Pain Perception and Control for Pediatric Patients

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Disclosures

• I have no financial interests relevant to this topic

• The opinions expressed in this presentation are those of the speaker and not necessarily those of the LSU Department of Continuing Education.

• The opinions expressed in this course should not be construed as advice to care for specific patients.
Learning Objectives:

1.) Acquire an understanding of pain perception and modulation in very young children.

2.) Describe appropriate local anesthesia agents and techniques for pain control in children.

3.) Formulate systemic pain control strategies for children.
FACT OR FICTION!!
Brain Changes with Pain and Anesthetic

FACT OR FICTION

Very young children do not perceive pain the same way as adults due to an immature nervous system.
“Pediatric patients seldom need medication for the relief of pain. They tolerate discomfort well. The child will say he does not feel well or that he is uncomfortable or that he wants his parents, but often he will not relate this unhappiness to pain.”

Historical Views of Pediatric Pain

• 25 children ages 4-8

<table>
<thead>
<tr>
<th></th>
<th>Narcotic Dosage</th>
<th>Nonnarcotic Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Adults</td>
<td>372</td>
<td>299</td>
</tr>
</tbody>
</table>

Key sites of developmental transition in infant pain pathways
FACT OR FICTION

Very young children do not perceive pain the same way as adults due to an immature nervous system.
If a painful procedure is performed when a child is very young then they will not remember it.
Central Sensitization

Central Sensitization

If a painful procedure is performed when a child is very young then they will not remember it.
What does this mean for dentists?

Benzocaine is safe and effective for children.
Topical Anesthesia

• 89% always
• Hurricaine gel most common (41%)
• Wait time
  • <10 sec 4%
  • 11-30 sec 30%
  • 31-60 33%
  • >61 sec 33%
• low confidence about adequacy
• Taste most disliked 90%

FDA Warning “Benzocaine and Babies: Not a Good Mix” - 2011

• Recommends parents and caregivers not use benzocaine products for children under 2 except under the advice and supervision of a health care professional

http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm306062.htm
Benzocaine is safe and effective for children.
Compound Topical Anesthetics

• “may be an effective alternative to local infiltration for some minimally invasive dental procedures; however, legitimate concerns exist in regard to their safety”

New Technology in Dentistry?
FACT OR FICTION

Mepivacaine plain is preferred in pediatric dentistry because its short duration is associated with less lip and cheek biting trauma.
Mepivacaine HCL
Mepivacaine plain is preferred in pediatric dentistry because its short duration is associated with less lip and cheek biting trauma.
Prilocaine

• 4% solution
• not a potent vasodilator
• associated with methemoglobinemia
• contraindicated with glucose 6 phosphate dehydrogenase deficiency
Prilocaine - more comfortable?

FACT OR FICTION

Articaine is safe and effective in dentistry for children.
Your poll will show here

1. Install the app from pollev.com/app
2. Make sure you are in Slide Show mode

Still not working? Get help at pollev.com/app/help
or
Open poll in your web browser
Articaine HCL

- 4% solution
- metabolized in plasma and liver shortest metabolic half-life (27-42 minutes)

Is it safe and effective for children?

Yes!

Adewumi 2008  Ram 2006
<table>
<thead>
<tr>
<th>Agents (Brand Name)</th>
<th>Concentration of Local Anesthetic mg/mL&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Concentration of epi/levo mg/Cartridge&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Maximum Dosing Adult (mg)</th>
<th>MRD/lb&lt;sup&gt;d&lt;/sup&gt; (mg/lb)</th>
<th>Maximum Number of Cartridges Adults&lt;sup&gt;e&lt;/sup&gt;</th>
<th>50 lb Child</th>
<th>25 lb Child</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lidocaine, 1:100,000 epi</td>
<td>20</td>
<td>36</td>
<td>0.018</td>
<td>500</td>
<td>3.3</td>
<td>13.8</td>
<td>4.6</td>
</tr>
<tr>
<td>2% Lidocaine, 1:50,000 epi</td>
<td>20</td>
<td>36</td>
<td>0.036</td>
<td>500</td>
<td>3.3</td>
<td>13.8</td>
<td>4.6</td>
</tr>
<tr>
<td>2% Lidocaine plain</td>
<td>20</td>
<td>36</td>
<td>—</td>
<td>300</td>
<td>2.0</td>
<td>8.3</td>
<td>2.8</td>
</tr>
<tr>
<td>4% Articaine, 1:100,000 epi</td>
<td>40</td>
<td>72</td>
<td>0.018&lt;sup&gt;*&lt;/sup&gt;</td>
<td>500</td>
<td>3.3</td>
<td>6.9</td>
<td>2.3</td>
</tr>
<tr>
<td>4% Articaine, 1:200,000 epi</td>
<td>40</td>
<td>72</td>
<td>0.009&lt;sup&gt;*&lt;/sup&gt;</td>
<td>500</td>
<td>3.3</td>
<td>6.9</td>
<td>2.3</td>
</tr>
<tr>
<td>3% Mepivacaine</td>
<td>30</td>
<td>54</td>
<td>—</td>
<td>400</td>
<td>2.6</td>
<td>7.4</td>
<td>2.5</td>
</tr>
<tr>
<td>2% Mepivacaine, 1:20,000 levo</td>
<td>20</td>
<td>36</td>
<td>0.09</td>
<td>400</td>
<td>2.6</td>
<td>11.1</td>
<td>3.7</td>
</tr>
<tr>
<td>4% Prilocaine</td>
<td>40</td>
<td>72</td>
<td>—</td>
<td>600</td>
<td>4.0</td>
<td>8.3</td>
<td>2.8</td>
</tr>
<tr>
<td>4% Prilocaine, 1:200,000 epi</td>
<td>40</td>
<td>72</td>
<td>0.009</td>
<td>600</td>
<td>4.0</td>
<td>8.3</td>
<td>2.8</td>
</tr>
<tr>
<td>0.5% Bupivacaine, 1:200,000 epi</td>
<td>5</td>
<td>9</td>
<td>0.009</td>
<td>90</td>
<td>0.6</td>
<td>10</td>
<td>NR</td>
</tr>
</tbody>
</table>

