

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

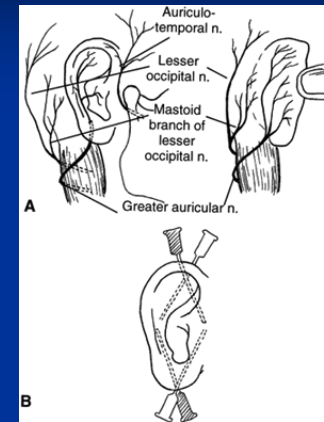
- Cocaine was first isolated in Europe during the years 1859-1860
- Sigmund Freud first to propose the idea of using cocaine clinically
- Simultaneously, the advent of a precise syringe



Infected earring



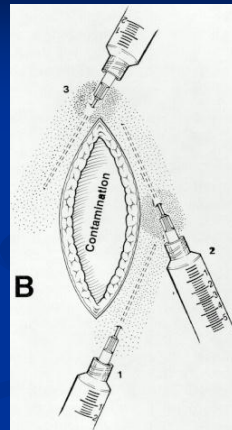
Auricular block



Local infiltration

Less painful:

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



Local infiltration

Buffering

- Epi = \downarrow pH = \uparrow pain
- Na Bicarb = \uparrow pH = \downarrow pain

1 mL of Na bicarb (1 mmol/mL)
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...

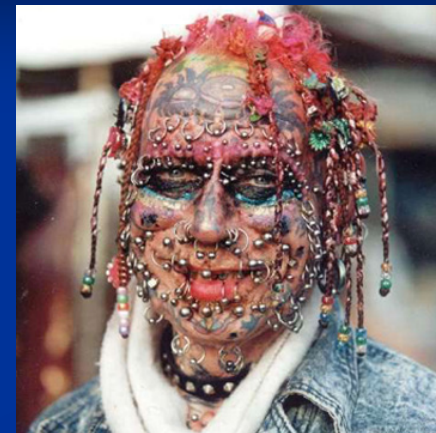
- 1% diphenhydramine (Benadryl) is as effective as 1% lidocaine
- Need to dilute! (usual 4% may cause necrosis)



Dire DJ, Hogan DE: Double-blinded comparison of diphenhydramine versus lidocaine as a local anesthetic. *Ann Emerg Med* 22:1419, 1993.
Green SM, Rothrock SG, Gorchynski J: Validation of diphenhydramine as a dermal local anesthetic. *Ann Emerg Med* 23:1284, 1994.

Know your limits

Patient requests
FB removal...



My toe hurts...

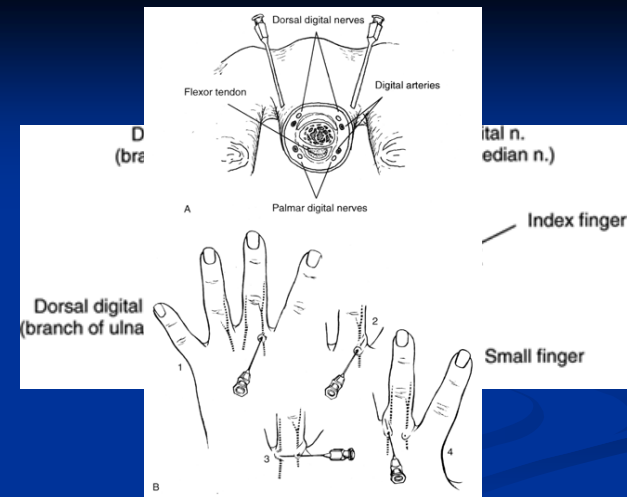


Nerve Block

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



From: Higginbotham E, Vissers RJ. Local and Regional Anesthesia, In Emergency medicine : a comprehensive study guide. Tintinalli JE, et al, Eds, 6th ed; 2003, McGraw-Hill.

