and/or perforation or deterioration despite maximal nonsurgical therapy. There is a recent surgical trend toward bedside peritoneal drain- age, thus decreasing frequency of formal laparotomy. About 50% of those patients treated at the bedside re- quire no further procedure. [16]

Intraoperative anesthetic management of these patients is often complicated by the presence of extreme prematurity, hemodynamic instability, acidosis, respiratory failure, sepsis, coagulopathy, electrolyte disturbance and patent ductus arteriosus. Marked abdominal distention is common and significantly reduces FRC. Therefore, if the airway is not yet secured before surgery, intubation of these fragile babies will accumulate by rapid and deep desaturation if it is not achieved with skill and speed after pre-oxygenation. Severe hemodynamic instability may be aggravated by inhaled anesthetic agents. Opioid-based anesthetic techniques, combined with muscle relaxants, are associated with less hemodynamic instability and can be suppressed by the judicious use of low-dose inhaled agents. However, the duration of opioids such as fentanyl, whose clearance depends on hepatic blood flow, is markedly prolonged in newborns with increased intra-abdominal pressure. [17] Ketamine is also an attractive option for the hemodynamically unstable infant. Nitrous oxide will aggravate bowel distention and should be avoided. Intravenous intravenous access is essential to facilitate the administration of fluids, anesthetics and resuscitation medications, blood products and inotropic infusions. Intraoperative fluid requirements are significant as a result of evaporation losses and bleeding and the third space. It is not uncommon for these patients to require several voluntary blood transfusions, including the administration of fresh frozen plasma and platelets. [18] Worsening respiratory stasis and increasing oxygen demand is common after resuscitation and transfusion, especially in presence of. marked abdominal distension An arterial line improves hemodynamic monitoring and facilitates arterial blood sampling, however, arterial cannulation can be a technical challenge and is not always available at that time. In the absence of arterial access, central venous samples should be taken to control the state of hematocrit, electrolytes, glucose, blood gas and coagulation. A central venous catheter is the preferred route for dopamine administration, with a greater objective intestinal perfusion and cardiac output. The majority of these patients will require continued ventilation and sedation in the postoperative period.

9 CONGENITAL DIAPHRAGMATIC HERNIA

Congenital diaphragmatic hernia (CDH) is characterized by a diaphragmatic abdominal viscera with a diaphragmatic defect, and is associated with varying degrees of pulmonary hypoplasia. [19] Left hemophilia is the most affected. Abnormalities associated with CDH include cardiovascular abnormalities and intestinal malrotation. CDH is associated with mortality, pulmonary hypoplasia, persistent pulmonary hypertension and congenital heart disease. [19, 20] Prenatal ultrasound diagnosis of CDH is important. It is safer to move a mother to a health center than to take a newborn baby. Recent strategies to reduce the incidence of CDH include delayed operation, pulmonary ventilation, high frequency absorption (HFO) and extracorporeal membrane oxygenation (ECMO) . Inhaled nitric oxide can help stabilize hypertension. ECMO conservation has severe lung cancers, but the final results do not seem to improve. Intrauterine fetal tracheal closure, prenatal steroids and surfactants have also been used with different strategies. [20]

Pulmonary hypoplasia is associated with a reduced pulmonary circulatory cross-sectional area. In HRC, this phenomenon is aggravated by excessive pulmonary vascular muscularization. The marked increase in pulmonary vascular resistance can cause life-threatening pulmonary hypertension. In the presence of hypoxia, hypercarbia and acidosis, already high pulmonary vascular resistance will be further increased by active pulmonary vasoconstriction. Persistent pulmonary hypertension causes a right to left shunt through the patent ductus arteriosus and the oval hole, thus worsening the preexisting hypoxia. Some patients with CHD demonstrate remarkable lability in their oxygenation status, reflecting a reversible component of pulmonary hypertension. In the past, attempts were made to treat this reversible component by vigorous hyperventilation. However, it is now clear that these efforts were complicated by iatrogenic injury to the already hypoplastic lungs, which ultimately contributed to poor outcomes.89 At the time of writing, lung protection strategies are commonly used. Typical objectives would be to use conventional ventilation with limited pressure using maximum airway pressures <25 cm H_2O to maintain preductal PaO_2 >60 mmHg, $PaCO_2$ <60 mmHg or pH >7.20.90 HFO can be used if there is failure to achieve these parameters with conventional methods. Severe oxygenation failure or significant respiratory and hemodynamic instability may indicate the need for ECMO.

