Workshop Local Anesthesia

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How do you do it?

- What types and techniques of local anesthesia are you using?
  - topical, infiltrative, tumescent anesthesia, nerve blocks
- Any additions to local anesthetics?
  - epinephrine, sodium bicarbonate, others?
<table>
<thead>
<tr>
<th>Generic name</th>
<th>Trade name®</th>
<th>Onset (min)</th>
<th>Duration (h)</th>
<th>Maximum dose plain (mg for 70 kg man)</th>
<th>Maximum dose with epinephrine (mg for 70 kg man)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Articaine</td>
<td>Septocaine</td>
<td>2–4</td>
<td>0.5–2</td>
<td>350</td>
<td>500</td>
</tr>
<tr>
<td>Bupivacaine hydrochloride</td>
<td>Marcaine</td>
<td>5–8</td>
<td>2–4</td>
<td>175</td>
<td>225</td>
</tr>
<tr>
<td>Etidocaine</td>
<td>Duranest</td>
<td>3–5</td>
<td>3–5</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>Levobupivacaine hydrochloride</td>
<td>Chirocaine</td>
<td>2–10</td>
<td>2–4</td>
<td>150</td>
<td>Not available</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>Xylocaine</td>
<td>Rapid</td>
<td>0.5–2</td>
<td>350</td>
<td>500 (3500 dilute)</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>Carbocaine</td>
<td>3–20</td>
<td>0.5–2</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>Prilocaine hydrochloride</td>
<td>Citanest</td>
<td>5–6</td>
<td>0.5–2</td>
<td>400</td>
<td>600</td>
</tr>
<tr>
<td>Ropivacaine*</td>
<td>Naropin</td>
<td>1–15</td>
<td>2–6</td>
<td>200</td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Esters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloroprocaine hydrochloride</td>
<td>Nesacaine</td>
<td>5–6</td>
<td>0.5–2</td>
<td>800</td>
<td>1000</td>
</tr>
<tr>
<td>Procaine</td>
<td>Novocaine</td>
<td>5</td>
<td>1–1.5</td>
<td>500</td>
<td>600</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>Pontocaine</td>
<td>7</td>
<td>2–3</td>
<td>100</td>
<td>Not available</td>
</tr>
</tbody>
</table>
the way I do it
Tumescent Local Anesthesia (TLA)
Tumescent Local Anesthesia (TLA)

- lat. „tumescere“ – swelling
- Delivery of large volumes of dilute anesthesia (usually 0.05–0.1% lidocaine with 1 : 1 000 000 epinephrine) into subcutaneous fat until the tissue distends
- Equal distribution of the anesthetic within a large area → extensive regional anesthesia of skin and subcutaneous tissue
- Application by hand or special pumping devices

**Indications e.g.**
- Large excisions
- Local Flaps
- Sentinel lymphnode biopsy
- Liposuction
- Phlebectomy
- Axillary hyperhidrosis
- Hidradenitis suppurativa
- …

Fig. from Petres/ Rompel - Operative Dermatologie, 2. ed. Springer 2007
Tumescent Local Anesthesia (TLA)

- **Advantages:**
  - **Reduced blood loss** (capillary bleeding is minimized by adrenaline induced vasoconstriction and increased distension of the tissue)
  - **Hydrodissection of the subcutaneous tissue** → easier and less traumatic preparation
  - **Reduction of postoperative hematomas**
  - **TLA lasts long** → less postoperative pain

- **Disadvantages:**
  - "wet operating field"
  - **Risk of intravascular application** (aspiration not possible) → pulse oximetry is mandatory
Different formulations of TLA solutions are possible

TLA is effective after 10-30 min due to the concentration

Table 5: Anästhesielösungen für die Tumeszenzlokalanästhesie (TLA)