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

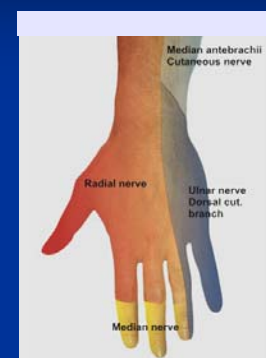
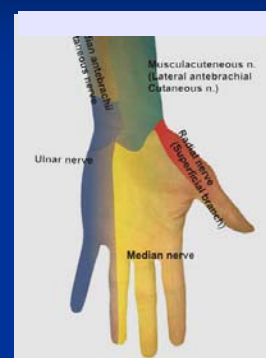
Chiu DTW: Transthecal digital block: Flexor tendon sheath used for anesthetic infusion. *J Hand Surg* 15A:471, 1990.

Hill RG Jr, et al: Comparison of transthecal digital block and traditional digital block for anesthesia of the finger. *Ann Emerg Med* 25:604, 1995.

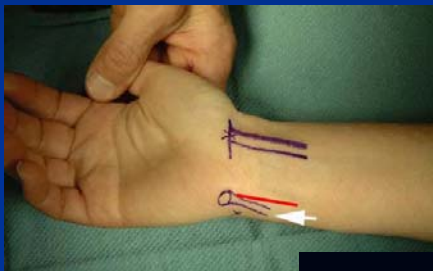
MCP...?



Sensory Inervation



Ulnar Nerve Block



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

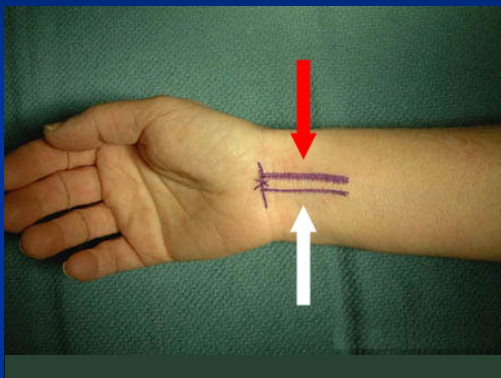
Ulnar Nerve Block



It's fourth of July...



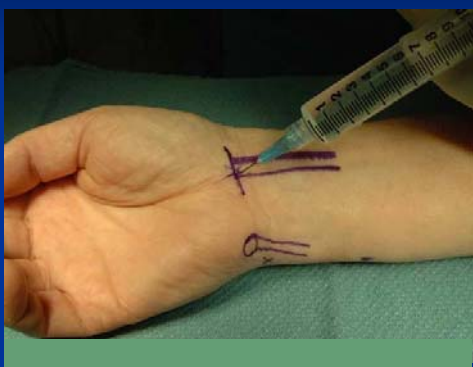
Median Nerve Block



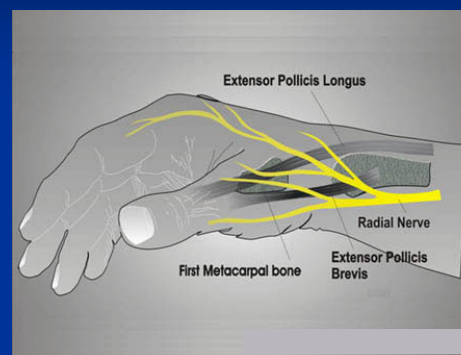
Median Nerve Block

- 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

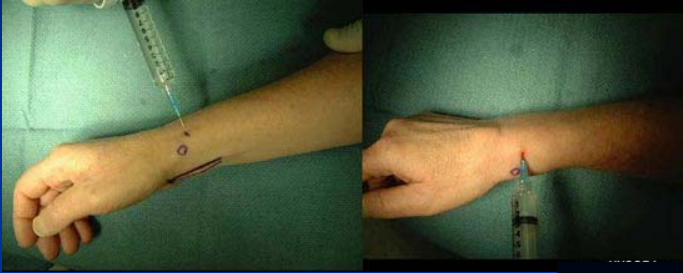
Median Nerve Block



Radial Nerve



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

McGlone R, Sadhra K, Hamer DW, Priddy PE: Femoral nerve block in the initial management of femoral shaft fractures. Arch Emerg Med 4:163, 1987.

Femoral nerve block

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

Fletcher AK, et al: 3-in-1 femoral nerve block as analgesia for fractured neck of femur in the emergency department: a randomized, controlled trial. *Ann Emerg Med* 2003;41:227.