Rule of 25
Articaine should not be used for mandibular blocks.
Articaine and Mandibular Blocks

• Pharmacovigilance Working party of the European Union

“Regarding articaine, the conclusion is the safety profile of the drug has not significantly evolved since its initial launch. Thus, no medical evidence exists to prohibit the use of articaine according to the current guidelines listed in the summary of product characteristics.” 2006
“...there exist data that suggest that these solutions are potentially associated with an increased likelihood of paresthesia...the authors recommend that the use of 4% articaine and 4% prilocaine for the mandibular block should be avoided.”

# Articaine Versus Lidocaine

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Articaine</th>
<th>Lidocaine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined studies</td>
<td>Significantly Better</td>
<td></td>
</tr>
<tr>
<td>Maxillary Infiltration</td>
<td>No Significant Difference</td>
<td></td>
</tr>
<tr>
<td>Mandibular Block</td>
<td>No Significant Difference</td>
<td></td>
</tr>
<tr>
<td>Supplemental Infiltration after IANB</td>
<td>Significantly Better</td>
<td></td>
</tr>
</tbody>
</table>

FACT OR FICTION

Articaine should not be used for mandibular blocks.
2% Articaine?

Senes AM, Calvo AM, Colombini-Ishikiriama, Goncalves PZ, Dionisio TJ, Santana E, Brosoki DR, Lauris JRP, Faria FAC, Santos CF. Efficacy and safety of 2% and 4% articaine for lower third molar surgery. J Dent Res. 2015;94(9 Suppl):166S-73S.
Mandibular infiltration on the mandibular is as effective as inferior alveolar nerve blocks.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Art. vs Lido Primary Molars</td>
<td>Art. vs. Lido Infil vs. IANB Prim and Perm Molars</td>
<td>IA vs. Infiltration Primary Molars</td>
<td>Art. vs Lido vs. Prilo</td>
<td></td>
</tr>
<tr>
<td>Intracoronal</td>
<td>Intracoronal</td>
<td>Amalgam, SSC, Pulp, Ext</td>
<td>EPT</td>
<td></td>
</tr>
<tr>
<td>LA</td>
<td>No Diff</td>
<td>No Diff</td>
<td>N/A</td>
<td>Articaine superior</td>
</tr>
<tr>
<td>Success</td>
<td>65%</td>
<td>71-65%</td>
<td>87% SSC 62% Pulp</td>
<td>52 55%</td>
</tr>
<tr>
<td>Technique</td>
<td>Median SEM score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inferior alveolar nerve block (n = 75)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular anterior local infiltration (n = 43)</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular posterior local infiltration (n = 53)</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle superior alveolar nerve block (n = 68)</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior superior alveolar nerve block (n = 89)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary anterior local infiltration (n = 79)</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater palatine nerve block (n = 25)</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasopalatine nerve block (n = 23)</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FACT OR FICTION

Mandibular infiltration on the mandibular is as effective as inferior alveolar nerve blocks.
Needle Breakage Prevention

Local Anesthetic - What’s New?
Wand STA System

<table>
<thead>
<tr>
<th>Injection condition</th>
<th>Mean duration</th>
<th>Any disruptive behavior</th>
<th>Crying</th>
<th>Body movement</th>
<th>Restraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wand</td>
<td>179</td>
<td>50%</td>
<td>30%</td>
<td>28%</td>
<td>3%</td>
</tr>
<tr>
<td>Traditional</td>
<td>54</td>
<td>71%</td>
<td>57%</td>
<td>49%</td>
<td>34%</td>
</tr>
<tr>
<td><em>t value</em></td>
<td>12.39‡</td>
<td>2.10*</td>
<td>2.40*</td>
<td>2.34*</td>
<td>3.44†</td>
</tr>
</tbody>
</table>