<table>
<thead>
<tr>
<th>Anästhesielösung</th>
<th>Menge (ml)</th>
<th>Lidocain</th>
<th>Ropivacain</th>
<th>Adrenalin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xylocain 0,5% mit Adrenalin</td>
<td>50 ml Beutel</td>
<td>0,5%</td>
<td></td>
<td>1:200.000</td>
</tr>
<tr>
<td>Naropin 0,2% (Handelspräparat)</td>
<td>200 ml Beutel</td>
<td>0,2%</td>
<td></td>
<td>1:750.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 ml/200 ml</td>
<td></td>
</tr>
<tr>
<td>0,25% Maximale Dosis: 3 ml/kg KG</td>
<td>100 ml Rasche</td>
<td>20 ml 1%</td>
<td>5 ml 1%</td>
<td>1:500.000</td>
</tr>
<tr>
<td></td>
<td>NaCl 0,9% oder Ringer (minus 25 ml)</td>
<td></td>
<td></td>
<td>+ 0,2 ml auf 100 ml</td>
</tr>
<tr>
<td>0,5% Maximale Dosis: 4 ml/kg KG</td>
<td>100 ml Rasche</td>
<td>10 ml 1%</td>
<td>5 ml 1%</td>
<td>1:500.000</td>
</tr>
<tr>
<td></td>
<td>NaCl 0,9% oder Ringer (minus 15 ml)</td>
<td></td>
<td></td>
<td>+ 0,2 ml auf 100 ml</td>
</tr>
<tr>
<td>0,21% Maximale Dosis: 7 ml/kg KG</td>
<td>500 ml Beutel</td>
<td>50 ml 2%</td>
<td>20 ml 1%</td>
<td>1:1.000.000</td>
</tr>
<tr>
<td></td>
<td>NaCl 0,9% oder Ringer</td>
<td></td>
<td></td>
<td>+ 0,5 ml auf 500 ml</td>
</tr>
<tr>
<td>0,18% Maximale Dosis: 4 ml/kg KG</td>
<td>500 ml Beutel</td>
<td>50 ml 2%</td>
<td></td>
<td>1:1.000.000</td>
</tr>
<tr>
<td></td>
<td>NaCl 0,9% oder Ringer</td>
<td></td>
<td></td>
<td>+ 0,5 ml auf 500 ml</td>
</tr>
<tr>
<td>0,11% Maximale Dosis: 6 ml/kg KG</td>
<td>500 ml Beutel</td>
<td>20 ml 1%</td>
<td>20 ml 1%</td>
<td>1:1.000.000</td>
</tr>
<tr>
<td></td>
<td>NaCl 0,9% oder Ringer</td>
<td></td>
<td></td>
<td>+ 0,5 ml auf 500 ml</td>
</tr>
<tr>
<td>0,05% Maximale Dosis: 12 ml/kg KG</td>
<td>500 ml Beutel</td>
<td>10 ml 2%</td>
<td>10 ml 1%</td>
<td>1:1.000.000</td>
</tr>
<tr>
<td>(Erwachsene 900 ml)</td>
<td>NaCl 0,9% oder Ringer</td>
<td></td>
<td></td>
<td>+ 0,5 ml auf 500 ml</td>
</tr>
<tr>
<td>0,04% Maximale Dosis: 13 ml/kg KG</td>
<td>500 ml Beutel</td>
<td>10 ml 2%</td>
<td></td>
<td>1:1.000.000</td>
</tr>
<tr>
<td>(Erwachsene 1000 ml)</td>
<td>NaCl 0,9% oder Ringer</td>
<td></td>
<td></td>
<td>+ 0,5 ml auf 500 ml</td>
</tr>
</tbody>
</table>

Zum Beispiel Phlebostintherapie (großes LA anästhesie-Volumen gewünscht) oder Chirurgie bei Säuglingen und Kleinkindern (geringe LA Dosis erforderlich).

Table 3.9: Klein’s basic tumescent anesthetic solution

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>FINAL CONCENTRATION</th>
<th>AMOUNT ADDED TO 1 LITER NORMAL SALINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>500 mg/L</td>
<td>50 mL of 1% Lidocaine</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>0.5 mg/L</td>
<td>0.5 mL of 1:10 000 epinephrine</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>10 mEq/L</td>
<td>10 mL of 8.5% sodium bicarbonate</td>
</tr>
</tbody>
</table>

Löser C., Möhrle M. Hautarzt. 2012 Feb;63(2):121-8

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Topical anesthesia
# Topical anesthetics for mucosal surfaces

