EXAMPLE CASE

‘SOPHIA’ 6 YEAR-OLD FEMALE

Referral by Pediatric Dentist – Couldn’t Complete Procedure with Moderate Sedation
Extremely Anxious at Consultation
   Tearful at Times, Minimal Eye Contact
Mom has often Withheld Information from Patient
History of Pain and Localized Gingival Swelling #J
Multiple Courses of Antibiotic Therapy

ASA I – NKDA – No Medications
ANESTHETIC TREATMENT PLAN: HOW DO WE DECIDE?

FACTORS INVOLVED IN TECHNIQUE DECISION-MAKING

- Patient Age - Health
- Developmental Disability
- Autism
- Preoperative Anxiety
- Needle Phobia
- Generalized Anxiety
- Difficulty of Surgery
- Length of Procedure
‘THE BENEFIT OF THE ANESTHETIC MAY BE MINIMIZED IF THE ADMINISTRATION OF THE AGENT IS ASSOCIATED WITH PAIN OR ADVERSE MEMORIES’

OFFICE-BASED INHALATION ANESTHESIA TECHNIQUES

Premedication?
Inhalation Induction
IV Access?
Airway Type, if Any?
‘Guarded’ Airway, LMA, ETT
OFFICE-BASED INHALATION ANESTHESIA
TECHNIQUES

Inhalation GA Induction – No IV Access
Premedication – Inhalation GA Induction – No IV Access
Premedication – Inhalation GA Induction – Switch to IV
Premedication – Inhalation GA Induction – IV – LMA
Inhalation GA Induction – Switch to IV
Inhalation GA Induction – IV – LMA
Addition of Endotracheal Tube
Use of Muscle Relaxant?

VOLATILE ANESTHETICS

Low Blood Gas Solubility Confers Many Clinical Advantages!

Rapid Onset
Greater Control & Precision of Depth
Rapid Recovery
Rapid Return of Airway Reflexes

McKay: Anesth Analg 2005

Desflurane > Sevoflurane > Isoflurane > Halothane
**VOLATILE ANESTHETICS**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Halothane</th>
<th>Isoflurane</th>
<th>Desflurane</th>
<th>Sevoflurane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling Point</td>
<td>50</td>
<td>48.6</td>
<td>22.8</td>
<td>58.6</td>
</tr>
<tr>
<td>Pungency</td>
<td>Excellent</td>
<td>Poor</td>
<td>Marked</td>
<td>Excellent</td>
</tr>
<tr>
<td>Blood Gas Solubility</td>
<td>2.3</td>
<td>1.4</td>
<td>0.42</td>
<td><strong>0.66</strong></td>
</tr>
<tr>
<td>MAC 100% O₂</td>
<td>0.77</td>
<td>1.15</td>
<td>6</td>
<td>2.05</td>
</tr>
<tr>
<td>MAC 70% N₂O</td>
<td>0.29</td>
<td>0.56</td>
<td>2.5</td>
<td>0.66</td>
</tr>
<tr>
<td>Metabolism</td>
<td>20%</td>
<td>2.4%</td>
<td>0.02%</td>
<td>3.3%</td>
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**MAC: MINIMUM ALVEOLAR CONCENTRATION**

‘Concentration of inhaled anesthetic agent that prevents movement in response to skin incision in 50% of subjects at sea level in 100% oxygen’

- Alveolar concentration can be easily measured
- Weight & Anesthetic duration do not alter Minimum Alveolar Concentration (MAC)
- Doses of anesthetics in MACs are additive
- MAC highest at age 6 months, then declines
### VOLATILE ANESTHETICS

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<th>Desflurane</th>
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#### SEVOFLURANE COMPARED to OTHER INHALED ANESTHETICS

- Low pungency
- Rapid induction & emergence
- Minimal respiratory depression
- Maximum bronchodilating effect
- Significantly lower airway hyper-reactivity
SEVOFLURANE vs PROPOFOL for ANESTHETIC INDUCTION: A META-ANALYSIS

