Physician Education

Curriculum on Pediatric Anesthesia for Residents in Anesthesiology

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I. Pediatric Developmental Principles

Knowledge

1. Define Preterm, Prematurity, Neonate, Infant, and Child.
2. Understand the terms Gestational Age and Post-Conceptual Age.
3. Understand the transition from fetal to neonatal circulation including the effect on vascular and cardiac structures (conversion from parallel to series circulation), fetal hemoglobin and blood gas values, arterial and pulmonary artery pressure changes, and ventricular function.
4. Understand normal airway and respiratory development, cardiac development, neurologic development, renal development and hematopoietic development including the conversion of fetal to adult hemoglobin.
5. Understand the effect of prematurity upon organ system development and the short and long-term risks of prematurity including respiratory distress syndrome, bronchopulmonary dysplasia, apnea, anemia, intraventricular hemorrhage, retinopathy of prematurity, and hypoglycemia.
6. Understand the basis of pharmacokinetic and pharmacodynamic differences of anesthetic agents between neonates, infants and children.

Skills

7. Appropriately administer anesthesia to all age groups and account for differences in drug volume of distribution, MAC, protein binding, metabolism, and excretion.

II. Coexisting Pediatric Diseases

Knowledge

1. Understand the anatomy and pathophysiology of common cyanotic and acyanotic congenital heart lesions including ventricular septal defect, atrial septal defect, patent

ductus arteriosus, critical aortic stenosis and coarctation, pulmonary stenosis, tetralogy of Falot, and transposition of the great arteries.

2. Understand the anesthetic implications for children with congenital heart disease including associated syndromes, preoperative assessment, SBE prophylaxis, anesthetic cardiovascular effects, and the effects of an intracardiac shunt on intravenous and inhalation induction of general anesthesia.
3. Understand the pathophysiology and anesthetic implications of obstructive sleep apnea, asthma, and acute upper respiratory tract infection.
4. Learn the common congenital syndromes that include difficult airways, e.g., Pierre Robin, Treacher-Collins, etc.
5. Know the anesthetic implications of cerebral palsy, seizure disorders, hydrocephalus, neuromuscular diseases, muscular dystrophies, and diseases of the neuromuscular junction and neuromuscular transmission.
6. Understand the anesthetic implications for pyloric stenosis, gastro-esophageal reflux, renal disease and liver disease in the pediatric patient.
7. Understand the anesthetic implications and perioperative management of inherited disorders of coagulation (e.g. hemophilia) and hemoglobinopathies (e.g., sickle cell disease).
8. Know the anesthetic considerations for children with oncologic disease and who have had chemotherapy.
9. Know the anesthetic implications of children with a newly diagnosed anterior mediastinal mass.
10. Understand the anesthetic considerations for Trisomy 21.
11. Understand the anesthetic considerations for a child with a latex allergy.
12. Know the residual medical problems in children born premature (e.g., bronchopulmonary dysplasia) and the potential impact on anesthetic care.
13. Know the essentials of Pediatric Advanced Life Support (PALS).

Skills

14. Perform a preoperative evaluation and participate in an anesthetic for a pediatric patient with congenital heart disease.
15. Perform a preoperative evaluation and present an anesthetic plant for a pediatric patient with an upper respiratory tract infection (URI). Develop a decision process for proceeding with elective surgery in a child with an acute or recovering URI.
16. Identify and evaluate the child with a difficult airway.
17. Be able to evaluate and institute appropriate therapy for a child with respiratory failure.
18. Plan an anesthetic for a child with a neuromuscular disease.
19. Develop a plan for the perioperative management of a child with sickle cell disease.
20. Develop a plan for the perioperative management of a child with a congenital bleeding disorder.
21. Describe a plan for the induction of anesthesia in a pediatric patient with gastroesophageal reflux.
22. Plan an anesthetic for the prematurely born child.
23. Using PALS, be able to preside over the resuscitation of a child in cardiac arrest, or with a life-threatening hemodynamic disturbance or arrhythmia.

III. Anesthetic Techniques

Knowledge

1. Understand the pre-operative issues relevant to the anesthetic care of neonates, infants and children including: coexisting morbidities, medications, allergic reactions, labor and delivery history, maternal history, family history, the normal pediatric physical exam and the evaluation of abnormal findings.
2. Know the ASA guidelines for preoperative fasting including clears, breast milk and formula based upon patient age. Understand the appropriate ordering of preoperative laboratory testing and evaluation.
3. Know the options available for premedication including agents, routes and side-effects.
4. Understand the differences between the various pediatric breathing circuits to provide oxygen and anesthesia.
5. Understand the factors determining the speed of inhalation induction in pediatric patients and the various agents currently available for inhalation induction including the benefits and side-effects of each.
6. Understand the regulation of temperature in infants and children and compensatory mechanisms, effects of anesthesia on temperature and the consequences of hypothermia.
7. Know the differential diagnosis and management of perioperative hyperthermia.
8. Know the age-related fluid and electrolyte requirements for infants and children including calculation of deficit, intra-operative fluid requirements, glucose requirements and the guidelines, indications and side effects for blood and blood product administration in the pediatric patient.
9. Understand the differences between the pediatric airway and the adult airway and the effects on pediatric airway management.
10. Know the various sizes of oral/nasal airways, facemasks, LMAs, blades for laryngoscopy and endotracheal tube sizes (cuffed and uncuffed) and their appropriate use in children of all ages.
11. Know the prevention, management and consequences of laryngospasm.
12. Know the pediatric doses of intravenous anesthetic medications including induction agents, opiates, muscle relaxants, reversal agents and emergency medications including side-effects and contraindications.
13. Know the criteria for tracheal extubation and how to perform a deep extubation safely.
14. Know the therapeutic and toxic doses of local anesthetics in infants and children.
15. Understand the indications and contraindications for spinal and epidural anesthesia and peripheral blocks in infants and children plus side effects and complications.
16. Understand the post-operative anesthetic complications for pediatric patients including stridor, croup, nausea/vomiting and emergence delirium and their management.

