



Pediatric Review for the Adult Provider

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Objectives

- The learner will be able to:
- Describe the differences between the adult and the pediatric airway
- List improved airway maneuvers in the pediatric patient
- Explain how obesity affects the pulmonary system of the pediatric patient
- Describe how medication is dosed in the pediatric patient who is obese
- Review steps related to the preparation of the child susceptible of malignant hyperthermia

They still are not just "small adults"

- This has not changed
- Large occiput tends to put the patient in a flexed neck position
- What do adults usually require?
- Relatively large tongue
- Makes them more prone to what?

The adult airway vs the Pediatric airway





The shape of the airway

ADULT



A familiar depiction



Anticholinergic prophylaxis

- Routine use has decreased considerably
- Halothane no longer used
- Decreased use in succinylcholine
- Post operative discomfort?
- Central anticholinergic syndrome
- When is it acceptable?

Age specific anxieties

- **0 6months**: Maximum stress for parents, minimum stress for infants
- 6months 4years: Maximal fear of separation, significant postoperative emotional upset and regression, increased temper tantrums
- 4years 8years: Begins to understand processes/explanation, fear of separation, fear of body injury
- 8years adolescence: Understands, may fear waking up during surgery or not at all, literal interpretation
- Adolescence: Developing sexual characteristics and fears loss of dignity, fear of unknown, independent

Obesity in the pediatric patient

- What characterizes obesity in a pediatric patient?
- National Center for Health Statistics
- Center for Disease Control
- Obesity is defined in the pediatric patient as:
 - Body Mass Index > 95th percentile of children of the same age and gender
 - The prevalence of obesity in children has increased from 1971-2011
 - 13.7 million children and adolescents between 2-19 years of age are obese

Parental Presence during Induction of Anesthesia (PPIA)

- Choose wisely!
- May be more distressing to parent
- Minimization of pharmacological intervention
- Disruption of operating room routine
- Appropriate and adequate preparation of the parent

Emergence Delirium (ED)

- Non purposeful restlessness, agitation disorientation
- Studies 18% of children undergoing surgery/anesthesia
- Factors include young age, previous surgery, type of anesthesia
- Closely related preoperative anxiety and maladaptive behaviors
- Marked increase in ED dependent on anxiety

Review of systems: Anesthetic Implications

System	Factor to assess	Possible Implication
Respiratory	Cough, asthma, recent cold, croup apnea	Irritable airway, bronchospasm, Subglottic narrowing Post operative apnea
Cardiovascular	Murmur Cyanosis History of squatting Hypertension Exercise intolerance	Septal defect Right to left shunt Tetralogy of fallot Coarctation, renal disease Congestive heart failure
Neurologic	Seizures Head trauma Neuromuscular disease	Metabolic derangement Increased ICP MH, sensitivity to NMBA

Review of systems

System	Factors to Assess	Possible Implication
Gastrointestinal/Hepatic	Vomiting, diarrhea Malabsorption Black stools Reflux Jaundice	Electrolyte imbalance Anemia Anemia, hypovolemia Possible full stomach Drug metabolism/ hypoglycemia
Genitourinary	Frequency Time of urination Frequent UTI	UTI, diabetes, hypercalcemia State of hydration Evaluation of renal function
Endocrine/metabolic	Abnormal development Hypoglycemia, steroid therapy	Hypothyroid, diabetes Hypoglycemia, adrenal insufficiency

Review of systems

System	Factors to Assess	Possible Implications
Hematologic	Anemia Bruising, excessive bleeding Sickle cell disease	Need for transfusion Coagulopathy, Hydration, possible transfusion
Allergies	Medication	Possible drug interaction
Dental	Loose or carious teeth	Aspiration of tooth, EI prophylaxis

Obesity and the pulmonary system



Closing volume = volume of the lung at which small dependent airways collapse

Normal patient: CV is less than the Functional Reserve Capacity (FRC) so that the airways remain open during normal tidal breathing