Meta-Analysis – 12 included studies
- Time to LOC was similar
- More frequent apnea in propofol group
- Induction complications similar
- PONV more significant in sevoflurane group
- Time to successful LMA insertion similar
- Success with LMA first attempt higher in sevoflurane group

Joo H
Anesth Analg
91:2000

ADVANTAGES of SEVOFLURANE

Induction of anesthesia without IV/IM access
Rapid onset
Induction of general anesthesia with one drug
Apnea less common than propofol
Less patient movement
Rapid emergence
SEVOFLURANE INDUCTION PROCEDURE: COMPARISON between FIXED 8% vs INCREMENTAL TECHNIQUE in PEDIATRIC PATIENTS

100 children

Both groups premedicated with midazolam 0.5mg/kg
Sevo at 1% N₂O 50%-increased sevo by 1% every 3 breaths for induction
Sevo 8% N₂O 50% induction

Time to LOC lower using 8% method
Incremental method cost almost half of fixed 8% induction method

Singh PM
AANA Journal
82:2014

ANESTHESIA MACHINES

ADDITIONAL EQUIPMENT
DISADVANTAGES of SEVOFLURANE

Importance of Recent URI
Possibility of MH
Requires provider with experience and high quality airway skills
Tachycardia more common than propofol
Higher incidence of nausea/vomiting than propofol
Emergence agitation more common

WHAT is EMERGENCE AGITATION?

Children aroused from anesthesia enter a state of excitation...
- Irritable, uncompromising, uncooperative, incoherent, crying
- Do not recognize familiar people, objects
- Combative behavior
- Occurs within 30 min of recovery
- Often resolves spontaneously
EMERGENCE AGITATION RISK FACTORS

- PRESCHOOL AGE: 2-6
- BOYS > GIRLS
- PREOPERATIVE ANXIETY
- DISTRESS DURING INDUCTION
- PREVIOUS TRAUMATIC EXPERIENCE AT DENTIST
- POOR PAIN CONTROL
- HEAD & NECK PROCEDURES

CHILDREN...
- MORE EMOTIONAL
- LESS SOCIAL
- MORE IMPULSIVE
- LESS ADAPTABLE

PARENTS...
- HIGH ANXIETY

EFFECTS OF EMERGENCE AGITATION

- Injury to the child
- Injury to the surgical site
- Inability to control bleeding
- Accidental removal of dressings
- Accidental removal of IV catheters
- May require additional nursing care
- May require supplemental sedatives/analgesics
- Raises questions about anesthetic ‘quality’
- Causes anxiety in parents witnessing EA
PHARMACOLOGICAL PREVENTION of SEVOFLURANE and DESFLURANE RELATED EMERGENCE AGITATION in CHILDREN: A META-ANALYSIS of PUBLISHED STUDIES

324 studies identified
58 relevant articles
37 studies included
3172 Total patients
Randomized studies
Double-blinded studies
Control group
Standardized definition of EA

Dahmani S
Brit J Anaes
104:2010

TREATMENTS STUDIED for PROPHYLACTIC PREVENTION of EA

Midazolam
Propofol +
Fentanyl +
Ketamine +
$\alpha_2$-Agonist +
Local anesthesia +
Ondansetron
### PROPHYLACTIC TREATMENT of EA  
Dahmani 2010

**Midazolam**
- Premedication – **not protective** against EA
- Bolus after induction – **not protective** against EA

**Propofol**
- Continuous infusion – **protective** against EA
- Bolus at end of case – **protective** against EA
- Bolus after induction – **not protective** against EA

**Ketamine**
- Premedication – **protective** against EA
- Bolus after induction – **protective** against EA
- Bolus at end of case – **protective** against EA

