Management of difficulties and complications in laryngology

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Objectives

- Identify common pitfalls and complications
- Review management
- Improve awareness → prevention
- Office
- Operating room
Local anesthetics

**AMIDES**
- Lidocaine (Xylocaine)
- Bupivacaine (Marcaine)
- Mepivacaine (Carbocaine)
- Prilocaine (Citanest)
- Etidocaine (Duranest)

**ESTERS**
- Tetracaine (Pontocaine)
- Benzocaine (Hurricaine)
- Benzocaine + tetracaine (Cetacaine)
- Procaine (Novocaine)
Amides ≠ Esters
Allergy to local anesthetics

- True allergy = rare
- Preservatives
- Esters > Amides
  - *Pontocaine, Benzocaine, Cetacaine, Novocaine*
- Site of injection = most important factor

Vascularity \(\rightarrow\) Pronounced/rapid effects
Allergic reactions: signs

- CNS $\rightarrow$ CV
- Resembles vasovagal
- Presentation
  - Early: metallic taste, tinnitus, lightheadedness, confusion
  - Intermediate: tremors, shivering
  - Later: generalized seizures, respiratory distress
- CV effects
  - Low-dose: vasoconstriction, HTN
  - High-dose: heart block
  - Ventricular arrhythmias rare
Allergic reactions: treatment

Stop injection
Airway
Ventilation
Evaluation of circulation
Drugs
Allergic reactions: treatment

• Bronchospasm/edema:
  – Bronchodilators
  – Antihistamines
  – Corticosteroids

• Hypotension:
  – IVFs

• Very bad bradycardia:
  – Pressors
  – AV pacing
  – Cardiopulmonary bypass
Local anesthetics: Toxicity

• 0.1-0.4% of local anesthetic administrations
• 0.5-1% lidocaine
• 0.25% bupivacaine
• ↑ concentrations → NO additional benefit!
# Lidocaine toxicity: injection

<table>
<thead>
<tr>
<th></th>
<th>Lidocaine plain</th>
<th>Lidocaine with Epi</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onset</strong></td>
<td>&lt; 2 min</td>
<td>&lt; 2 min</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>1.5-2 hours</td>
<td>2-6 hours</td>
</tr>
<tr>
<td><strong>Maximal dose</strong></td>
<td>4 mg/kg 28cc of 1% 14cc of 2%</td>
<td>7 mg/kg 50cc of 1% 25cc of 2%</td>
</tr>
</tbody>
</table>
# Maximum safe doses (injection)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Concentration</th>
<th>Max dose (mg)</th>
<th>Max volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine (plain)</td>
<td>1%</td>
<td>300</td>
<td>30</td>
</tr>
<tr>
<td>Lidocaine w/ epi*</td>
<td>1%</td>
<td>500</td>
<td>50</td>
</tr>
<tr>
<td>Bupivacaine (plain)</td>
<td>0.25%</td>
<td>175</td>
<td>70</td>
</tr>
<tr>
<td>Bupivacaine w/ epi*</td>
<td>0.25%</td>
<td>225</td>
<td>90</td>
</tr>
</tbody>
</table>

*Concentration=1:100,000

Toxicity: CNS effects

- CNS: stimulation → depression
  - Numbness of tongue
  - Lightheadedness
  - Tinnitus
  - Visual changes
  - Muscle twitching
  - Convulsions/seizures
  - Coma
  - Apnea
Toxicity: treatment

- Oxygen/ventilation
- IV access
- Monitor vital signs and cardiac rhythm
- For hypotension:
  - Leg elevation
  - IVFs
  - Pressors (DA, NE, Epi)
Methemoglobinemia

- Benzocaine
  - Hurricane spray
- Cetacaine
  - Tetracaine + benzocaine
- Drugs involved:
  - Nitrates, nitrites, nitric oxide, silver nitrate, silver sulfadiazine, sulfonamides, metoclopramide
  - Also OTC toothache relief, baby-teething gels, sting relief formulas, pain relief sprays, hemorrhoidal creams
Methemoglobinemia