Femoral nerve block

- Drug safety study of 2mg/kg bupivacaine 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**

* Snoek MM, et al: steady-state bupivacaine plasma concentrations and safety of a femoral “3-in-1” with bupivacaine in patients over 80 years. *Int J Clin Pharmacol* 2003;41:107.

** Van Leeuwen FL, et al: The three-in-one block as locoregional analgesia in an emergency Department. *Eur J Emerg Med*. 2000;7:35.

Femoral nerve block



Femoral nerve block

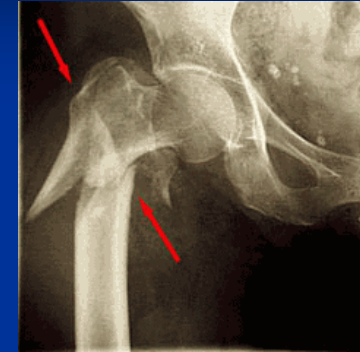


Femoral nerve block

- 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

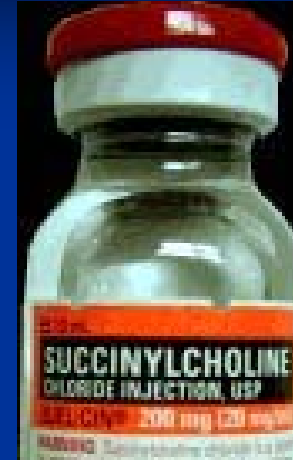


Bilateral lower leg fractures

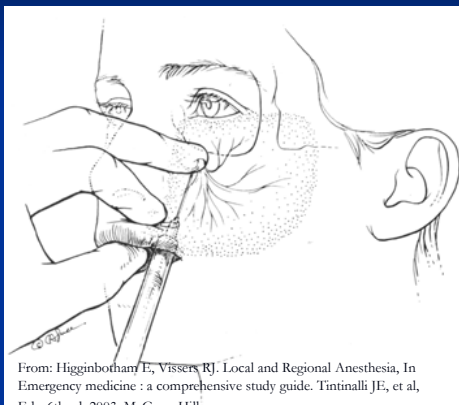
- Pedestrian hit by car
- Intoxicated
- Bilateral tib-fib
- Patient keeps trying to get up



Whole Body Nerve Block



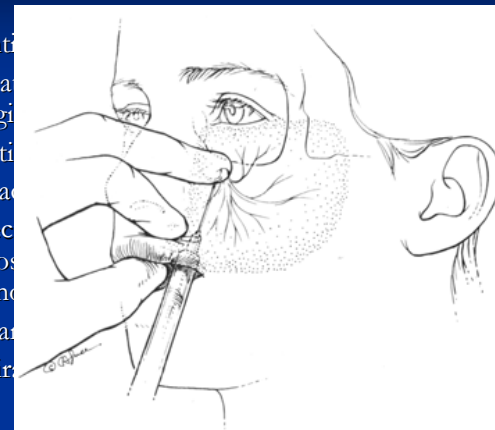
Infraorbital block



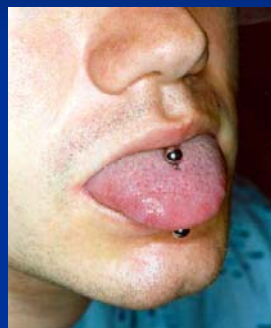
From: Higginbotham E, Visser RJ. Local and Regional Anesthesia, In Emergency medicine : a comprehensive study guide. Tintinalli JE, et al, Eds. 6th ed. 2003. McGraw-Hill.

Infraorbital block

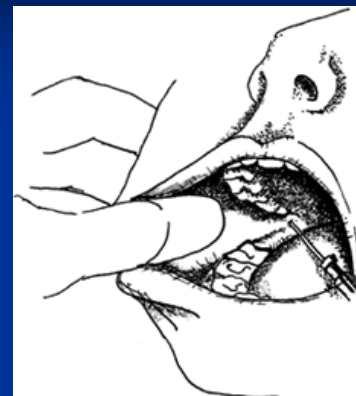
- Ident
- Palpa
- margi
- Positi
- Retra
- Direc
- oppos
- preme
- Advan
- Aspir



Ma Ung Urrs...



