Objectives
- Explain the techniques for local and regional anesthesia in various parts of the body.
- Explain the techniques for intra-articular, hematoma, and Bier blocks.
- Discuss recent advances in regional anesthesia.

Regional Anesthesia

Case discussion of:
- Local infiltration
- Nerve blocks
- Intraarticular anesthesia
- Hematoma blocks
- Bier Blocks

Local Anesthetic History
- Cocaine was first isolated in Europe during the years 1859-1860
- Sigmund Freud first to propose the idea of using cocaine clinically
- Simultaneously, the advent of a precise syringe
Infected earring

Auricular block

Local infiltration

Less painful:
- Small needle
- Slow injection
- Inject on withdrawal
- Inject through wound edge, not skin
- Distraction
- Proximal first

Buffering
- Epi = ↓ pH = ↑ pain
- Na Bicarb = ↑ pH = ↓ pain

1 mL of Na bicarb (1 mmol/mL) to 10 mL of anesthetic
Local infiltration

- Wound with excessive bleeding:
  - lidocaine with epinephrine
- Apprehensive patient:
  - lidocaine with sodium bicarbonate
- Prolonged postprocedure pain:
  - bupivacaine

I’m allergic to that stuff...

- Allergic reactions rare – usually Esters (procaine, tetracaine) from metabolite PABA
- Amide may cross-react due to methylparaben
- Use single-use, or lido from resuscitation cart

I’m allergic to that stuff...

- 1% diphenhydramine (Benadryl) is as effective as 1% lidocaine
- Need to dilute! (usual 4% may cause necrosis)

Benadryl


Know your limits

Patient requests FB removal…
My toe hurts...

Nerve Block

Indicated when:
- Local infiltration impairs closure or compromises blood flow (e.g., fingertip)
- Multiple injections painful, amount excessive
- Most efficacious form of treatment
- Extensive limb surgery or manipulation

Digital Block

Flexor Tendon Sheath Digital Block

Advantages:
- Single injection
- Small amount
- Rapid onset
- High success rate

Flexor Tendon Sheath Digital Block
- Hand supinated
- Flexor tendon is located
- Needle inserted into the flexor tendon sheath at distal palmar crease

Flexor Tendon Sheath Digital Block
- Flexion-extension of finger causes wide swing of the needle

Flexor Tendon Sheath Digital Block
- Attach syringe, inject 2-4 ml of local anesthetic
- Resistance suggests needle tip is against the flexor tendon - careful withdrawal
Pediatric Metacarpal Block

Flexor Tendon Sheath Digital Block

- Chiu described in 1990
- Methylene blue in cadavers diffused to all 4 digital nerves
- 99% success in 420 patients
- Also called transthecal digital block


MCP…?

Sensory Inervation
Ulnar Nerve Block

- Under the tendon of the flexor carpi ulnaris
- Above the styloid process of the ulna
- Advance 5-10 mm
- Also inject above tendon to block hypothenar cutaneous

It’s fourth of July…
Median Nerve Block

- Proximal volar crease of the wrist
- Between palmaris longus and flexor carpi radialis tendons
- Less than 1 cm deep, below flexor retinaculum
- About 5 cc

Radial Nerve

- Extensor pollicis longus
- Flexor pollicis brevis
- First metacarpal bone
**Radial Nerve Block**

**Crash…**
- Morbidly obese
- Backboard, collar
- Head injury
- Left leg adducted, internally rotated

**Posterior hip dislocation**

**Femoral nerve block/ 3-in-1**
- 3-in-1 femoral nerve block
- Femoral nerve, obturator nerve, lateral cutaneous nerve
- Commonly used post hip surgery, proximal femur fractures
- Innervates the anterior thigh, the periosteum of the femur, hip joint capsule, and the knee joint

Femoral nerve block

- 50 patients with fractured neck of femur
- Randomized to morphine IV (24) vs. 3-in-1 block 20cc 0.5% bupivicaine (26)
- Performed by ED staff after training
- Pain improved twice as fast
- Required half the morphine
- No adverse events


Femoral nerve block

- Drug safety study of 2mg/kg bupivicaine in 3-in-1 femoral blocks in patients >80 years*
- No toxic levels in 6 hour arterial sampling
- Average analgesia and anesthesia, 26.6 hours
- Study of 61 ED patients with femur fractures – safe, reliable, fast, easy – used wt based dosing**


Femoral nerve block

- Recommend 0.25% bupivacaine, 0.5cc/kg, max of 20cc to 30cc
- To achieve 3-in-1:
  - Use higher end of volume (30cc)
  - Apply pressure distally for 5 minutes to encourage proximal diffusion
- Wait 15 minutes for full effect

Sound familiar…?

