Preoperative Evaluation and Considerations of the Pediatric Patient

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The ideal pediatric anesthetic strikes the perfect balance between psychological and clinical considerations and care.

Pediatric Preoperative Evaluation

Part I: Psychological Considerations
Psychological evaluation and preparation
History
Medications
Physical examination
Diagnostic testing
Fasting
Risks
Anesthetic Prescription and Informed Consent
Premedication and Parental Presence
Emergence agitation

Part II: Clinical Considerations
Special considerations for anesthetic evaluation
Intermittency
Upper Respiratory Tract Infections (URTI)
Reactive Airways Disease (RADS)
Obstructive Sleep Apnea (OSA)
Obesity
Gastroesophageal Reflux (GER)
Type 1 Diabetes Mellitus (T1DM)
Bleeding disorders
Cardiomyopathies (Down Syndrome)
Cerebral Palsy (CP)
Cystic Fibrosis (CF)
Duchenne Muscular Dystrophy (DMD)
Jehovah’s Witness

Prematurity
Preterm defined by birth before 37 weeks gestation
- Low birth weight (<2500 g)
- Very low birth weight (<1500 g)
- Extremely low birth weight (<1000 g)

Postoperative Apnea in Former Preterm Infants after Inguinal Herniorrhaphy: A Combined Analysis

Cote, Charles; Zaslavsky, Alan; Downes, John; Kurth, C; Welborn, Leila; Warner, Louise; Malviya, Shobha

Postanesthesia apnea in former preterm infants

See additional slides for more detailed information on specific topics.
Prematurity

- Risk of apnea after anesthesia (central and obstructive)
- Anemia increases risk
- CHCO guidelines for admission
  - Former premature infants born prior to 37 weeks gestational age who are less than 56 weeks PCA
  - Full term infants (gestational age > 37 weeks) less than 44 weeks PCA

Neurologic Complications

- Periventricular white matter susceptible to injury
- IVH can be early or late in onset (50% D1, 90% by D4)
- Long-term neurologic and developmental disabilities are common

Pulmonary Complications

- BPD
  - Form of chronic lung disease associated with prolonged mechanical ventilation and oxygen toxicity
  - Infants with BPD may suffer from hypoxemia, hypercarbia, abnormal airway growth, tracheomalacia, bronchomalacia, subglottic stenosis, increased PVR, CHF
  - Pulmonary function abnormalities may persist into school-aged years

Rad

- Incidence of children with RAD is increasing rapidly in North America
- Continue bronchodilators including (especially) on the morning of surgery
- ETT and light anesthesia may trigger bronchospasm
  - Propofol
  - Ketamine
  - Lidocaine
  - Opioids
  - Volatile agents
  - B-agonists

URI

- Postpone acute purulent URI, fever, change in behavior/mental status, signs of lower respiratory tract involvement
- Evaluate risk of acute nonpurulent URI or URI within the last month
- Predictors of adverse perioperative events
  - Airway management
    - Nasal congestion
    - Gagging tendencies
    - Snoring
    - Passive smoke
  - Induction agent
  - Former premature infants
  - Reactive airway disorder
  - Risk takes four to six weeks (or more) to return to baseline
"The single most important task during the preoperative evaluation of the child for adenotonsillectomy is to distinguish the child with OSA from the child with obstructive breathing, because the child with OSA is at greater risk to develop severe perioperative respiratory complications, possibly including death, after adenotonsillectomy."

OSA

- Extreme limit of the spectrum of sleep-disordered breathing
  - Partial or complete upper airway obstruction
  - Hyperartha and/or hypoxemia
- Asian and African-American populations
- Common medical conditions/syndromes
  - Craniofacial syndromes
  - Disorders of the cranial base
  - Neuromuscular disorders
  - Trisomy 21
  - Infiltrative disorders
  - Temporomandibular joint ankylosis

OSA

- Apnea classification
  - Central, obstructive, mixed
- Hypopnea
- OSA classification (based on AHI)
  - Mild: 5-15
  - Moderate: 15-30
  - Severe: Greater than 30

OSA

- Recurrent hypoxemia is associated with increased sensitivity to opioids
- Children having displayed SpO2 <85% during sleep required one half the total analgesic dose of morphine after adenotonsillectomy compared to those whose SpO2 nadir was >85%

A 51 kg, 8 year-old male presents for adenotonsillectomy for OSA...
OSA

Diagnosis:
1. Severe Obstructive Sleep Apnea, OAI > 20 events per hour and increased in the REM sleep to > 50 events per hour.
2. Significant hypoxemia with O2 saturations <90% for 4-5% of total sleep time.