Lingual/Alveolar block

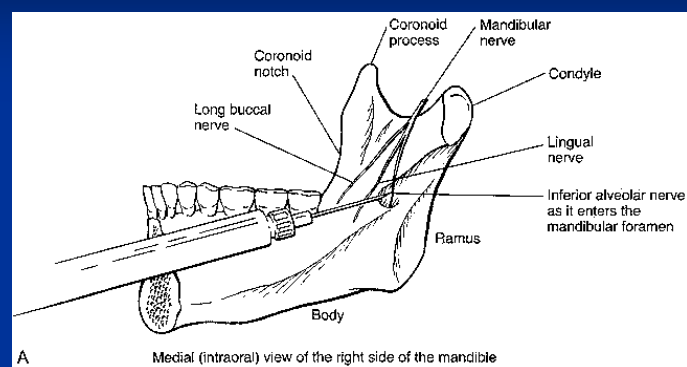


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Lingual/Alveolar block

- 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.

Lingual/Alveolar block



Ouch

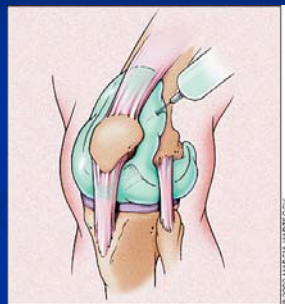


Procedural sedation?



Intraarticular anesthesia

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



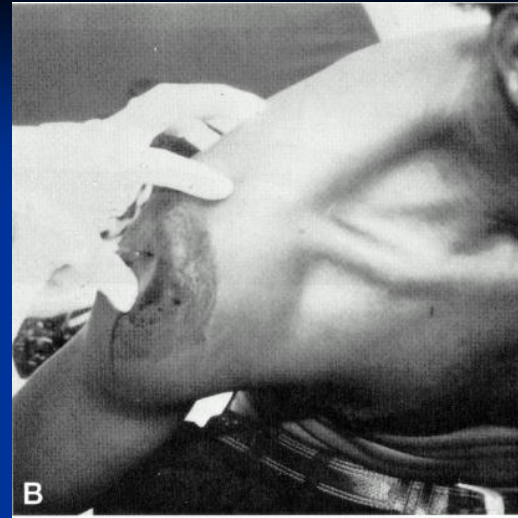
- 42 y old male with a history of shoulder pain
- On the day of the procedure, the patient requests
- no sedation



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

Lippitt SB, Kennedy JP, Thompson TR: Intraarticular lidocaine versus intravenous analgesia in the reduction of dislocated shoulders. *Orthop Trans* 1991;15:804



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%

Matthews DE. Intraarticular lidocaine versus intravenous analgesic for reduction of acute anterior shoulder dislocations. A prospective randomized study. *Am J Sports Med* 1995; 23(1): 54-8

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

Kosnick J, et al. Anesthetic Methods for Reduction of Acute Shoulder Dislocations: A Prospective Randomized Study Comparing Intraarticular Lidocaine With Intravenous Analgesia and Sedation. *Am J Emerg Med* 1999; 17

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



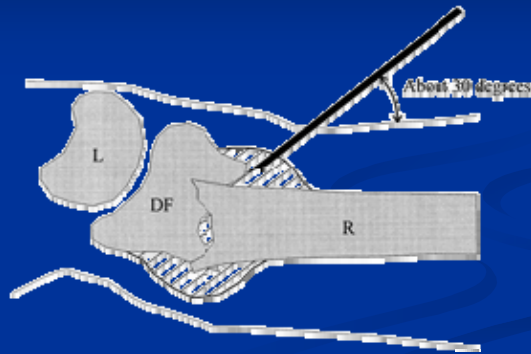
FOOSH



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. Bier's Block

- 142 patients with Colles' fractures 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**

* Kendall JM, et al: Haematoma block or Bier's block for Colles' fracture reduction in the accident and emergency department – which is best? J Accid Emerg Med 1998;15:207.

