Eye of the Storm: induction techniques in children

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Goals of the pediatric induction

- safety
- efficiency
- acceptance
- outcome
Pediatric induction: overview

- evaluation and preparation
- decision to use premedication
- involvement of parents
- choice of induction
- special situations
- measurement of outcome
  - safety (stable transition to maintenance)
  - “hidden” psychological morbidity
Evaluation and preparation: medical issues

- history and physical exam
  - airway, complex issues (consult needed?)
- anesthetic history
- most lab–work unnecessary
  - ± pregnancy, coags, C–spines (TRI 21)
- optimized? (potential consultation)
- NPO guidelines
### NPO guidelines

<table>
<thead>
<tr>
<th>Ingestion</th>
<th>NPO Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear fluids</td>
<td>2 hours</td>
</tr>
<tr>
<td>Breast milk</td>
<td>4 hours</td>
</tr>
<tr>
<td>Infant formula</td>
<td>6 hours</td>
</tr>
<tr>
<td>Milk/solids</td>
<td>6–8 hours</td>
</tr>
</tbody>
</table>

Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: a report by the American Society of Anesthesiologist Task Force on Preoperative Fasting. *Anesthesiology* 1999

Hunt J N, MacDonald M: J Physiol 1954; 126:459-474.)
Advantage to clear fluids day of surgery

- diminished hunger and thirst
- easier compliance
- decreased risk hypoglycemia
- decreased risk of hypotension
- OR delays not as devastating
- happier, more cooperative child
postoperative regressive changes correlate w/preoperative anxiety (as high as 40–60%)

preoperative anxiety a function of genetics, parenting, past medical experiences
- a function of age and cognitive development
- ↑ risk with attachment issues, shy temperament

preoperative anxiety may correlate with postoperative excitement and ↑ pain scores
Perioperative behavioral stress: overview

- Preparation programs
- Desire for information
- Educational interventions
- Music
- Hypnosis
- Acupuncture
- CAM interventions
- Neuroendocrine

Risk factors
- Genetics
- Behavioral interventions
- Pharmacological interventions
- Midazolam
- PPIA and behavioral technologies: shaping, exposure, reinforcement, distraction, mindfulness, coping skills

Perioperative behavioral stress response

Outcomes
- Preoperative
- Intraoperative
- Postoperative
- Psychological
- Clinical
- Anesthetic requirements
- Anxiety
- Satisfaction
The role of preoperative education in allaying anxiety

- evolving methods of delivery
- education may allay specific fears
  - fear of needles
  - fear of hunger and thirst
  - fear of separation
  - fear of being awake in OR
  - loss of autonomy
- Fortier: majority of children (age 7–17) desire information, especially about pain *

* Anesth Analg 109:1085;2009
Psychological preparation: the preoperative visit

- individual attention and formulation of a plan
- informed consent (risk) and assent
- specific “rehearsal” for the day of surgery
- improved anxiety scores & quality induction
  - Vernon – meta-analysis: fewer postoperative behavior Δ’s (*Dev Behav Pediatr* 1993;14:36)
Preoperative education: potential interventions

- Coping skills
- Modeling
- Preoperative tour

Effectiveness
Cost
Family–centered preoperative program (ADVANCE)

- Anxiety ↓
- Distraction
- Video model
- Add parents
- No excessive reassurance
- Coach parents
- Exposure of child (shaping)

<table>
<thead>
<tr>
<th></th>
<th>Cont</th>
<th>Midaz</th>
<th>PPIA</th>
<th>ADV</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>99</td>
<td>98</td>
<td>94</td>
<td>96</td>
</tr>
<tr>
<td>HU Anxiety M–YPAS</td>
<td>36</td>
<td>37</td>
<td>35</td>
<td>31*</td>
<td>.001</td>
</tr>
<tr>
<td>Mask Anxiety M–YPAS</td>
<td>52</td>
<td>40*</td>
<td>50</td>
<td>43*</td>
<td>.018</td>
</tr>
<tr>
<td>PACU Fentanyl (ug/kg)</td>
<td>1.37</td>
<td>1.23</td>
<td>0.81*</td>
<td>0.41*</td>
<td>0.16</td>
</tr>
<tr>
<td>PACU (m)</td>
<td>120</td>
<td>129**</td>
<td>122</td>
<td>108*</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Kain. *Anesthesiology* 2007; 106:65
The day of surgery