- Present in normal erythrocytes
  - 1-2%)

- Pathophysiology:
  - Iron in Hgb oxidized → unable to bind and carry oxygen
  - Oxygen delivery to tissues impaired
  - Eventually reduced to deoxyhemoglobin → able to bind and carry oxygen again
Methemoglobinemia: signs/symptoms

- **Onset within**
  - 20-60 minutes

- **Signs depend on concentration**
  - 10-15% = cyanosis
  - >20% = anxiety, fatigue, dyspnea, dizziness, tachycardia, HA, syncope
  - >50% = marked dyspnea, metabolic acidosis, dysrhythmia, lethargy, progressing to stupor, coma, convulsions
  - >70% = death

- **Symptomatic once methemoglobin > 8%**
Suspect methemoglobinemia

- Cyanosis is out of proportion to O2 sats
  - Pulse ox < hypoxia
  - Pulse ox < ABG

- Kronenberg “red-brown” test
  - Arterial blood = chocolate brown
  - Fails to change color when exposed to air or when dried on filter paper
Methemoglobinemia: treatment

- $T_{1/2} = 55$ minutes

- Treatment =
  - IV methylene blue (1-2mg/kg)
  - MOA = converts iron back to reduced state $\rightarrow$ oxygen carrying capacity restored

- Cyanosis resolves within 15-30 minutes

- Beware rebound methemoglobinemia
  - Can occur up to 18 hrs after $\rightarrow$ ADMIT
Methemoglobinemia: warnings/recommendation

- No known predisposing factors

- Can occur with only one spray of benzocaine
  - Sprays should be <1 sec
  - No more than 2 sprays total (<1 sec each)

- Do not apply to inflamed or broken skin/mucus membranes
Flexible nasolaryngoscopy

“Now open even wider, Mr. Stevens. … Just out of curiosity, we’re going to see if we can also cram in this tennis ball.”
Vasovagal response

- Initiated by stressful or painful experience
- Young women and men
Vasovagal response

- Hypotension and bradycardia → cerebral hypoperfusion
- Prodrome = lightheadness, nausea, tinnitus, diaphoresis, salivation, pallor, pupil dilation/vision changes, tachycardia
- Patient loses consciousness and postural tone
- Consciousness regained when pt becomes horizontal
Vasovagal response: treatment

- Remove inciting stimulus
- Lay patient supine
- Elevate the legs
- Cool washcloth to forehead
- Smelling salts
- Atropine if bradycardic
Flexible fiberoptic laryngoscopy
Flexible fiberoptic laryngoscopy

- **Enzol**
  - Enzymatic detergent
  - Removes organic matter

- **Cidex**
  - Gluteraldehyde
  - 14- or 28-day reuse life
  - “Standard”

- **Cidex OPA**
  - 0.55% ortho-phthaldehyde
  - No dialdehyde
  - Gentle, fast, efficient, environmentally safer
Prevention is key!

- Chip-tip vs. fiberoptic
- Working channel

- Preclean: Enzymatic agent (Enzol®)
- Leak testing
  - either via hand leak testing or automated leak tester (recommended) → using water under pressure through channel
- Cleaning
- 3 rinses of 200 ml
- Drying with forced air or 70% alcohol
- Proper storage
“Whoa! *That* was a good one! Try it, Hobbs—just poke his brain right where my finger is!”
Suspension laryngoscopy

• Suspension system
  – Bed
  – Mayo stand
  – Chest

• Direction of force of pull
  – BU system
  – Lewy system
Microsuspension laryngoscopy

- Dental injury
- Nerve injury
- Mucosal injury
- Throat pain
- TMJ aggravation
- Dysphagia
Dental injury

- Incidence: 0%-6.5%
  - Loosening of 1 or more teeth = 43%
  - Fracture of teeth and roots = 24%
  - Avulsions = 13%
  - Other (damage of prostheses and dental fillings) = 24%