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

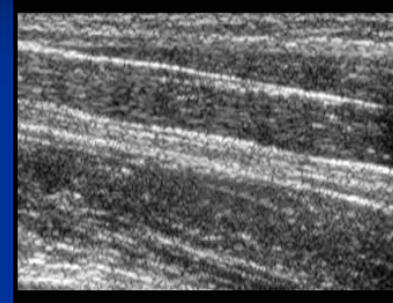
- Flexible extension tubing
- Esmarch bandage
- Double cuff tourniquet
- Pressure source



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



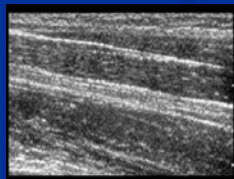
Marhofer P, Schrogendorfer K, Wallner T, et al. Ultrasonographic guidance reduces the amount of local anesthetic for 3-in-1 blocks. *Reg Anesth Pain Med* 1998; 23: 584.

Marhofer P, Schrogendorfer K, Koinig H, Kapral S, Weinstabl C, Mayer N. Ultrasonographic guidance improves sensory block and onset time of three-in-one blocks. *Anesth Analg* 1997; 85:854-7.

Ultrasound Nerve Localization

Feasibility of Forearm Ultrasonography-Guided Nerve Blocks of the Radial, Ulnar and Median Nerves for Hand Procedures in the Emergency Department.

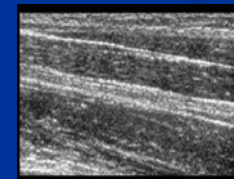
Liebmann O, et al. *Ann Emerg Med*, Nov, 2006.

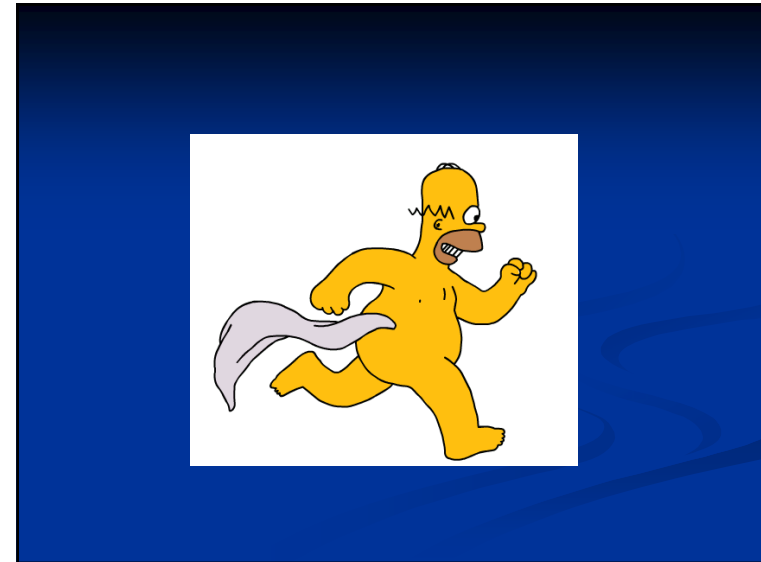


Ultrasound Nerve Localization

Ann Emerg Med, Nov, 2006.

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





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. Bier's 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
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Intravenous regional anesthesia

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 - fracture reductions
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- 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



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
- **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