» review history / update / NPO status
» introduce new faces and address concerns
» diversions (Child-Life) in holding unit
» evaluate need for premedication
» prepare parent for induction
» allow familiar objects into the OR
Factors predictive of poor compliance with inhaled induction

- ages 1–13; parents present; premedication at discretion of anesthesiologist (25% overall)
- poor compliance in 21% -- risk →
  - age < 4
  - prior anesthetics (risk in older kids, not younger)
  - lack of preoperative tour
  - anxiety level in HU
  - less time in HU (“no-wait” ↓ compliance)
  - no benefit to midazolam pre-medication

Premedication: an overview

- infrequent at HCH (~ 25% nationwide)
  - usage varies inversely with PPIA
- oral midazolam most common (80–90%)
  - higher doses will hasten onset but prolong effect
  - alternatives include ketamine, μ-2 agonists
- side effects rare but can be troublesome
- cost measured in both drug and personnel
## Premedication: dosing

<table>
<thead>
<tr>
<th>DRUG</th>
<th>ROUTE</th>
<th>DOSE (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>midazolam</td>
<td>oral, nasal /SL, rectal</td>
<td>0.25–0.75, 0.2–0.4, 0.5–1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ketamine</td>
<td>oral, nasal, rectal, IM</td>
<td>3–6, 3, 6–10, 2–10</td>
</tr>
<tr>
<td>methohexital</td>
<td>rectal (10%)</td>
<td>20–40</td>
</tr>
<tr>
<td>clonidine</td>
<td>oral</td>
<td>0.004 (4 mcg)</td>
</tr>
<tr>
<td>dexmedetomididine</td>
<td>nasal</td>
<td>0.002 (2 mcg)</td>
</tr>
</tbody>
</table>
### Potential role for premedication

<table>
<thead>
<tr>
<th>PRIMARY ROLE</th>
<th>SECONDARY ROLES *</th>
</tr>
</thead>
<tbody>
<tr>
<td>allay anxiety</td>
<td>block vagal reflexes</td>
</tr>
<tr>
<td></td>
<td>↓ airway secretions</td>
</tr>
<tr>
<td></td>
<td>anterograde amnesia</td>
</tr>
<tr>
<td></td>
<td>↓ aspiration risk</td>
</tr>
<tr>
<td></td>
<td>facilitate induction</td>
</tr>
<tr>
<td></td>
<td>provide analgesia</td>
</tr>
</tbody>
</table>

* historical indications predominate here
Evidence-based clinical update: does premedication with oral midazolam lead to improved behavioural outcomes in children?

- Literature search for RCT with preoperative midazolam (M) with control arm (30)
- M reduced anxiety at separation and induction (grade A) with minimal effect recovery
- Inconsistent effect on PACU agitation
- Inconsistent effect on behavioral outcomes at home (some have had increased ∆’s)

Midazolam vs. Game-Boy™

- prospective RCT
- 78 children 4–12 yrs

Tran. SPA winter meeting 2005
“parents as partners” philosophy at HCH
avoid separation (allows ↓ use premed)
will increase parental satisfaction ALTHOUGH
may increase parental anxiety with measurable changes in HR, cortisol (Kain)
evidence-based review → PPIA is a poor anxiety reducer for either parent or child *

* Chundamala. Can J Anaesth 56:57;2009
PPIA works best with a calm and well-prepared parent

- emotion-based behaviors tend to decrease coping
- distraction-based behaviors tend to increase coping
- parents will take cues


Caldwell-Andrews. *Anesthesiology* 2005;103:1130
Inhalation induction: overview

- most common induction US < 10
- familiar with long history safe use
- non-pungent agents (hal/sevo) preferred
- agents have evolved but not basic technique
  - induce in mother’s arms *
  - gentle voice *
  - essence of bitter orange to mask odor *

