

# Episode 127: Upper Extremity Blocks with Drs. Segna and Rayaz

On this episode: Dr. Jed Wolpaw, Dr. Kara Segna and Dr. Hassan Rayaz

In this 127th episode I welcome Drs. Segna and Rayaz to the show to discuss upper extremity nerve blocks. We discuss how they're done, what they're done for, and some high yield board style questions that may come up based on them.

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## General approach to regional anesthesia

- Day before surgery, complete chart review looking for comorbidities
- Day of surgery, take detailed history and perform physical
- Perform physical exam on the extremity that the regional block will be applied to
  - o Look for signs of nerve injury: numbness, tingling, weakness, muscle wasting
    - Nerve injury may increase risk of further nerve injury
    - This may change approach (eg. concentration of local anesthetic, catheter vs. single shot)
- Make sure surgeon present
- Discuss risks with patient: bleeding, infection, pain, nerve injury, local anesthetic toxicity, block failure
- Attach standard ASA monitors to patient
  - o ECG is necessary; especially because HR and rhythm important for early signs of local anesthetic systemic toxicity (LAST) syndrome → cardiac and neurological depression from overdose from local anesthetic

## Contraindications

- Absolute contraindications:
  - o Patient refusal
  - o Infection over area of planned block
- Relative contraindications:
  - o Extensive prior nerve injury

## Brachial Plexus Anatomy

- “**Randy Travis Drinks Cold Beer**” for different divisions of brachial plexus
  - o **R**oots
    - Roots become trunks @ anterior scalene muscle
  - o **T**runks
    - Trunks become divisions @ 1<sup>st</sup> rib
  - o **D**ivisions
    - Divisions become cords @ clavicle
  - o **C**ords
    - Cords become branches @ pectoralis minor muscle
  - o **B**ranches
- Nerves that make up brachial plexus come from C5 to T1 with minor or absent contributions from C4 and T2

## Classification of Blocks

- Major blocks
    - o Interscalene nerve blocks
    - o Supraclavicular nerve blocks
    - o Infraclavicular nerve blocks
    - o Axillary nerve blocks
  - Minor blocks:
    - o Bier blocks
    - o Superficial cervical plexus
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## Patients Who Are Anticoagulated

- See the ASRA guidelines in references; there is also an app available through ARSA
- Considerations for superficial vs. deep blocks
  - o Superficial blocks allow the ability to compress any hematoma that may be caused
    - Eg. axillary blocks
  - o Deep blocks don't allow compression of hematomas that are formed
    - Eg. infraclavicular block
- Sample exam questions:
  - o Question: How long do you need to wait to place a nerve block after someone stops taking warfarin, heparin, etc.?
    - Answer: depends, most upper extremity blocks are superficial; infraclavicular block may be deep depending on patient habitus
  - o Question: How does the answer to the above question change if placing a catheter?
    - Answer: the guidelines are the same as a single shot block

## Interscalene Block

- **Patient positioning:** Head of bed up 30 degrees (some people use 45-50); patient in semi-recumbent position with head turned away from you; ultrasound is on opposite side of bed
- Use ultrasound to look for snowman symbol which represents roots and trunks
  - o Snowman symbol is cross section of roots and trunks
    - Top circle is C5
    - Middle circle is C6
    - Lower circle is C7 OR bifurcation of C6
  - o Do NOT go between middle and lower circles
- Inject local anesthetic between anterior and middle scalene muscles
  - o Inject below nerves to avoid nerve injury
- **Indications:** shoulder to elbow procedures
  - o More significant ulnar sparing, so don't want for hand surgeries
- Basic exam questions (heavily tested):
  - o Question: Which of the following nerves is often missed when utilizing an interscalene block for a shoulder procedure?
    - Answer: ulnar sparing is seen in up to 20% of interscalene blocks. Anesthesia for shoulder surgery is targeted towards C5; may or may not get C7-8 resulting in ulnar sparing, therefore it is not abnormal for patients to be able to move finger, typically pinky
  - o Question: You are using a nerve stimulator to place an interscalene catheter and you notice the diaphragm move, how should you move your needle?
    - Answer: diaphragm moves because phrenic nerve lies on belly of anterior scalene muscle; therefore, you would want to direct needle posteriorly
      - Phrenic nerve is blocked 100% of the time!
      - On the other hand, if you notice trapezius muscle is activated by stimulator, want to change needle to more anterior approach
  - o Question: What level is this block performed at?
    - Answer: interscalene block is at C6 and anatomical landmark is Chassaignac's tubercle; blocks brachial plexus at roots/trunks
- Advanced exam questions:
  - o Question: What are the complications of an interscalene catheter?
    - Answer: 100% phrenic nerve paralysis, inadvertent vertebral artery injection, blockade of sympathetic cervical chain (stellate ganglion to face) causing