Until recently, CDH was considered to be one of the few true neonatal surgical emergencies. However, the evidence suggests that in unstable patients, a period of preoperative stabilization (which generally lasts a few hours to several days) using sedation, mechanical ventilation and, if necessary, nitric oxide, HFO and / or ECMO may be beneficial. [8, 9] Early repair in unstable patients increases intra-abdominal pressure, thereby decreasing thoracic compliance and worsening respiratory function. [15, 16]

10 ANESTHETIC MANAGEMENT

For those babies with ECMO or HFO, surgical repair of CDH is often performed in the neonatal intensive care unit (NICU). The administration of general anesthesia to a seriously ill newborn in a place outside the operating room presents a significant challenge in the anesthetic management of CHR and a detailed discussion is beyond the scope of this review. However, critical elements in the anesthetic care of patients in NICU locations include the unknown environment, lack of space, poor lighting, availability of equipment, supplies and assistance, suboptimal access to the airways, lines and patient monitors, and inability to administer volatile anesthetic agents through conventional neonatal ventilation systems. The relative risks of providing care in the NICU should be balanced with those of transporting a newborn sick in ECMO or HFO to the operating room.

Anesthetic considerations in patients with CHD include avoiding nitrous oxide because it will spread to the intestine, thereby increasing the volume of the herniated intestine in the thoracic cavity and compromising ventilation. Excessive ventilatory pressures should not be used after reduction of the hernia in an attempt to expand the hypoplastic atelectatic lung. This strategy can cause pneumothorax on the contralateral side (good) and will also contribute to iatrogenic lung injury. The abdominal cavity in patients with CHD is underdeveloped. After the reduction of the hernia, it is possible that the abdomen cannot accommodate all the viscera. If excessive force is used to close the abdomen, the resulting increase in intra-abdominal pressure will displace the cephalic membrane of the diaphragm, reducing functional residual capacity and also compressing the vena cava and reducing cardiac output. The anesthesiologist should inform the surgeon if the primary abdominal closure is considered to be causing a significant cardiorespiratory compromise. If the repair is done while on ECMO, there is a greater potential for significant bleeding. All the necessary equipment and supplies for Administering fluids and transfusing blood products should be available immediately.

11 TRACHEO ESOPHAGEAL FISTULA

The most commonly found variety of tracheoesophageal fistula (TEF) consists of a blind upper esophageal pouch and a fistula between the trachea and the lower esophageal segment. Bronchoscopic evaluation of infants with TEF reveals that almost 90% of these infants have tracheobronchial system abnormalities, such as tracheomalacia and tracheal stenosis. [19]

Pulmonary aspiration of the oropharyngeal secretions of the blind upper bag or of the gastric contents through the fistula may further worsen the respiratory status of babies. Between 30% and 40% of patients with TEF are premature and 22% have significant cardiac abnormalities (interventricular communication, tetralogy of Fallot, interventricular communication and coarctation of aorta) . Improved perioperative and neonatal intensive care have contributed to Almost 100% survival in those babies without associated anomalies and without pulmonary complications. [18, 19] Babies with a higher risk of death weigh less than 1500 g at birth and have associated cardiac or chromosomal abnormalities. [20]

