A practical guide to uncommonly performed ultrasound-guided peripheral nerve blocks for chronic pain
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Disclosures

• None
Overview

- Greater Occipital Nerve (GON) block
- Cervical medial branch blocks
- Stellate ganglion block
- Brachial plexus block; interscalene, supraclavicular, and infraclavicular
- Paravertebral blocks
- Ilioinguinal and Iliohypogastric nerve blocks
- Lateral femoral cutaneous nerve block
Nerve Block Basics: Patient Care/Safety

- IV access, supplemental O2 via nasal cannula, pulse oximeter, BP cuff

- Intubation equipment and personnel experienced in emergency airway management

- Epinephrine syringe & Intralipid (20% lipid emulsion) in case of local anesthetic systemic toxicity (LAST)

- Optional: sedative (midazolam, 2 mg) and/or analgesic (fentanyl, 50-100 mcg)
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Indication: Occipital neuralgia

- International Headache Society
  - paroxysmal stabbing pain
  - with or without persistent aching between paroxysms
  - in the distributions of the greater, lesser, and third occipital nerves
- Common cause of intractable headache
- More common in women

Anatomy of Occipital Nerve

- Third occipital n.
- Greater occipital n.
- Lesser occipital n.
- Greater auricular n.
- Suboccipital n.
Anatomy of Occipital Nerve

a. Third occipital n.
b. **Greater occipital n.**
   - Medial branch of dorsal ramus of C2
   - Passes btw ICO and SSCa
   - Ascend to pierce SSCa and Trap
c. Lesser occipital n.
d. Greater auricular n.
e. Suboccipital n.
Anatomy of Occipital Nerve

a. Third occipital n.
b. Greater occipital n.
  - Medial branch of dorsal ramus of C2
a. Lesser occipital n.
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c. Suboccipital n.
Occipital nerve block

1. Traditional approach
   1. Identify EOP
   2. Move the probe laterally to find OA
   3. Identify GON medial to OA

2. C2 level approach
   1. Identify EOP
   2. Move the probe caudally to identify Atlas/Axis
   3. Rotate probe to visualize IOC
Occipital nerve block: EOP level
Occipital nerve block: OCI level
Overview

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Cervical facetogenic pain

- Axial neck pain
- Whiplash
- Cervicogenic headache
Normal anatomy

- Cervical z-joints = innerved by articular branches derived from the MB of the cervical dorsal rami
- C3-C7 dorsal rami arise from respective spinal nerves and pass dorsally over root of their corresponding TP
- MB of cervical dorsal rami run transversely across centroid of corresponding articular pillars and are bound to periosteum
US anatomy

Transducer placed over mastoid process almost parallel to the underlying spine in longitudinal plane.

Transducer than moved 5-8mm posterior to position shown below.

Final position to identify C2-3 facet joint.
US anatomy

Transducer position in relation to neck

Image obtained by transducer obtained in final position to identify C2-3 facet joint

Medial branches seen at deepest point of bony surface more caudally of the articulating facet joints
Performance of block

Relation of needle to transducer; Transducer positioned longitudinal to neck and needle introduced immediately anterior to US probe

- Introduce needle from anterior to posterior because all vulnerable structures are situated more anterior to facet joint line
- This lowers risk of inadvertent puncture of these structures in case needle tip is not correctly identified
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Stellate Ganglion (SG) Block: Anatomy

- Sympathetic fibers for the head, neck, arms, and heart
- Fusion of the inferior cervical ganglion and the 1st thoracic ganglion
- Within the prevertebral fascia posterior to the carotid sheath

Sit the patient up to ~60° and have them face forward with slight neck extension. Place the U/S probe (depth: 3 cm) axially over the cricoid cartilage (C6 level) then scan laterally.
The MSG may or may not be visible as a small hyperechoic spindle-shaped/globular structure posterolateral to the CA and anterolateral to the LCM.

**Stellate Ganglion Block: Technique**
Use doppler to look for the inferior thyroidal artery (*) between the CA and LCM
If you scan caudally to the C7 level, you may visualize the SG (also a small hyperechoic spindle-shaped/globular structure) as well as the C7 NR without the protection of an AT.