- 85 year old, found down in nursing home
- Demented, yelling
- Significant cardiac history
- Dehydrated

What about prosthetics?

Knee dislocation
Bilateral lower leg fractures

- Pedestrian hit by car
- Intoxicated
- Bilateral tib-fib
- Patient keeps trying to get up

Whole Body Nerve Block

Infraorbital block

Identify the infraorbital foramen, palpated 1 cm inferior to the midpoint of the lower margin of the orbit. Position finger over the infraorbital foramen and retract the cheek. Direct needle through the mucosa of the upper gum, opposite, parallel to the long axis of the upper premolar tooth. Advanced until palpated near the infraorbital foramen. Aspirate, then instil 2 to 3 mL of lidocaine 1%.
Lingual/Alveolar block

- Direct infiltration of the tongue is painful and ineffective
- Lingual nerve innervates anterior two-thirds of the tongue, floor of the mouth and gums
- Can be blocked with alveolar block
- Or, lingual nerve can be anesthetized by injecting 2 to 3 mLs into the lateral floor of the mouth adjacent to the premolar teeth.
**Intraarticular anesthesia**

- Consider as primary or supplementary anesthesia
- Useful for reductions
- Reduces the needs for sedatives

**42 year old male trips, “popped my shoulder again.”**

Out of town, wants to drive home, requests no sedation.
Intraarticular shoulder anesthesia

- 20 cc of 1% plain lidocaine is injected using an 18 gauge needle
- 2 cm below the lateral edge of the acromion
- Directed towards the glenoid fossa
- Fifteen minutes to maximize the analgesic effect


Intraarticular shoulder anesthesia

- 30 patients, anterior shoulder dislocation
- Randomized to intraarticular lido VS morphine and versed
- No difference in pain and success
- Shorter stay (78 vs. 186 min, p<0.004)
- Reduced cost by 62%


Intraarticular shoulder anesthesia

- 49 patients, anterior shoulder dislocation
- Randomized to intraarticular lido (29) VS morphine and diazepam (20)
- No difference in pain and success
- Lido-only less successful if >5.5 hours
- Patients preferred analgesia

Where’s the sulcus sign?

Intraarticular shoulder anesthesia
- Consider if no sedation (or less) desired
- Sooner the better
- May be faster
- Consider doing before x-ray

Hematoma block
- For isolated closed fracture reduction
- Local anesthesia
- Hematoma is aspirated
- Lidocaine 1% is infiltrated (3 to 10 mL) into the fracture cavity and around the periosteum
- Effective within 5 to 10 min - several hours duration
**Hematoma block**

**Hematoma vs. Biers Block**

- 142 patients with colles’ randomised to hematoma block (70) or bier’s block (72)*
- Bier’s block less painful
- Less pain and better result with less manipulations under bier’s block
- Same length of stay times


**Intravenous regional anesthesia**

- Intravenous administration of local anesthetic distal to an inflated pneumatic tourniquet
- Useful for:
  - fracture reductions
  - large laceration repairs
  - foreign body removal
- Duration of regional anesthesia 30 to 60 min

**Intravenous regional anesthesia**

**Bier’s block equipment**

- Flexible extension tubing
- Esmarch bandage
- Double cuff tourniquet
- Pressure source
Intravenous regional anesthesia

- Proximal cuff is inflated to 50 to 100 mmHg above systolic pressure
- Lidocaine (0.6 mL/kg of 0.5 percent solution) without epinephrine is used IV distal to cuff
- Do not deflate for 30 minutes

Ultrasound Nerve Localization


Ultrasound Nerve Localization


Ultrasound Nerve Localization


- 22 blocks on 11 patients after 1 hour of training
- All successful, no rescue needed
Questions?

