Anesthetic Management of the Obese Child

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Disclosures

• None
Learning Objectives

At the end of this presentation, participants will be able to

– Perform an effective preoperative assessment on the obese child

– Plan an anesthetic based on the findings

– Describe risk factors and management for obese children with obstructive sleep apnea
Fat for Life?
Six Million Kids Are Seriously Overweight. What Families Can Do.
By Geoffrey Cowley & Sharon Begley
Definitions

BMI

- Concept: 200 lbs is ok if you are 6’6” tall… but not if you are 5’ tall
- Concept: Chubby is ok at 2 yrs, but not at 10 yrs
- BMI scores change with growth
Definitions

- **Normal weight**
  - Adult: BMI 18.5-24.9
  - Kids: 5th – 85th %ile

- **Overweight**
  - Adult: BMI 25-29.9
  - Kids: 85th - 95th %ile

- **Obese**
  - Adult: BMI >30
  - Kids: > 95th %ile
American Obesity Trends

www.cdc.gov
Progression of Pediatric Obesity
World-wide Problem: BMI for age > 85%
Epidemiology

Percent of children age 5-17 who are overweight or obese:

- 10% Worldwide
- 20% Europe
- 30% USA

Interventions for treating obesity in children (Cochrane Review). Luttikhuis, 2009
Anesthetic Issues

- Airway
- Respiratory function
- Cardiac function
- Vascular access
- Positioning
- Pressure neuropathies

- Fluid management
- Anesthetic choice
- Pre-medication
- Acid prophylaxis
- Analgesia
- Prevention of DVTs
Two Patients

4 yo boy for T&A
- 40 kg, 40 inches tall
- Mouth breather
- Snores and gasps
- Poor exercise tolerance

14 yo girl for lap chole
- 110 kg, 5’4”
- Asthma controlled with albuterol prn
Two Patients

- What additional workup is necessary?
- How does obesity influence the anesthetic plan?
What do we mean by “Difficult Airway”?

- Difficult to maintain mask ventilation
- Difficult to visualize the larynx and/or intubate the trachea
- Difficult to predict the patient’s ability to maintain airway patency following extubation
How can we predict which ones will be “really” tough?

- Physical exam
- Mallampati classification
  - More than 50% of the difficult laryngoscopies were not picked up by this classification*
- Neck circumference model**
- Review of prior records

*Frappier et al  **Nafui et al, Peds, 2011
Possible Solutions?

- Inhalation induction $\rightarrow$ LMA $\rightarrow$ fiberoptic intubation
- Awake fiberoptic intubation
- Asleep spontaneously breathing oral fiberoptic intubation
- Lightwand, Glidescope, short standard laryngoscope handles
- Intubating LMA
Positioning
Airway: Summary Tips

- MOST obese children are not difficult to intubate with standard laryngoscopes
- Positioning is key
- For inhalation induction, use O2 and Sevo, no N2O
- Preoxygenation enhances safety, buys time
Sleep Disordered Breathing

- Up to 37% of obese children have an abnormal sleep test. (Wing, 2003)
- True sleep apnea occurs in ~7% of obese children. (Dietz, 1998)
- Associated with Attention Deficit/Hyperactivity Disorder?
- 34 adolescents, mean age 17, mean BMI 57
- BMI >40: 55% had sleep apnea
- BMI >60: 75% had sleep apnea

Kalra M, Obesity Research 2005;13:1175
Children with sleep-nadir SpO2 < 85% require only ~ 50% as much opiate as those without hypoxia at night.