Obese patients have higher closing volumes, so even a small decrease in FRC can cause small dependent airway collapse Obesity and the pulmonary system

Obesity in the pediatric community

Obesity and the pulmonary system

- Obese patients have decreased FRC
- FRC may fall below CV and lead to alveoli closure during normal tidal volumes, causing atelectasis and a ventilation : perfusion mismatch
- V/Q mismatch during ventilation leads to hypoxemia
- Chronic hypoxemia leads to the inability to normalize PaCO2



Pickwickian syndrome

- Literature and medicine?
- Obstructive Sleep Apnea
- Polysomnography
- Apnea Hypopnea Index (AHI)
- Severe in children = 10 or more apneic periods in one hour
- What is severe in the adult patient?

Obesity and the cardiac system

- Increase in cardiac output and blood volumes
- Cardiac output increased by increasing stroke volume
- Increase in pulmonary blood flow

Medication profiles for the obese child

- **Propofol** : lipophilic drug; dose according to ideal body weight (IBW)
- **Propofol** : infusion based on total body weight (TBW)
- Midazolam : very lipophilic; TBW
- Rocuronium : IBW
- Morphine : IBW
- Succinylcholine : TBW
- Fentanyl : TBW

Positioning obese children

- Supine and trendelenberg positions are less tolerated than the following positions:
- Prone
- Lateral decubitus
- Beach chair
- Reverse trendelenberg

Malignant hyperthermia review

- Hypermetabolic state
- Calcium release from sarcoplasmic reticulum of myocytes into myoplasm
- Results in:
 - Muscle contraction
 - Mixed acidosis
 - Tachycardia
 - Hypercarbia
 - Hyperthermia

Triggers

- Volatile Anesthetics
 - Sevoflurane
 - Desflurane
 - Isoflurane
- Succinylcholine

Genetic disorders

- King-Denborough Syndrome
- Central Core Disease
- Multi-Minicore Disease <u>with</u> a ryanodine receptor mutation

No association or association not substantiated

- Osteogenesis Imperfecta
- Duchenne's Muscular Dystrophy *
- Becker's Muscular Dystrophy *
- Noonan's Syndrome
- Arthrogryposis

Where is this located at your hospital?





Treatment

- DANTROLENE 20mg vial
- Needs to reconstitute with 60cc of sterile water
- Inhibits calcium release from the sarcoplasmic reticulum
- Antagonistic to the ryanodine receptor
- Initial dose 2.5mg/kg up to 10mg/kg
- Infusion rate of 0.25mg/kg/hr or 1mg/kg Q4-6 hours



RYANODEX®

- Newer on the market (2014)
- Dantrolene sodium
- 250mg vial
- Reconstitute with 5cc of sterile water for injection
- Dose remains 2.5mg/kg

Preparation for a Malignant Hyperthermia susceptible patient

- Remove vaporizers from machine
- MH susceptible patients can safely be exposed to only 5 ppm of volatile anesthetic
- Utilization of non-triggering agents
- Use of activated charcoal filters
- Anesthesia machine must be flushed
- Change circuit, breathing bag, and soda lime
- Can use a virgin anesthesia machine
- Intensive care unit ventilator (takes preparation with respiratory department)

Anesthesia machine flush GE Healthcare (Ohmeda)

Anesthesia machine system	Exposed to Desflurane	Not exposed to Desflurane
Aisys	35 minutes	30 minutes
Avance or Aespire	30 minutes	25 minutes
Aestiva	40 minutes	35 minutes

MHAUS

- Malignant Hyperthermia Association of the United States
- http://www.mhaus.org/
- Phone number 1.800.644.9737 (1800.MH.HYPER)
- Name, number, facility and email



We don't always like to talk about it, but this is what a true "cardiac arrest" looks like:



9 Cardiac Arrest 0

Questions?

A LITTLE ANESTHESIA HUMOR

References

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