<table>
<thead>
<tr>
<th>ANESTHETIC</th>
<th>TRADE NAME</th>
<th>CONCENTRATION (%)</th>
<th>VEHICLE</th>
<th>ONSET OF ACTION</th>
<th>DURATION OF ACTION</th>
<th>CLINICAL USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocaine</td>
<td></td>
<td>4, 10</td>
<td>Solution</td>
<td>1-5 minutes</td>
<td>30-60 minutes</td>
<td>Intranasal</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>Xylocaine</td>
<td>2-5</td>
<td>Gel, ointment, topical and viscous solution</td>
<td>1-2 minutes</td>
<td>15-20 minutes</td>
<td>Oral mucosa</td>
</tr>
<tr>
<td>Benzocaine</td>
<td>Hurricane</td>
<td>20</td>
<td>Liquid, gel, spray, swab</td>
<td>&lt;5 minutes</td>
<td>15-45 minutes</td>
<td>Oral mucosa</td>
</tr>
<tr>
<td>Benzocaine combination</td>
<td>Cetacaine</td>
<td>*</td>
<td>Spray, liquid</td>
<td>30 seconds</td>
<td>30-60 minutes</td>
<td>Oral mucosa</td>
</tr>
<tr>
<td>Proparacaine</td>
<td>Alcaine</td>
<td>0.5</td>
<td>Solution</td>
<td>20 seconds</td>
<td>15-20 minutes</td>
<td>Ophthalmic</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>Pontocaine</td>
<td>0.5</td>
<td>Solution</td>
<td>20 seconds</td>
<td>12-20 minutes</td>
<td>Ophthalmic</td>
</tr>
</tbody>
</table>

Robinson / Hanke / Siegel et al. - Surgery Of The Skin, 2nd edition, Mosby 2010
EMLA

- EMLA (eutectic mixture of local anesthesia) is a mixture composed of 2.5 mg/mL of lidocaine and 2.5 mg/mL of prilocaine in an oil-in-water emulsion cream.
- EMLA's formulation contains emulsifiers that enhance skin penetration and increase the anesthetic concentration to 80% in the oil droplets.
- A 60-minute application period under an occlusive dressing, such as Tegaderm (3M Healthcare, St Paul, MN) is needed before the procedure.
- Depth of analgesia after 60 minutes is 3.0 mm and after 120 minutes, 5.0 mm.
- Because of the risk of methemoglobinemia associated with prilocaine, EMLA should be used with caution in infants.
- Use of EMLA close to the eyes should be avoided.
Topical anesthesia / Cryoanesthesia
Infiltrative techniques
Local infiltration

- **Most commonly used technique** in cutaneous surgery

- Either intradermally and/or subcutaneously

- **Intradermal injection** results in an
  - **immediate onset and prolonged duration** of anesthesia compared to deeper injections
  - cause **more** tissue distortion and **pain**

- **Subcutaneous injection** of anesthetics produces
  - **less tissue distortion and pain**, but has
  - **slower onset and duration** (result of diffusion and increased absorption)

- Patients often feel a ‘stick’ and ‘burning’ sensation associated with the entry of the needle into the skin and the infiltration of the anesthesia.

- **Injecting slowly** and using only the volume necessary to achieve adequate anesthesia can attenuate the pain associated with tissue distension.
Field block

- Placement of anesthesia **circumferentially** around the operative site
- Useful when direct infiltration into the surgical field is undesirable
- Minimizes the total amount of anesthetic required
- To obtain optimal anesthesia the anesthetic should be injected into the **superficial and deep planes**.

Robinson / Hanke / Siegel et al. - Surgery Of The Skin, 2nd edition, Mosby 2010
Nerve blocks

- Enables one to *anesthetize large areas* of skin using a *small amount of anesthesia*.
- Nerve blocks cause *less discomfort for the patient* given the *limited number of injections*, especially during a mucosal approach.
- Nerve blocks *do not usually provide sufficient hemostasis*.
- If wide undermining is planned and hemostasis is needed, a more dilute lidocaine with epinephrine mixture can be infiltrated painlessly in the field following the block.
- As vessels tend to travel along sensory nerves, care must be taken to avoid injecting into a vessel by *aspirating before injection*.
- After the needle is placed into the desired area, a small volume of *anesthetic is injected and allowed to diffuse around the nerve*.
- Do not inject into the nerve itself, which can cause a neuropraxia resulting in paresthesia in the distribution of the nerve.
- Usually the block is *effective after 5–10 minutes*. 
Nerve blocks on the face

A

Supratrochlear nerve

Supraorbital nerve

B

Infraorbital nerve

C

Mental nerve

Robinson / Hanke / Siegel et al. - Surgery Of The Skin, 2nd edition, Mosby 2010
Supraorbital and supratrochlear nerve

- branches of the frontal nerve, which arises from the ophthalmic (V1) nerve
- innervate the **ipsilateral forehead** and frontal scalp to the vertex

- **supraorbital nerve** emerges from the supraorbital foramen located on the **superior orbital rim** in the **midpupillary line**.