Enhanced sensitivity
Respiratory Function in MO

- Decreased FRC $\rightarrow$ hypoxemia
  - Correlates with BMI
  - Cranial shift of the diaphragm + atelectasis
  - Made worse by paralysis of the diaphragm & by pneumoperitoneum
  - Made worse by costal retractors in open procedure
Respiratory Function in MO: Possible Solutions

- Reverse Trendelenburg position
  - Improves A-a gradient
  - Improves compliance
- Ventilate with moderately large TVs: ~13 ml/kg IBW
- PEEP
Postop Respiratory Care

- 45% incidence of atelectasis following upper abdominal surgery in MO patients
- Which patients should be ventilated overnight?
- Should all others receive CPAP or BiPAP?
- Risks associated with CPAP/BiPAP in abdominal surgery?
Extubation

- Are your criteria different for extubation of the obese child?
- What features suggest risks of failed extubation?
- What steps can you take to increase likelihood of success?
Tips for Successful Extubation

- History of OSA?
- Baseline pCO$_2$?
- Limiting opiates intra-operatively
- Awake extubation, elevate head of bed
- Postoperative oxygen therapy in PACU
Cardiac Risk Factors

- 50% of overweight adolescents have one risk factor for cardiovascular disease
- 20% have two factors
- Insulin resistance
- Hyperlipidemia
- Sleep apnea
- Hypertension
Cardiac Function in the MO

- Systemic hypertension
- Pulmonary hypertension
- LVF or RVF
- Ischemic heart disease

Typical physical exam signs may be difficult to elicit
Pulmonary HTN

- What history suggests PHTN?
- What would you see on exam?
- Diagnostic studies?
  - Echocardiogram may be difficult
- What are the anesthetic implications?
Pulmonary HTN in the Obese

- **Signs/symptoms**
  - Exertional dyspnea, fatigue, syncope
  - ECG—RVH, RAD, tall precord R

- **Anesthetic implications**
  - Avoid N₂O, prevent/limit hypoxemia
  - Use volatile agent to promote bronchodilation and blunt hypoxic vasoconstriction
  - Which patients need PA Catheter?
Vascular Access in the Obese

- Challenging venous access
  - Avoid “wasting” good veins with too small I.V.s
  - Which patients should have central lines?
- Arterial lines for which procedures?
  - Easier/more accurate monitoring of BP
  - Easier lab sampling
Vascular Access in the Obese

- Consider preoperative PICC line placement for major surgery requiring postoperative admit
- Use VEIN FINDER
Positioning & Prevention of Pressure Neuropathies

- Extra large OR table, or two bolted together?
- Safety strap(s)
- Transfer to OR table and then off while still obtunded?
- “Hovercraft” air mattress
Positioning & Prevention of Pressure Neuropathies

- Increased incidence of ulnar neuropathy
  - 90° limit on shoulder extension
  - Elbow sl. bent, hand supinated

- Proper head positioning—gel pad
  - Risk of upper plexus injuries with extreme lateral positioning
  - Elevate head/shoulders for ease of intubation
Fluid Management

- Maintenance, based on LBW
- NPO deficit
  - Avoid prolonged fasting
  - Recognize delayed gastric emptying
  - ~ 4 hours clear liquids
- Consider **NOT** placing IV pre-op?
Anesthetic Choice

- 4 yo T&A
- 14 yo lap chole
No Data Available here!
Anesthetic Choice

- Most authors report the use of a balanced anesthetic: volatile agent + opiate + NMB
- Desflurane—ideal agent?
- Possible role for regional techniques in selected cases?
  - Impact of DVT prophylaxis on regional
- Influence of obesity on dosing
- Dexmedetomidine?
# Anesthetic Choices / Dosing

## Drug Dosing Comment

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td>Propofol</td>
<td>IBW/ TBW Maint</td>
<td>CI &amp; Vd correlate w TBW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Induction dose:  2 mg/kg to loss of lid reflex*</td>
</tr>
<tr>
<td>Midazolam</td>
<td>TBW</td>
<td>Prolonged sedation</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>TBW</td>
<td>Incr Vd, T ½, distributes thro all tissues</td>
</tr>
<tr>
<td>Sufentanil</td>
<td>TBW/ IBW Maint</td>
<td>Incr Vd, T ½, distributes thro all tissues</td>
</tr>
<tr>
<td>Remifentanil</td>
<td>IBW</td>
<td>CI, Vd smaller, similar pharmacokinetics to normal</td>
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*Olutoye O, Anes Analg 2012.*
### Anesthetic Choices / Dosing