- Prevent with use of reinforced dental guard
Nerve injury

- **Tongue symptoms:**
  - Numbness
  - Dysguesia
  - Weakness

- **Klussman study: (n=339)**
  - 3.8% of all patients had nerve injury
  - 2.6% lingual injury, median duration 4 weeks
  - 1.1% hypoglossal injury, median duration 8 weeks

- **Rosen study: (n=56)**
  - 37.5% lingual injury (change in taste or sensation of tongue)
    - 17.9% change in taste
    - 0% hypoglossal injury

Mucosal injury

- **Klussman study:**
  - 75% of patients overall
  - "Mucosal erosion" = 55%
  - Hematoma = 29%
  - Bleeding = 7%
  - Fissures = 3%
  - Mucosal swelling = 5%

- **Rosen study:**
  - 0% tongue laceration
  - No mention of mucosal lacerations

- **Locations:** tonsils, posterior wall, FOM
Other complaints

- Throat pain
- TMJ aggravation
- Dysphagia (16%)
- Lip burn
  - Equipment malfunction
  - Light cords on sheets
  - Light sources
Lasers

- Airway fire
- Burns/thermal damage
- Tracheal perforation
Airway fire

- Incidence = 100 episodes/year
- 95% occur in H&N procedures
- Necessary triad for airway fire:
  - Heat/ignition
  - Fuel
  - Oxidizer
- Most common ignition source
  - electrosurgical unit (i.e. Bovie)
Combustible materials

- Alcohol concentration $\rightarrow$ flammability

- Only water-based prep solutions contain no alcohol $\rightarrow$ nonflammable
  - betadine, soloprep, and pharmaseal

- Other flammable substances:
  - $O_2$-rich environments (e.g. draped head)
  - Any ointment because all are suspended in alcohol (e.g. benzoin, mastazol)
  - Degreasers (e.g. ether, acetone)
  - Hair
  - Abdominal gases
Airway fire: prevention/treatment

- Apnea, laser-resistant ETT
- Use $\text{FiO}_2 \leq 30\%$
- Do not use nitrous oxide
- Ensure that all staff know location of fire extinguishers
- Have response plan in place
In the event of airway fire:

- 4 “E’s”
  - Extract
  - Eliminate
  - Extinguish
  - Evaluate

- Immediately remove combustible material (ETT/pledgets)
- Turn off $O_2$
- Saline flush/bucket of water to extinguish fire
- Evaluate rest of airway → bronchoscopy
- Ventilate with room air
Laryngospasm

- **Incidence = 0.04-14%**
  - Seen in 21-27% of T&A sxs
  - 2-3x MC children:adults
  - OR / office

- **Causes:**
  - Inadequate CNS depression → no inhibition of glottic reflexes
  - Increased stimuli:
    - Secretions/blood on vocal folds, laryngoscope, suction, LMA, ETT
Laryngospasm

• **Complications:**
  – Cardiac arrest = 0.5%
  – Pulmonary aspiration = 3%
  – Obstructive negative pressure pulmonary edema = 4%
  – Bradycardia = 6%
  – $O_2$ desaturation = 61%

• **Risk factors:**
  – Young age, URI, smoking/passive smoking, hyperactive airway, GERD, OSA, elongated uvula, airway anomaly, ex-premature under 1 y/o
Laryngospasm: usually self-limited

Laryngospasm

Hypoxia/hypercapnia

Reflex broken

Spasm ends
Laryngospasm Treatment

• Prevention
  – LTA
  – Extubate during proper stage of anesthesia

• Conservative
  – Remove stimulus/stop airway instrumentation
  – Nasal inhalation → vocal fold abduction
  – Open mouth, tight seal with facemask, jaw lift, 100% O₂ with CPAP
    • 38% response to mask ventilation with CPAP
Laryngospasm Treatment

- Medications
  - Lidocaine → 1-1.5 mg/kg/dose
    - LTA
    - SLN block
  - Succinylcholine (1-2 mg/kg) with atropine (0.02 mg/kg) if bradycardia (intubate)
  - Propofol (0.5-0.8 mg/kg)
    - 47.6% response to muscle relaxants and ventilation
Questions?

“I know nothing about the subject, but I’m happy to give you my expert opinion.”