- **supratrochlear nerve** lies along the **upper medial corner** of the orbit approximately **1.5 cm medial to the supraorbital notch**

- Both nerve blocks can be achieved by entering just lateral to the supraorbital notch in the midpupillary line and injecting 1–2 ml of anesthetic toward the midline.
External nasal nerve

- Branch of the anterior ethmoidal nerve
- Emerges from between the lower border of the nasal bone and the upper lateral nasal cartilage.
- Anesthesia to the skin of the ipsilateral nasal dorsum, nasal tip, and columella
- Injecting approximately 1 ml of anesthetic bilaterally just off the midline after palpating for the junction between the mobile lateral cartilage and the firm nasal bones.

Nasal cutaneous sensory nerves
Infraorbital nerve

- Largest branch of the maxillary nerve (V2)
- Emerges from infraorbital foramen
- Innervation of the ipsilateral lower eyelid, nasal sidewall and ala, upper lip and medial cheek
- Infraorbital foramen is located medial the midpupillary line 0.7 – 1cm below the infraorbital rim.
- Percutaneous and intraoral approach for blocking this nerve is possible
- With the intraoral approach, the needle is advanced through the buccal sulcus at the canine fossa for about 1 cm. Injection of 1-2ml of anesthetic just over the periosteum.
- Intraoral route tends to be less painful - combine this with the use of a topical mucosal anesthetic.
Mental nerve

- Terminal branch of the mandibular nerve (V3)

- Emerges from the mental foramen approx. 2.5 cm lateral to the midline just medial to the midpupillary line and midway along the vertical height of the mandibular bone.

- Innervation of ipsilateral chin and lower lip including adjacent mucosa and gingiva.

- Percutaneous or intraoral approach for blocking this nerve is possible

- When using the intraoral route the anesthetic is injected into the inferior labial sulcus between the 1st and 2nd premolars just over the periosteum (1-2ml).
Anesthesia of the ear

BRANCH OF GLOSSOPHARYNGEAL NERVE (CN IX)
- Tonsils and pharynx
- Posterior tongue
- Middle ear
- Medial surface of tympanic membrane
- Mastoid air cells

BRANCH OF VAGUS NERVE (CN X)
- Pharynx and larynx
- Lateral surface of tympanic membrane
- External acoustic meatus
- Concha

NERVUS INTERMEDIUS (CN VII)
- Lateral surface of tympanic membrane
- External acoustic meatus
- Concha

LESSETER OCCIPITAL NERVE (C2, C3)
- Posterior scalp
- Superior pinna
- Supra-auricular scalp

AURICULOTEMPORAL NERVE (CN V)
- Lateral surface of tympanic membrane
- External acoustic meatus
- Temporal scalp
- Pre-auricular area and tragus
- Temporomandibular joint

GREAT AURICULAR NERVE (C2, C3)
- Angle of jaw
- Majority of pinna
- Lateral neck
- Skin over parotid gland and mastoid process
Tips and tricks
Tips and tricks for optimizing outcomes

- Talk to your patient and reassure the patient ("talk-esthesia")
- Consider using topical agents (anesthetics, ice, gentle cryotherapy) before injecting in children and extremely anxious patients
- Position the patient with head supported, leaning back in a chair or on the table
- Use small-diameter (30-gauge) needles and small volume syringes (5ml syringe)
- Minimize patient viewing of needle and injection
- Add sodium bicarbonate to neutralize pre-mixed epinephrine-containing solutions (and use within 24 hours to minimize loss of vasoconstrictor effect of epinephrine)
- Warm the anesthetic solution
- Use counter-irritation of adjacent skin (punch or squeeze the skin) to lessen pain
Tips and tricks for optimizing outcomes II

- Inject and infiltrate anesthetic slowly, deep to more superficial
- Use adequate volume of anesthetic only
  - too much increases risk of toxicity
  - too little increases patient discomfort and bleeding
- Minimize the number of skin punctures
- Re-introduce needle at previously anesthetized areas
- Change the needle frequently in case of multiple injections
- Use field or nerve blocks for larger areas
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Thank you very much
for your attention!

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