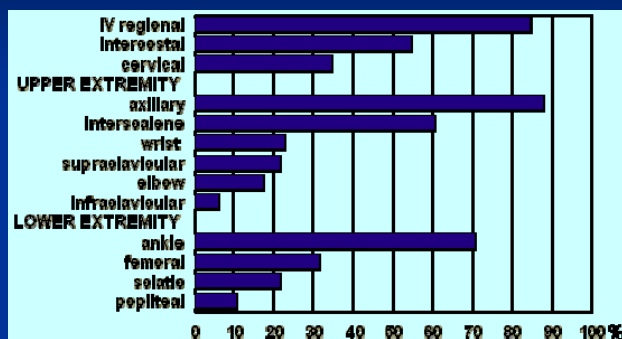
Intravenous regional anesthesia

- 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

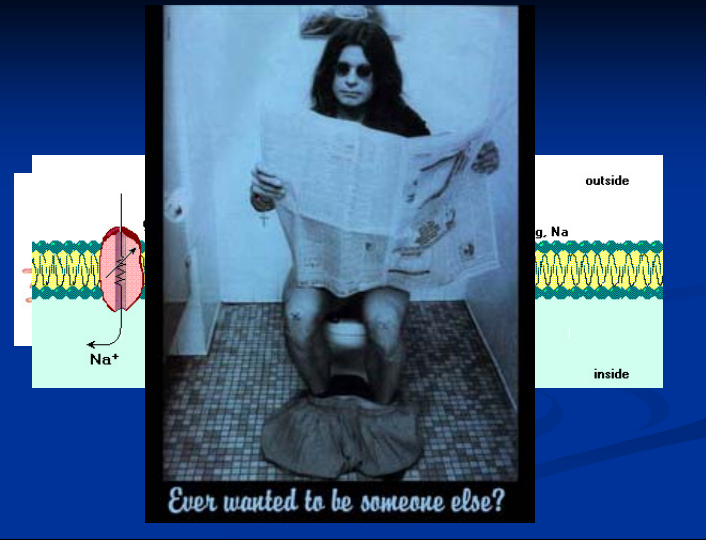
- Always use a distal IV site
- Have an IV line in the opposite arm
- Always check the Tourniquet-pressure-tubing-valves apparatus before the procedure
- Never check the apparatus after the injection
- Use adequate pressure and a sufficiently wide cuff
- Inject slowly
- Monitor the patient continuously

Peripheral nerve blocks performed by anesthesiologists



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

* Hadzic A, Vlika JD et al. The use of peripheral nerve blocks in anesthesia practice. A national survey. *Regional Anesthesia*, 1998.



Local anesthetics

Potency:

- Lipid solubility
- Agent concentration
- Addition of epinephrine

1cc lidocaine 1% = 1cc bupivacaine 0.25%

Local anesthetics

Duration:

- Protein binding
- Vasodilation
- Addition of epinephrine
- Metabolism – Amides generally longer than Esters

Bupivacaine (4-6 hrs) > Lidocaine (1 hr)

Local anesthetics

Onset of Action:

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

Local anesthetics

Solution	pH	Methylparaben	Antioxidant
Plain, single dose	4.5-6.5	No	No
Plain, multidose	4.5-6.5	Yes	No
Epi, single dose	3.5-4.0	No	Yes
Epi, multidose	3.5-4.0	Yes	Yes

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:

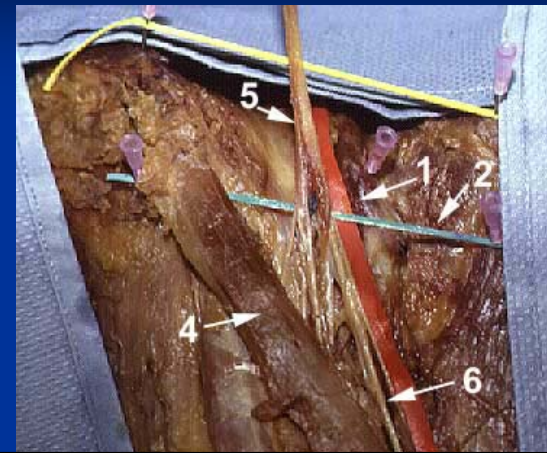
- Anesthesia of entire digit with single injection
- Small amount of anesthetic agent
- Rapid onset of anesthesia
- Less trauma to the neurovascular structures
- High success rate

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

McGlone R, Sadhra K, Hamer DW, Priddy PE: Femoral nerve block in the initial management of femoral shaft fractures. Arch Emerg Med 4:163, 1987.

Femoral nerve block



Femoral nerve block



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.

Lippitt SB, Kennedy JP, Thompson TR: Intraarticular lidocaine versus intravenous analgesia in the reduction of dislocated shoulders. *Orthop Trans* 1991;15:804

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.

Lippitt SB, Kennedy JP, Thompson TR: Intraarticular lidocaine versus intravenous analgesia in the reduction of dislocated shoulders. *Orthop Trans* 1991;15:804



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Facial block cautions

- Needles must be used
- If breakage difficult:
 - Do not
 - Direction changed an
- Injection infected an
- Consider



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