* Gwathmey Anaesthesia (1914)
Inhalation induction: technique

- high-flow; N₂O will hasten induction
- sevo can be ↑ quickly (± nitrous “pre-med”)
- mask or cupped hand if fearful of mask
- distraction / medical reinterpretation
- don’t dawdle / bargain / apologize
- early CPAP may be advantageous
- avoid stimulation in light plane
Inhalation induction: turbulence (i)

- struggling, uncooperative
  - 8% sevoflurane ("Brutane")
  - adapt to IV (butterfly) induction or IM
  - regroup, premedicate

- airway obstruction (vs. breathholding)
  - open airway non-invasive → invasive
  - hold CPAP / switch to 100% oxygen
  - IM sux or IV anesthetic
Inhalation induction: turbulence (ii)

- bradycardia / hypotension
  - IM/IV atropine (± glossal)
- arrhythmias (very common with halothane)
  - tachy ass’d with sevo → agitation (EEG Δ’s)
  - ↓ sevoflurane to < 5 vol %, monitor
- emesis / aspiration
- difficulty with IV insertion
  - LMA option to secure airway, free hands
  - IO or surgical access if becomes urgent
Intravenous induction

- indwelling *sure* IV catheter
- special circumstances that preclude inhalation
- patient preference
- pain of IV insertion: EMLA vs. N\(_2\)O
- drug of choice usually propofol
  - injection pain troublesome; N\(_2\)O may work best
<table>
<thead>
<tr>
<th>DRUG</th>
<th>DOSE</th>
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<tbody>
<tr>
<td>thiopental</td>
<td>5–8 mg/kg</td>
</tr>
<tr>
<td>methohexital</td>
<td>1–2.5 mg/kg</td>
</tr>
<tr>
<td>propofol</td>
<td>2.5–3.5 mg/kg</td>
</tr>
<tr>
<td>ketamine</td>
<td>1–2 mg/kg</td>
</tr>
<tr>
<td>etomidate</td>
<td>0.2–0.3 mg/kg</td>
</tr>
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</table>
Caveat emptor

- In a holding unit study at Rainbow Babies, 35% of inpatient IV’s had significant issues that rendered them useless or sub-optimal.
- 50% likely if infants.
- 75% likely if > 72 hours.

Tripi et al  SPA winter meeting 2006
## The induction debate

<table>
<thead>
<tr>
<th>Inhalation</th>
<th>Intravenous</th>
</tr>
</thead>
<tbody>
<tr>
<td>fear of needles</td>
<td>fear of mask</td>
</tr>
<tr>
<td>pain of needle/drug</td>
<td>unpleasant scent</td>
</tr>
<tr>
<td>dexterity not an issue</td>
<td>availability EMLA™ etc</td>
</tr>
<tr>
<td>reversible/incremental</td>
<td>post–sevo agitation</td>
</tr>
<tr>
<td>can be done in a lap</td>
<td>IV available if issues</td>
</tr>
<tr>
<td>↑ safety sevoflurane</td>
<td></td>
</tr>
<tr>
<td>child can participate</td>
<td></td>
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</table>
Special topic: intubation without muscle relaxants (IWMR)

- risks: laryngospasm, trauma, hemodynamic ↓
- SPA survey: 38% infants / 44% older children
  - ↑ non–academic setting / working alone
- Simon (*Ped Anaesthesia* 2002) – questionnaire
  - sevoflurane utilized more than propofol
  - ~ 5 vol % is optimal dose (± N₂O)
  - opioids as adjunct in slightly more than half
  - 87% success rate overall
  - ↑ desaturation < 1 year (15.9% vs. 1.7%)
Induction: special circumstances *

- full stomach / aspiration risk
- anticipated difficult airway
- malignant hyperthermia susceptible
- congenital heart disease
- increased intracranial pressure
- trauma / hypovolemic

* not all inductions are the same, and special circumstances bring individual considerations