Stellate Ganglion Block: Technique
Stellate Ganglion Block: Technique

• Aspirate and inject 5 mL of LA
  • Make sure to inject into the prevertebral fascia, where the CST is located, and not into the LCM, which renders the injection ineffective

• Sit the patient upright to 90° so gravity helps the LA spread caudally from the MSG (site of injection) to the SG (target)
  • Injection of 5 mL of LA typically results in C3–T1 prevertebral spread and complete blockade of the CST and SG

• Confirmation of SGB:
  • Ipsilateral Horner’s syndrome signifies blockade of the MSG (i.e. sympathectomy of the head/neck) but not necessarily blockade of the SG (i.e. sympathectomy of the arm)
  • The key to confirming SGB as opposed to just MSGB is increase in skin temperature (i.e. vasodilation) in the ipsilateral UE
Stellate Ganglion Block: Clinical Pearls

- **Risks specific to SGB:**
  - **Spinal nerve root injury:** More likely at C7, where there is no protective AT, then at C6, where there is one
  - **Vertebral a. (VA) injection:** More likely at C7. In 92%, VA entered through transverse foramen of C6
  - **Esophageal perforation:** More on the left, may result in mediastinitis
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Interscalene Block: Anatomy

- Blocks the brachial plexus (BP) at the level of the distal roots/proximal trunks, which pass in between the anterior (ASM) and middle (MSM) scalene muscles
  - Roots: C5 (top), C6 (middle), C7 (bottom)
    - C7 & T1 are often not visualized
  - Trunks: Superior (C5,6), Middle (C7), Inferior (C8,T1)
  - The roots converge to form trunks at the medial border of the MSM
- Nearby structures:
  - Vertebral artery (VA): medial to the ASM, anterior to the BP
  - Phrenic nerve: overlies the ASM

Interscalene Block: Technique
Identify the roots/trunks: stacked hypoechoic ovals within the interscalene groove, between the ASM and MSM. Insert the needle in-plane, lateral to medial, and advance toward the BP while maintaining needle visualization.
**Supraclavicular Block: Anatomy**

- Blocks the brachial plexus (BP) at the level of the distal trunks/proximal divisions
  - Trunks: Superior (C5,6), Middle (C7), Inferior (C8,T1)
  - Divisions: Anterior (Flexors), Posterior (Extensors)
  - The trunks begin to diverge into the anterior and posterior divisions as the BP courses below the clavicle and over the first rib
- Nearby structures:
  - Subclavian artery (SCA): anteromedial to the BP, overlying the first rib
  - Pleura/Lung: below the first rib

Supraclavicular Block: Technique
Identify the roots/divisions: bundled hypoechoic ovals immediately lateral to the subclavian artery (SCA) and medial to the middle scalene muscle (MSM). Insert the needle in-plane (parallel to probe), lateral to medial, and advance toward the BP bundle while maintaining needle visualization. Be careful not to pass the first rib (highly hyperechoic streak) which casts an acoustic shadow (from U/S beam attenuation by bone) into the pleura (less hyperechoic streak).
Risks of UE Nerve Blocks: Side Effects

More common in ISB

- Hemidiaphragmatic Paresis (dyspnea)
  - 2/2 blockade of phrenic nerve
  - Results in 25-32% reduction in PFTs
  - Caution in patients with poor pulmonary reserve (e.g. COPD)
- Ipsilateral Vocal Cord Paresis (hoarseness)
  - 2/2 blockade of recurrent laryngeal nerve (responsible for VC adduction)
- Horner’s Syndrome (ptosis, miosis, anhidrosis)
  - 2/2 blockade of cervical sympathetic chain
- Neuraxial (Epidural/Subarachnoid) injection
- Consequence: apnea, loss of consciousness, +/- cardiac arrest

More common in SCB

- Pneumothorax
  - Patients who develop PTX are unlikely to report symptoms for 6-12 hours, and symptoms are often mild (primarily pleuritic chest discomfort)
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  - Ilioinguinal and Iliohypogastric nerve blocks
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Paravertebral Block

- The paravertebral space extends from the cervical spine to the sacrum.

- It is a space of triangular shape, borders include:
  - Anterolaterally: Parietal Pleura
  - Medially: Vertebrae
  - Posteriorly: costotransverse ligament

USRA: Thoracic Paravertebral Block
Technique

• These blocks should be performed in an area with full monitoring and readily available resuscitation equipment.
• Identify the proper level: “follow the ribs”
• A probe is applied parallel to the spinous process
• Identify the transverse process, the costotransverse ligament, and the pleura
• After negative aspiration, 5-10ml of local anesthetic is injected
• Note, anterior movement of the parietal pleura
Clinical Pearls

Risks

• Pneumothorax
  • Around 1%, but if bilaterally performed, increased by 8-fold
  • Less likely, if below T10