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<tr>
<td>Succinylcholine</td>
<td>TBW</td>
<td>Plasma cholinesterase activity incr w wt., incr total dose</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>IBW</td>
<td>Recovery delayed if TBW used, and hepatic clearance impaired</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>IBW</td>
<td>Faster onset, longer duration; unchanged pharm</td>
</tr>
<tr>
<td>Atracurium*</td>
<td>TBW</td>
<td>Cl, Vd, T ½ unchanged. Dose unchanged, organ-indepdt elimination</td>
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Premedication

- Would you sedate the 4 yr old?
- Would you sedate the 14 yr old?
- Under what circumstances (what findings) would you refuse to sedate?
Pre-medication

- Oral midazolam—4 yo
- Oral valium the AM of surg—14 yo
- Supplemental IV midazolam as necessary in Holding
- Other agents? Dexmedetomidine?
- Candidates for parental presence at induction?
Acid Prophylaxis

- Increased gastric volume & decreased pH in the morbidly obese, conflicting data
- Pick a protocol…which kids?
- Bicitra +/- metoclopramide
Postoperative Analgesia

- 4 yo T&A—staying overnight
- 14 yo lap chole—somnolent but complaining of pain in PACU—now what?
Postoperative Analgesia

- Short-acting agents
- Maximize use of acetaminophen and NSAIDs
- Local anesthesia + PCA for most: with NO BASAL infusion
- Lap vs. Open Chole—open cases MAY benefit from epidural analgesia *(technically challenging!)*
- Oral analgesia as soon as tolerated
NO Codeine please!

Tonsillectomy-Adenoidectomy Fatalities

EmaxHealth
Codeine

- Poor efficacy c/w Ibuprofen for musculoskeletal pain; no better than placebo for cough

- ![Codeine → morphine](CYP2D6)
  - Normally 10% converted
  - 6-10% whites, 2-5% Asian & A/A adults don’t convert
  - 46% children had CYP2D6 phenotypes assoc with decreased metabolism; 36% children given codeine had no detectable morphine 4 hr later

- Ultra-rapid metabolizers - enhanced toxicity

Galinkin JL, AAP News 32(9) Sept 2011
Hydrocodone

- Hydrocodone metabolized...
  - hydromorphone CYP2D6
  - norhydrocodone CYP3A4
  - 40% metabolized by non-CYP mechanisms
- Fatalities—medical and post-surgical

MAYBE Oxycodone instead...?
DVT Prophylaxis

- Which patients?
- Age? Size? Procedure?

GOAL: EARLY postop ambulation
DVT Prophylaxis

- Pick a protocol
- Subcutaneous heparin or LMWH ?
- Compression devices intraop / postop?
- Influences selection of RA

Goal of therapy for heparin or LMWH?
Pediatric Obesity Persists into Adulthood

<table>
<thead>
<tr>
<th>Teens &gt; 99%ile</th>
<th>Adult BMI</th>
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<tr>
<td>100%</td>
<td>≥ 30</td>
</tr>
<tr>
<td>88%</td>
<td>≥ 35</td>
</tr>
<tr>
<td>65%</td>
<td>≥ 40</td>
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Freedman, DS. J Pediatr 2007;150:12-7
Reduction in Lifespan

BMI > 40 at 20 yrs of age results in a loss of life expectancy:

- 22 years for black males
- 12 years for white males
- 8 years for white females
- 4 years for black females

Rationale for Bariatric Surgery

- Progressive epidemic of pediatric obesity
- Severely obese adolescents develop “adult” diseases

Limited efficacy of dietary, behavioral or pharmacologic approaches
Summary: Anesthesia for Obese Children

- Preoperative assessment
- Airway mgt /postop respiratory concerns
- Beware the child with true OSA
- Planning an anesthetic
- Postoperative pain management
- Attention to detail, use of short-acting agents are key