**Fentanyl**
- Intranasal – **protective** against EA
- Bolus after induction – **not protective** against EA

**α₂-Agonist – Dexmedetomidine/Clonidine**
- All routes/timing – **protective** against EA

**Local anesthesia**
- **Protective** against EA

**Ondansetron**
- **Not protective** against EA
- Only 2 studies – more research needed
EVIDENCE-BASED CONCLUSIONS
Reduce/Eliminate Emergence Agitation & Prevalence of Nausea/Vomiting to attain Ideal Pediatric Anesthetic Experience

Premedication: Midazolam 0.5mg/kg
Dexmedetomidine: 3-4mcg/kg
Induction: Sevoflurane: Incremental to 8%
Maintenance: Sevoflurane 1.5-3%
Emergence: Propofol 0.5-1mg/kg

‘GUARDED’ AIRWAY
‘GUARDED’ AIRWAY

IF INADEQUATE – UPPER AIRWAY COMPLICATIONS MORE LIKELY INCLUDING A HIGHER CHANCE OF LARYNGOSPASM

FUNCTIONAL RESIDUAL CAPACITY

Airway Matures to that of an Adult by age 10-12
<table>
<thead>
<tr>
<th>Date</th>
<th>10/11/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Name</td>
<td>Little John Doe</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>65</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>29.3</td>
</tr>
<tr>
<td>Premedication</td>
<td></td>
</tr>
<tr>
<td>Midzolam PO (0.5mg/kg)</td>
<td>15 mg</td>
</tr>
<tr>
<td>Propofol IV (0.5mg/kg)</td>
<td>Deepen 15 mg</td>
</tr>
<tr>
<td>Lidocaine IV (1.5mg/kg)</td>
<td>Break 44 mg</td>
</tr>
<tr>
<td>Succinylcholine IV (0.5 mg/kg)</td>
<td>Break 15 mg</td>
</tr>
<tr>
<td>IV (1.5 mg/kg)</td>
<td>Intubation 44 mg</td>
</tr>
<tr>
<td>Subcutaneous (3 mg/kg)</td>
<td>Intubation 89 mg</td>
</tr>
<tr>
<td>IM (4 mg/kg)</td>
<td>Intubation 118 mg</td>
</tr>
<tr>
<td>Bradycardia Atropine IV (0.02 mg/kg)</td>
<td>0.6 mg</td>
</tr>
<tr>
<td>ETT (0.06 mg/kg)</td>
<td>1.8 mg</td>
</tr>
<tr>
<td>Bronchoscopy Epinephrine IM (0.01 mg/kg)</td>
<td>2nd Dose = 0.5mg</td>
</tr>
<tr>
<td>Anaphylaxis 2nd Dose = 0.5mg</td>
<td>0.5 cc</td>
</tr>
<tr>
<td>Reversal Flumazenil IV (0.03 mg/kg)</td>
<td>0.3 mg</td>
</tr>
<tr>
<td>Naloxone IV (0.03 mg/kg)</td>
<td>0.3 mg</td>
</tr>
<tr>
<td>Arrest Lidocaine IV (1 mg/kg)</td>
<td>30 mg</td>
</tr>
<tr>
<td>ETT (2.5 mg/kg)</td>
<td>74 mg</td>
</tr>
<tr>
<td>Epinephrine IV (0.01 mg/kg)</td>
<td>1:10,000</td>
</tr>
<tr>
<td>Induction Propofol IV (2.5 mg/kg)</td>
<td>74 mg</td>
</tr>
<tr>
<td>Fluid Bolus Lactated Ringers 591 ml</td>
<td></td>
</tr>
<tr>
<td>Maximum Dose</td>
<td></td>
</tr>
<tr>
<td>2% Lidocaine 1:100K Epi</td>
<td>215 mg</td>
</tr>
<tr>
<td>4% Articaine 1:100K Epi</td>
<td>215 mg</td>
</tr>
<tr>
<td>.5% Bupivacaine 1:200K Epi</td>
<td>39 mg</td>
</tr>
</tbody>
</table>

**Excel spreadsheet Available Online at the ADSA Website**

www.adsahome.org
QUESTIONS?

THANK YOU!