• Bleeding (5%) and Hematoma (2.4%)

• Epidural spread
  • Increased with
    • lateral to medial approach
    • Volume >5ml
    • High pressure injection

Tips

• Ask patient to breathe deeply to identify the pleura
• Visualize the needle “tip” at all times
• Inject small amount of local or saline to check for tissue spread while advancing
• Use as little volume as possible
• Inject slowly
Ultrasound Image: Paravertebral Block
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# Differential for Groin Pain

| Superior | Rectus femoris tendinopathy  
Hernia  
Nerve entrapment |
|----------|-----------------------------|
| In the triangle | Iliopsoas syndrome  
Iliopectineal bursitis  
Rectus femoris tendinopathy/enthesopathy  
Femoral hernia  
Nerve entrapment |
| Lat to triangle | Hip OA  
Impingement/labral pathology (femoroacetabular joint)  
Femoral neck Frx  
ITB syn  
Nerve entrapment |
| Med to triangle | Adductor/gracilis enthesopathy/tendinopathy (at MT junction)  
Pubic bone stress injury, inferior ramus injury  
Nerve entrapment  
External iliac A endofibrosis |
Differential for Neuralgic Pain in the Groin

- **Peripheral N Entrapment**
  - Meralgia Paresthetica
  - Iliohypogastric/ilioinguinal N
  - Medical femoral cutaneous N lesion
  - Obturator N lesion

- **Other Differential**
  - L2-3 radiculoplexoneuropathy (DM or Non-DM/idiopathic amyotrophy)
  - Lumbar plexopathy
  - L2-3 radiculopathy

- **Atypical presentation of MSK or Muscular Dz**
Border Nerves Syndrome (Ilioinguinal, iliohypogastric and genitofemoral nerves)

• Cutaneous sensation between the abdomen and thigh (border)

• Anatomy
  • Iliohypogastric and ilioinguinal (L1); ventral to quad lumborum → pierce the transverse abdominis
    • Iliohypogastric: between internal and external oblique, inguinal ring and skin over the lower part of the rectus abdominis
    • Ilioinguinal: below iliohypogastric nerve; superomedial aspect area of the thigh, skin over the penis and scrotum and mons pubis and labium major in women
  • Genitofemoral: L1,2, femoral (follow external iliac artery and pass under the inguinal ligament and penetrate fasia lata to supply skin to the femoral triangle and genital branch

Anatomy

Schematic diagram showing the course of the ilioinguinal, iliohypogastric and genitofemoral nerves. GFN = genitofemoral nerve. Reproduced from USRA (www.usra.ca)
Lateral Femoral Cutaneous Nerve

**Anatomy**

- The ventral rami of the L2 and L3
- Course: inferior to the inguinal ligament on the anterior surface of the thigh
- Anterior and posterior branches pierce the fascia lata
  - Ant: L3, 10 cm below ASIS, contributes to the patellar plexus
  - Posterior: L2 higher than Ant branch
  - ASIS to point of crossing ilioinguinal ligament
  - > 4 cm in 8.5%

Lateral femoral cutaneous neuropathy

• Epidemiology
  ▪ 1-5 in 10,000, 2nd most common entrapment neuropathy in the lower extremity

• Etiologies
  ▪ Idiopathic (common): mechanical, obstructive sources from increased intra-abdominal pressure such as pregnancy, obesity, pelvic tumors, braces/corsets, and pelvic crush injury; surgical procedures and metabolic causes
  ▪ Compression of the LFCN between the anterior superior iliac spine (ASIS) and the inguinal ligament to enter the thigh

Lateral femoral cutaneous nerve block

- “Sonopalpation”
  - Symptomatic neuroma
- US guided injection (diagnostic block)
  - Positive block?
  - Amount of lidocaine, duration etc
- Other cutaneous nerve in the region while scanning

Medial (Anterior) femoral cutaneous nerve

Originate from the femoral nerve, 4 cm distal to the inguinal ligament. Crosses the femoral A. at the apex of the femoral triangle then divide into the anterior/posterior.

Genitofemoral nerve

Descend on the surface of the psoas major M behind the ureter, dividing into the genital and femoral branch. Femoral branch accompanies the external iliac A. and below the inguinal lig enveloped by the femoral vascular sheath.
Ilioinguinal or Iliohypogastric Nerve Block

Ultrasound-guided blocks of the ilioinguinal and iliohypogastric nerve: accuracy of a selective new technique confirmed by anatomical dissection, Eichenberger, U et al, Br J Anaesth, 2006