**Hematoma block**

- For isolated closed fracture reduction
- Local infiltration or EMLA applied to the skin over the fracture site
- Hematoma is aspirated using a 10-mL syringe and 20- to 22-gauge needle
- Lidocaine 1% is infiltrated (3 to 10 mL) into the fracture cavity and around the periosteum
- Effective within 5 to 10 min - several hours duration

**Hematoma vs. Biers Block**

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Bier’s block equipment

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- Double cuff tourniquet
- Pressure source

- Proximal cuff is inflated to 50 to 100 mmHg above systolic pressure
- Lidocaine (0.6 mL/kg of 0.5 percent solution) without epinephrine is used
- DO NOT DEFLATE DISTAL CUFF UNTIL AT LEAST 20 MIN FROM INJECTION
- Contraindications: PVD, Raynaud’s, sickle cell, cardiac conduction abnormalities, hypertension, cellulitis, and children < 5 years
Intravenous regional anesthesia

- Systemic toxicity most common complication
- From potentially toxic dose of local anesthetic accidentally injected into the central circulation
- Related to either a leak under the tourniquet or premature release
- Recommendations can be used to minimize this risk

Intravenous regional anesthesia

- Always use a distal IV site
- Have an IV line in the opposite arm
- Always check the Tourniquet-pressure-tubing-valves apparatus before the procedure
- Never check the apparatus after the injection
- Use adequate pressure and a sufficiently wide cuff
- Inject slowly
- Monitor the patient continuously

Peripheral nerve blocks performed by anesthesiologists

Legend: Horizontal bars represent percentages of anesthesiologists who reported performing the indicated anesthesia techniques in their practice.*

Local anesthetics

Potency:
- Lipid solubility
- Agent concentration
- Addition of epinephrine

1cc lidocaine 1% = 1cc bupivacaine 0.25%

Duration:
- Protein binding
- Vasodilation
- Addition of epinephrine
- Metabolism – Amides generally longer than Esters
  Bupivicaine (4-6 hrs) > Lidocaine (1 hr)

Onset of Action:
- Lower pKa is faster
- More non-ionized = more lipid soluble
- Amount of interspersed tissue
- Size of the nerve sheath

Antioxidant

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<th>Solution</th>
<th>pH</th>
<th>Methylparaben</th>
<th>Antioxidant</th>
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<td>4.5-6.5</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Plain, multidose</td>
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<tr>
<td>Epi, multidose</td>
<td>3.5-4.0</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Adapted from Orlinsky M. Local and topical anesthetics, in Roberts Clinical Procedures in Emergency Medicine, 3rd ed., 1998 W. B. Saunders Company
Local anesthetics

- Lower pH of epinephrine-containing solutions = more pain on infiltration and delayed onset
- Methylparaben found in multidose vials has been implicated in many allergic reactions

Flexor Tendon Sheath Digital Block

Advantages:
- Anesthesia of entire digit with single injection
- Small amount of anesthetic agent
- Rapid onset of anesthesia
- Less trauma to the neurovascular structures
- High success rate

Femoral nerve block

- 3-in-1 femoral nerve block
- Femoral nerve, obturator nerve, lateral cutaneous nerve
- Commonly used post hip surgery, proximal femur fractures
- Innervates the anterior thigh, the periosteum of the femur, and the knee joint

Femoral nerve block

- Recommend 0.25% bupivacaine, 0.5cc/kg, max of 20cc
- Apply pressure distal to injection, during and a few minutes after
- Wait 10-15 minutes for full effect

Intraarticular shoulder anesthesia

- 20 cc of 1% plain lidocaine is injected using an 18 gauge needle
- 2 cm below the lateral edge of the acromion just posterior to the dislocated humeral head
- Directed towards the glenoid fossa
- Fifteen minutes are allowed to maximize the analgesic effect of the lidocaine prior to manipulation.

Intraarticular shoulder anesthesia

**Needle in the joint is confirmed:**
- Feel needle penetrate the glenohumeral capsule
- Aspirating joint fluid/hemarthrosis - not intravascular
- Palpating the glenoid fossa with the needle
- Easy flow on injection and return of lidocaine.

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Facial block cautions

- Needles no smaller than 27 ga should be used
- If breakage occurs, needle retrieval is difficult:
  - Do not insert needle to its full length
  - Direction of a needle should not be changed
- Injection should not be made through an infected area
- Consider topical first if intraoral

Needles no smaller than 27 ga should be used
- If breakage occurs, needle retrieval is difficult:
  - Do not insert needle to its full length
  - Direction of a needle should not be changed
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Local anesthetics

- **Ester-type agents:** procaine, chloroprocaine, cocaine, and tetracaine
- **Amide-type agents:** lidocaine, mepivacaine, prilocaine, bupivacaine (Marcaine), and etidocaine
- Multidose vials contain methylparaben as the antibacterial preservative
- With epinephrine, contains antioxidant (sodium bisulfite) more acid pH - 3.5 to 4.0