*P<.05; †P<.01; ‡P<.001.
Vibrating Devices In Dentistry

Vibraject Accupal Dental Vibe
Vibraject

Dental Vibe

• Statistically significant reduction in pain in adolescents

Buffered Anesthetic
Sodium Bicarbonate


- 20 participants
- used mixing pen device
- IANB
- 71% achieved pulpal analgesia in 2 minutes or less versus 12%
- 72% rated the alkalized injection as more comfortable
Double-Blind Crossover Study to Compare Pain Experience During Inferior Alveolar Nerve Block Administration Using Buffered Two Percent Lidocaine in Children

Radhika Chopra, BDS, MDS1 • Garima Jindal, BDS, MDS2 • Vinod Sachdev, BDS, MDS3 • Meera Sandhu, BDS, MDS4
Phenolatamine Mesylate

• non-selective alpha-adrenergic blocking agent

• vasodilation
K305 (3% tetracaine plus 0.05% oxymetazoline)
Systemic Analgesics
FACT OR FICTION

Tylenol with codeine is the preferred analgesic for moderate to severe postoperative pain in children.
Opioids

• Severe pain
• Can be combined with acetaminophen or NSAIDS
• Side effects
  • sedation
  • constipation
  • pruritus
  • dysphoria
  • respiratory depression

• Boxed working
• risk of adverse events in post-operative pain management following tonsillectomy and/or adenoidectomy
• Contraindication
Codeine metabolism and genetic polymorphism of CYP2D6

- Poor metabolizers
- 2 nonfunctional alleles
- Extensive Metabolism
- 1 or 2 functional alleles
- Ultra-rapid metabolism
- duplicated or amplified genes

### Prevalence of Ultra-rapid Metabolizers in Different Populations

<table>
<thead>
<tr>
<th>Population</th>
<th>UM Genotypes/Phenotypes († Activity)</th>
<th>Prevalence % (UM/Total n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>African/Ethiopian</td>
<td>UM (active duplicate genes)</td>
<td>29% (35/122)</td>
</tr>
<tr>
<td>African American</td>
<td>UM (three active duplicate genes)</td>
<td>3.4% (3/87) 6.5% (60/919)</td>
</tr>
<tr>
<td>Asian</td>
<td>UM (active duplicate genes)</td>
<td>1.2% (5/400) 2%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>UM (three active duplicate genes)</td>
<td>3.6% (33/919) 6.5% (18/275)</td>
</tr>
<tr>
<td>Greek</td>
<td>CYP2D6*2xN/UM</td>
<td>6.0% (17/283)</td>
</tr>
<tr>
<td>Hungarian</td>
<td>UM (active duplicate genes)</td>
<td>1.9%</td>
</tr>
<tr>
<td>Northern European</td>
<td>UM (active duplicate genes)</td>
<td>1-2%</td>
</tr>
</tbody>
</table>

FACT OR FICTION

Tylenol with codeine is the preferred analgesic for moderate to severe postoperative pain in children.
Morphine vs. Ibuprofen

Table 2: Mean pre–post differences in pain scores* between groups†

<table>
<thead>
<tr>
<th>Dose</th>
<th>No. of participants</th>
<th>Pre–post difference, mean ± SD</th>
<th>No. of participants</th>
<th>Pre–post difference, mean ± SD</th>
<th>Between-group difference (95% CI)</th>
<th>p value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>66</td>
<td>1.5 ± 1.2</td>
<td>68</td>
<td>1.3 ± 1.0</td>
<td>0.2 (-0.2 to 0.6)</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>1.3 ± 1.3</td>
<td>54</td>
<td>1.3 ± 0.9</td>
<td>0.0 (-0.4 to 0.4)</td>
<td>0.9</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>1.3 ± 1.4</td>
<td>48</td>
<td>1.4 ± 1.1</td>
<td>-0.1 (-0.7 to 0.4)</td>
<td>0.6</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
<td>1.5 ± 1.4</td>
<td>36</td>
<td>1.1 ± 1.2</td>
<td>0.4 (-0.2 to 1.1)</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Note: SD = standard deviation, CI = confidence interval.
* Determined using the Faces Pain Scale — Revised.
† Reflects the number of participants taking the dose of each medication at the corresponding time interval.
‡ Unpaired t test.

### Table 3: Proportion of participants with adverse effects between groups

<table>
<thead>
<tr>
<th>Adverse effect</th>
<th>Morphine n = 66</th>
<th>Ibuprofen n = 68</th>
<th>p value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>37 (56.1)</td>
<td>21 (30.9)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Nausea</td>
<td>18 (27.3)</td>
<td>4 (5.9)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Vomiting</td>
<td>8 (12.1)</td>
<td>2 (2.9)</td>
<td>0.04</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>23 (34.8)</td>
<td>14 (20.6)</td>
<td>0.07</td>
</tr>
<tr>
<td>Dizziness</td>
<td>8 (12.1)</td>
<td>6 (8.8)</td>
<td>0.5</td>
</tr>
<tr>
<td>Constipation</td>
<td>4 (6.1)</td>
<td>1 (1.5)</td>
<td>0.2</td>
</tr>
<tr>
<td>Other‡</td>
<td>8 (12.1)</td>
<td>3 (4.4)</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*Some patients had more than 1 adverse effect.
†Pearson χ² test.
‡Includes headache, abdominal pain, irritability and hyperactivity.

Thank you!

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