Obesity

- In 2011, the incidence ranged from 8%-11%
- Increasing in developed and developing countries
- Anesthesia-relevant coexisting diseases
  - Hypertension
  - Dyslipidemia
  - Type 2 diabetes mellitus
  - Nonalcoholic fatty liver disease
  - OSA
  - Asthma
  - Psychosocial issues

40% of newborns regurgitate in the first few days of life
The lower esophageal sphincter pressure takes 3-6 weeks to increase to adult levels
Symptoms may be GI and/or pulmonary
- Esophageal persistent vomiting, failure to thrive
- Aspiration (pneumonia), bronchospasm/RAD
- Apnea and bradycardia in preterm infants

Type 1 Diabetes Mellitus

- Absolute deficiency of insulin secretion
- Most cases are primarily due to T-cell mediated pancreatic islet beta cell destruction
- Metabolic disorder characterized by chronic hyperglycemia and disturbances of carbohydrate, protein, and fat catabolism
- Hormonal responses to surgery result in hyperglycemia and potentially ketoacidosis

Evaluation and planning are best conducted in advance with the help of an endocrinologist
ISPAD guidelines are an excellent reference
- First case of the day
- Avoid hypo- and hyperglycemia, fluid and electrolyte imbalance, and ketosis
- Management depends on procedure, duration, and patient’s usual regimen
- IV access, glucose infusion, and frequent blood glucose monitoring is essential
- Even fasting Type 1 diabetic patients need insulin

[http://ispad.ste-ym.com]
Von Willebrand Disease

- Autosomal dominant (disorder occurs equally in both sexes)
- Nosebleeds, bleeding from gums, prolonged bleeding from lacerations, increased bleeding during surgery
- Prolonged bleeding time due to defect in platelet-binding protein (platelet count and PT are normal)
- Treat with von Willebrand factor (FFP or cryoprecipitate)

Hemophilia

- 1/10,000 males (defective gene carried on X chromosome)
- Bleeding during the neonatal period suggests the diagnosis (factor VIII does not cross placenta)
- Hallmark of the disease is hemarthrosis

Factor VIII should be measured during the preoperative period
- Prolonged PTT but normal platelet count, bleeding time, and PT
- Preoperative factor VIII and/or DDAVP may be required (consult pediatric hematologist)
- Intramuscular medication administration should be avoided

Sickle Cell Disease

- Autosomal recessive
- 8% of the African American population are heterozygotes (trait)
- Does not affect anesthetic management or perioperative outcome
- 0.10% are homozygotes
- Increased risk of ACS, MI, sickle cell crisis
- Perioperative preparation
  - PTT
  - Hemoglobin electrophoresis
  - Hb or Hematocrit
  - Partial exchange transfusion to Hb 10 g/dL to decrease HbS transfused to 10 or less in cases of severe anemia or history of ACS

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Down Syndrome

• Upper airway obstruction
  • Macroglossia, narrow nasopharynx, hypertrophic lymphatic tissue, tracheal and subglottic stenosis, airway malacia, hypotonia
  • OSA is common
• Thyroid problems
• Congenital heart disease (40-50%)
  • AVSD most common
• Bradycardia with sevoflurane
• Pulmonary hypertension
• Leukemia
• Obesity

Cerebral Palsy

• Nonprogressive, but often changing, motor impairment syndromes secondary to lesions or anomalies in the brain that occur during early stages of development
• Leading cause of motor disability in childhood (2/1,000)
• Classified according to deficit and distribution
• Three broad categories:
  • Spastic (70%)
  • Dyskinetic (10%)
  • Ataxic (10%)
• Distribution may involve:
  • Single limb (monoparesis)
  • Both limbs on one side (hemiparesis)
  • Both lower limbs (diparesis)
  • Three limbs (triparesis)
  • All four limbs (quadriparesis)

Cystic Fibrosis

• Autosomal recessive disorder
• 1/2,000 white births
• Mutation on long arm of chromosome 7 leads to disruption of electrolyte transport in epithelial cells
• Lung disease is the main cause of morbidity and mortality
• Malnutrition, diabetes, and hepatic dysfunction are common

Cerebral Palsy

• Systemic disorders affect respiratory, GI, GU, orthopedic systems
• Disorders include cognitive impairment, sensory loss, seizures, and communication and behavioral disturbances
• Post-op pain and spasticity are common and often undertreated
• Communication disorders and sensory deficits may mask near-normal or normal intellect

Duchenne Muscular Dystrophy (DMD)

• X-linked recessive
• Characteristic clinical features include muscle weakness, contractures, slurred speech, and involvement of cardiac and respiratory musculature
Duchenne Muscular Dystrophy (DMD)

- Rhabdomyolysis, hyperkalemia, and cardiac arrest in the setting of inhalational agents and/or succinylcholine
  - Rhabdomyolysis may mimic malignant hyperthermia (MH) but DMD and MH are independent disease processes
  - The risk of MH is NOT higher in patients with DMD than it is in the general population

The child of a Jehovah’s Witness

- Belief that the “life force” resides in the blood requires them to refuse transfused blood
- While adults may refuse a life-saving transfusion, a child may not
- Anesthesia team must define a plan with the family in the event that a transfusion is required
- No child of a Jehovah’s Witness parent should die due to lack of transfused blood without the physician seeking a court order

Vaccines and anesthesia

- No direct evidence of any major interaction
- Possible that immunosuppressive effect of anesthesia and surgery may decrease efficacy
- Diagnostic difficulty may arise with post-op fever or malaise
- Recommend postponing elective surgery for 1 week after inactive vaccination and 3 weeks after live attenuated vaccination

Concussion and anesthesia

- Very little data available
- Mutch and colleagues reported abnormalities in mean regional CBF and cerebrovascular responsiveness to CO₂ in adolescents with postconcussion syndrome
- Unclear clinical and anesthetic significance
In Summary

- Children are not small adults
- The effects of events in the fetal and neonatal period can persist for years
- Pediatric patients often present with different comorbidities and anesthetic considerations than adults
- Children require different psychological and medical preoperative evaluation and preparation than adults for an optimal perioperative experience

References