12 OPERATIONAL MANAGEMENT

The preferred surgical approach is fistula ligation and primary anastamosis of the esophageal segments. Prematurity, significant comorbidity or pneumonia predict an increased risk and may dictate a staged approach with initial gastrostomy under local anesthesia. The definitive repair is carried out later after the improvement of the pulmonary state and the general stabilization. A long atrial esophageal segment may be particularly challenging and may require a graft of colonic or jejunal interposition, a gastric tube or a gastric transposition to join the two ends of the esophagus. [18]

13 ANESTHETIC MANAGEMENT

Airway management is a crucial element of the anesthetic care of a baby with TEF. The objective is to ensure the airway in such a way that the flow of gas in the gastrointestinal (GI) tract through the TEF is minimized while avoiding aspiration of gastric contents. Gastric inflation will limit diaphragmatic excursion, compromise ventilation, increase intra-abdominal pressure and decrease cardiac output by decreasing venous return. Aspiration of gastric contents contributes significantly to perioperative morbidity and mortality. [10] The fistula is usually located in the posterior wall of the middle trachea, but it can enter at any point between the bronchial tubes, the carina (it appears bronchoscopically as a trifurcated trachea).) and the cervical region.96 The tip of the endotracheal tube should be placed over the carina, but under the fistula. Intubation awakens after pre-oxygenation is an attraction technique that avoids the use of positive pressure ventilation, thus avoiding gastric distention. However, inhalation induction of anesthesia, maintenance of spontaneous ventilation, has also been used successfully, as well as muscle relaxation before intubation. Accurate placement of the endotracheal tube can be achieved through the use of an endotracheal tube without a Murphy eye and deliberate endobronchial intubation. The tube is then removed gradually until the respiratory sounds are heard bilaterally. The tube must be rotated so that the bezel is facing forward.

Occasionally, the escape of gas through the fistula cannot be prevented by careful positioning of the tube alone. In these circumstances, occlusion of the fistula with a Fogarty catheter may be necessary, either with the help of a bronchoscopy or less commonly retrogradely, through a gastrostomy, to isolate the airway of the gastrointestinal tract. Care must be taken to avoid tension pneumothorax during bronchoscopy by limiting oxygen insufflation through the bronchoscope. The transverse area of the trachea, which is already small, is significantly compromised by the simultaneous presence of an endotracheal tube and a bronchoscope, which significantly increases expiratory resistance and significantly limits gas leakage from the lungs. Any technique that Ultimately used to secure the airway, frequent chest auscultation is required to confirm proper tube position. Fistula ligation and esophageal repair are performed using a right thoracotomy and result in significant pulmonary retraction and compression. Therefore, migration of the endotracheal tube down the right main bronchus during thoracotomy will significantly compromise ventilation. Similarly, the migration of the endotracheal tube into the fistula will cause rapid desaturation, a waveform of carbon dioxide at the end of the diminished or absent tide, and loss of respiratory sounds.

14 POSTOPERATIVE CONSIDERATIONS

More aggressive approaches to postoperative pain control have included single-dose intrathecal morphine and epidural catheter techniques. The latter have been used with variable success via both the caudal and lumbar routes. The above techniques may facilitate early weaning and extubation, which is generally a desirable goal in most patients with TEF. However, in those infants with a large gap between the esophageal ends, the anastamosis may be constructed under tension. In these circumstances, postoperative ventilation, sedation, paralysis, and neck flexion may reduce the incidence of anastamotic leak. However, the evidence sup- porting this strategy is inconclusive. Infants with TEF typically have deficient tracheal cartilage that occasionally results in tracheal collapse after extubation and may require immediate reintubation. [19, 20]

15 CONCLUSION

Pediatric anesthesia involves patients during the perioperative period and those in critical care of all ages, from premature babies to adolescents. Differences in physiological characteristics make anesthetic management different and extremely challenging for the anestheiologist. It is imperative to have a good knowledge of the anatomical and physiological differences between pediatric age groups (infants, infants, children, adolescents) and between pediatric and adult patients to carry out a successful and safe anesthesia.

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