Skills

17. Perform appropriate preoperative evaluation of neonates, infants and children.
18. Obtain informed consent from a parent and assent from an appropriately aged child.

19. Administer premedication to a child.
20. Perform a parent-present induction of general anesthesia, if allowed by the institution.
21. Use a precordial or esophageal stethoscope for an anesthetic.
22. Perform inhalation inductions on pediatric patients of all ages.
23. Monitor patient temperature and perform warming methods on a neonates, infants and children.
24. Appropriately choose and administer fluids to pediatric patients of all ages.
25. Calculate allowable blood loss for children of all ages.
26. Demonstrate the ability to estimate blood loss in pediatric patients.
27. Perform mask ventilation, LMA placement and intubation on pediatric patients of all ages.
28. Appropriately manage upper airway obstruction, laryngospasm, and bronchospasm in pediatric patients.
29. Perform commonly used regional analgesic techniques in pediatric patients.

IV. Anesthesia for Pediatric Surgical Procedures

Knowledge

1. Know the pathophysiology, indications for surgical intervention, and anesthetic implications for the following common pediatric and neonatal surgical conditions:
    a. congenital diaphragmatic hernia (CDH)
    b. inguinal hernia
    c. intussusception
    d. necrotizing enterocolitis (NEC)
    e. omphalocele and gastroschisis
    f. pyloric stenosis
    g. otitis media requiring myringotomy and tube placement
    h. obstructive sleep apnea or recurrent tonsillitis requiring adenotonsillectomy
    i. acutely bleeding tonsil
    j. esophageal foreign body
    k. tracheal or bronchial foreign body
    l. retropharyngeal abscess
    m. epiglottitis
    n. hydrocephalus requiring ventriculo-peritoneal (VP) shunt insertion or revision
    o. myelomeningocele
    p. blocked tear ducts requiring lacrimal duct probing and irrigation
    q. open globe injury
    r. strabismus
    s. scoliosis
    t. craniosynostosis
    u. cleft lip or palate
    v. tracheoesophageal fistula
    w. pediatric trauma
    x. pediatric burns
2. Understand the age-related changes and pathophysiology of intracranial pressure (ICP) in children.
3. Know the pathophysiology and treatment of the oculocardiac reflex.

4. Understand the implications of subcutaneous infiltration of epinephrine in pediatric patients.
5. Understand the implications of providing pediatric anesthesia for radiation therapy, CT scan, MRI, and additional procedures outside of the traditional OR environment.

Skills

6. Develop the ability to choose appropriately between endotracheal intubation, laryngeal mask airway, or facemask ventilation for any pediatric surgical procedures.
7. Be able to choose whether or not to place an intravenous catheter during a general anesthetic.
8. Be able to place an intravenous catheter in a pediatric patient.
9. Develop a plan when intravenous catheter placement fails.
10. Develop the ability to appropriately manage intraoperative hypoxemia.
11. Develop the ability to appropriately manage intraoperative hypocarbia or hypercarbia.
12. Develop the ability to appropriately manage intraoperative hypotension or hypertension.
13. Develop the ability to appropriately manage intraoperative bradycardia or tachycardia.
14. Develop the ability to appropriately manage intraoperative increased ICP.

V. Pediatric Pain Management

Knowledge

1. Understand methods for recognition and assessment of pain in different pediatric age groups.
2. Know methods for treatment of acute postoperative pain in children.
3. Understand the age-related differences in use of opioid analgesics in children.
4. Know different regimens for postoperative epidural analgesia in children.
5. Understand the pathophysiology and treatment of common chronic painful conditions in children (e.g., sickle cell disease, oncologic disease, reflex sympathetic dystrophy, etc.)

Skills

6. Demonstrate the ability to develop and carry out a plan to manage and treat postoperative pain in children across all age groups.
7. Demonstrate the ability to treat refractory postoperative pain in children of all ages.
8. Be able to evaluate and treat common complications of analgesic therapy in children (e.g., nausea, vomiting, pruritus, and ventilatory depression).
9. Be able to evaluate and manage children with epidural analgesic therapy and break-through pain.
10. Be able to evaluate a child for the use of patient-controlled analgesia (PCA), and demonstrate appropriate ordering of PCA for all age groups.