Lower Extremity Ultrasound-Guided Regional Anesthesia

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Anesthesia student tip #24. When your staff asks you what the mechanism of action for benzodiazepines are, don't say "magic".

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Objectives

• Review anatomy of lumbosacral plexus
• Lumbar plexus blocks
  • Psoas
  • Femoral
    • Saphenous
    • Lateral Femoral Cutaneous
• Sacral plexus blocks
  • Classic Landmarks
  • Parasacral
  • Subgluteal
  • Popliteal
• Rectus sheath block
• Transversus Abdominal Plane (TAP)
Lumbar Plexus Anatomy

Interested In Getting Lunch On Friday?

- Iliohypogastric
- Ilioinguinal
- Genitofemoral
- Lateral Femoral Cutaneous
- Obturator
- Femoral
Lumbar Plexus Anatomy

- Anterior rami of T12 to L4
- Gives rise to
  - Ilioinguinal
  - Iliohypogastric
  - Genitofemoral
  - LFC
  - Obturator
  - Femoral
Lumbar Plexus Anatomy

- Femoral Nerve
  - Motor: hip flexors, quadriceps, leg extension
  - Sensory: anterior thigh and knee
  - Terminates as the saphenous nerve

- LFC: lateral thigh sensation
- Obturator: adductors and medial thigh sensation
Femoral Nerve

- Enveloped by Fascia Iliacus
- Femoral Artery (5), Femoral Vein (6)
- After Inguinal Ligament (4)
  - Anterior Division
    - Sartorius and Cutaneous Branches (3)
  - Posterior Division (1)
    - Quadriceps
    - Saphenous
Lumbar Plexus Block

- AKA Psoas Compartment Block
- Good for complete lumbar plexus coverage
  - Obturator
  - LFC
  - Femoral
- Useful for hip procedures
- May be unilateral alternative to neuraxial block
Lumbar Plexus Block

- Prone or lateral
- Landmarks
  - Iliac crest
  - Spine (midline)
  - PSIS
  - 2/3 dist PSIS line
- Large curvilinear probe at intersection
- Visualize transverse processes; note depth
- Stimulate quadriceps twitch (or psoas on US)
Lumbar Plexus Block

- Transverse process is a good and safe gauge of depth
Complications

- Highly vascular psoas m.
  - Hematoma
  - LA toxicity
  - Beware multiple needle passes!
Complications

- Psoas Hematoma
- Psoas: 3rd most common site of iatrogenic bleed with coumadin
- Avoid multiple needle passes
- Anticoagulation is contraindication
Complications

- Visceral Injury
- Kidneys
- Major Vascular
- Bowel
Complications

- Inadvertant spinal or epidural anesthesia
  - Don’t deviate medially
- Sympathectomy
  - Hypotension
  - < 15% of blocks
- Infection - Discitis

Kirchmair et al; A&A 2002;94:706-10
Lumbar Plexus Summary

- Excellent block for hip, thigh and knee
- Depth < 2 cm past TP = Safety
- Anticoagulation: Psoas = Epidural
Femoral Nerve Block

- Bread and Butter Block
- Great block to practice US and needle control
Femoral Nerve Block: Overview

- Indication
  - Anterior thigh
  - Knee (often combined with other blocks)

- Continuous perineural infusion improves recovery following total knee arthroplasty (TKA)\(^1\)
  - May shorten hospital stay after TKA\(^2\)

\(^1\) DeRuyter ML, et al. J Arthro 2006;21:1111
FNB Anatomy

- NAVEL
- Nerve
- Artery
- Vein
- Lymphatics
FNB: Surface Anatomy

- Supine position
- Pubic tubercle and ASIS
- Palpable femoral artery
Femoral Nerve Block

- Lateral-Medial Approach
- Short axis/in-plane
- 1. Hydrodissect FN off FI
- 2. Advance under nerve, place catheter if desired
Femoral Nerve Catheter
Contraindications?
Lateral Femoral Cutaneous

- If missed with FNB
  - e.g., skin graft
- Start at ASIS with linear probe and scan area (2 cm down, 2 cm medial)
Obturator Nerve

- Rarely needed?
  - Possible knee innervation (~20%) – 2 studies show decreased pain scores in TKA patients with obturator block.
- Located medial to femoral vein
- Derives from L2-4
  - Enters thigh through obturator foramen
- Motor component of medial thigh (adductors)
- Variable sensory
  - 57% no sensory
  - 20% show deficit on medial aspect of upper thigh (including knee)
Saphenous

- For foot and ankle surgery
- Remember, sensory only
- Can do field block…
  - 33-65% effective
- Better options…
Saphenous:

- **Sub-sartorial**
  - 5-7 cm proximal to knee
  - Lateral-medial approach
  - Fascial plane between sartorius m. and vastus medialis m.

- **Perifemoral**
  - Mid-thigh
  - Lateral-medial approach
  - Nerve lateral to superficial femoral artery and vein
Adductor Canal Block

- Adductor Canal anatomy relevant to knee
  - Aponeurotic space extending from apex of femoral triangle to the adductor hiatus
- Contains:
  - Saphenous n. (femoral)
    - Infrapatellar skin and anterior knee capsule
  - Distal branch of the motor n. to vastus medialis (femoral)
    - Sensory innervation to superomediaal aspect of knee and knee capsule
Adductor Canal Block

- Posterior branch of obturator n. (inconsistently present)
  - +/- medial cutaneous and and anterior branches of obturator n.
- Most motor branches to quadriceps m. branch from femoral n. approximately 5 cm below inguinal ligament
Adductor Canal Block

• Postop analgesia with motor sparing?
  • Effective analgesic adjunct for TKA
      • AC catheter boluses vs. morphine PCA 2.5 mg bolus, 10 min lockout
      • Improved pain, decreased morphine consumption, improved ambulation
    • Perlas, et al. RAPM 2013
      • ACB + knee infiltration better postop analgesia than fem n. cath
  • Mid-thigh ACB is motor-sparing
    • Kwofie, et al. RAPM 2013
      • 95% strength reduction with femoral n. block
      • 11% strength reduction with ACB (mostly vastus medialis)
      • No significant reduction in hip adductor strength
Sacral Plexus Anatomy

- 12 branches
  - 5 in pelvis (gluteal nerves)
  - 7 emerge (buttock and LE)
- Sciatic is largest
  - Lumbosacral trunk L4-5 and anterior divisions of sacral plexus S1-3 form TIBIAL nerve
  - Post divisions form PERONEAL nerve
Sacral Plexus Anatomy

- L4-S3 assemble into sciatic nerve on the ventral surface of piriformis muscle
Approaches to Sciatic Nerve Blockade

- Parasacral Classic (Labat)
- Subgluteal
- Popliteal Fossa
Subgluteal

- The lowest sciatic block that reliably picks up the PFC
  - Ideal
  - Realistic

- I do this full prone as well
  - Scan distal-to-proximal can be helpful
Sciatic Scan
Poaliteal

- Great for learning US
  - Popliteal artery
  - Scan posterolateral from artery
  - Prone position easier.
    - Can flip screen for supine

- Start at crease and scan cephalad until the two nerves become one (or at least 7-10 cm)
PoPliteal Block: Distribution of Anesthesia
Popliteal TN PN
Popliteal

- A few tips
  - Tibial is deeper, more medial,
  - Peroneal is more superficial and lateral
- If adding twitch, remember:
  - Tibial (Toes)
    - Plantar flexion and inversion
  - Peroneal
    - Dorsiflexion and eversion
Popliteal

- US view in supine position
- Popliteal Artery
  - Nerve is superficial and lateral (almost always)
Popliteal Ultrasound Lateral Approach

- Needle entry point on lateral aspect of leg to ensure parallel path of needle to US probe (spectral reflection)
  - Increases needle visualization
Popliteal Lateral Approach with Ultrasound
Complications

- Multiloculated Abscesses
- Diffuse Edema
Rectus Sheath Block

- Rectus sheath block
- Internal oblique
- External oblique
- Transversus fascia
- Transversus abdominis plane
- Rectus abdominis
- TAP block
Rectus Sheath Block
Rectus Sheath Block

- Indications:
  - Umbilical hernia repair
  - Laparoscopy (umbilical port)
  - Midline incision laparotomy
    - TAH
  - Vascular procedures midline
Rectus Sheath Block Anatomy

- Supplied bilaterally by terminal cutaneous branch of T10 spinal (intercostal) nerves
  - sensory innervation to the skin after passing through the rectus abdominis muscles.
  - Rectus sheath (fascia of the external/internal oblique aponeurosis) envelops the two muscles.
QUESTIONS?