- Horner's syndrome (miosis, ptosis, anhidrosis), anesthesia of recurrent laryngeal nerve causing hoarse voice
- Question: Which complication leads to hypotension and bradycardia?
  - Answer: total spinal because injection site is very close to cervical vertebra
- Oral board exam questions:
  - Question: You decide to place an interscalene block in an outpatient setting for shoulder surgery on someone who has morbid obesity and COPD, which is a safer technique between using the nerve stimulator or ultrasound? Is an interscalene block safe in someone with COPD?
    - Answer to part 1: there is no evidence that using an ultrasound or the nerve stimulator is safer than the other; the best way to minimize nerve injury is limit trauma to neural fibers → prefer awake patients who can let us know they are experiencing paresthesia; when they are, pull needle back by a couple of millimeters
    - Answer to part 2: for patients with COPD, it depends on their severity and their dependence on accessory muscles for breathing; it is NOT safe if patient is wheezing and/or using accessory muscles

## Supraclavicular Block

- **Patient positioning:** same as interscalene block
- Place ultrasound probe on clavicle and move up into groove
  - Identify subclavian artery divisions and tilt probe so the artery is sitting on first rib
  - Identify the "bundle of grapes" which are the trunks
  - Hypoechoic structures are nerve tissue, brighter structures are connective tissue
- Inject local anesthetic in perineural fashion in corner pocket and above the divisions to allow diffusion into plexus
- **Indications:** mid humerus and distal procedures
- Basic exam questions:
  - Question: What part of brachial plexus is blocked with supraclavicular block?
    - Answer: trunks of brachial plexus, this is one of the most reliable blocks for anesthesia
  - Question: What brachial plexus block is associated with highest risk of pneumothorax?
    - Answer: supraclavicular, incidence of 6% because of proximity. This risk decreased with the use of ultrasound and increased in patient with bullous lung disease and smokers
- Oral board exam questions:
  - Question: In an outpatient setting, a patient is having a thumb arthroplasty. They smoke 2 packs/day and has COPD and home oxygen requirement. He is requesting a block, which block would you choose and why?
    - Answer: axillary because patients with COPD and home oxygen requirement need accessory muscles to breath
      - The supraclavicular block may be contraindicated in this patient because there is a 50% chance of phrenic nerve block as well as the risk of pneumothorax
  - Question: What if he had normal functioning lungs, but history of previous nerve injury with numbness and tingling at baseline?
    - Answer: Prefer to not do block because of risk of further nerve injury

## Infraclavicular Block

- **Patient positioning:** patient in supine position with head turned away from you, arm bent at 90 degrees, abducted and angled above head. Stand at head of bed with ultrasound at feet of patient
- Place ultrasound below clavicle; identify axillary artery, axillary vein, and cords
- Inject local anesthetic below axillary artery and get “U” shaped spread going around axillary artery → should spread up to both sides of artery
- Sample questions:
  - o Question: which part of brachial plexus is blocked with infraclavicular block
    - Answer: cords
  - o Question: put ultrasound pictures with star and ask to label what is seen in ultrasound
    - Artery is axillary artery
    - Distinguish lateral vs. medial cords
      - Lateral side has lateral cord
      - One right below is posterior cord
      - Medial side has medial cord
- Remember this is a deeper block compared to other brachial plexus blocks
- Could still paralyze phrenic nerve; 10% range of risk

## Axillary Block

- **Patient positioning:** similar position to infraclavicular block; if can't abduct arm, won't be able to do block
- Perivascular injection of local anesthetic around axillary artery
  - o Ensure to inject local anesthetic around musculocutaneous nerve within coracobrachialis muscle
- Indications: distal surgical procedures (ie. hand)
- Contraindications: not as bad as others because superficial; main thing is positioning with axillary area access
- Sample Questions:
  - o Question: You are performing an axillary block and the patient is still able to flex at the elbow, what nerve was missed?
    - Answer: musculocutaneous nerve
  - o Question: If you were to stimulate the musculocutaneous nerve, how would that manifest?
    - Answer: flexion of elbow
  - o Question: If you were to stimulate the radial nerve, how would that manifest?
    - Answer: extension of digits
  - o Question: If you were to stimulate ulnar nerve, how would that manifest?
    - Answer: adduction of thumb
  - o Question: If you were to stimulate median nerve, how would that manifest?
    - Answer: pronation of forearm
  - o Question: What part of the brachial plexus is blocked when doing an axillary block?
    - Answer: branches
  - o Question: What nerve is commonly missed in axillary block?
    - Answer: musculocutaneous nerve
  - o Question: What muscle is the musculocutaneous nerve embedded in?
    - Answer: coracobrachialis
  - o Question: ultrasound image of axillary artery and as you to label
    - Answer: Musculocutaneous nerve lateral left field in middle of muscle

- Axillary artery should be big black ball in middle of ultrasound
- Ulnar nerve black nerve ball most lateral and to side of artery
- Radial nerve underneath artery
- Median nerve on top of artery
- Oral board questions:
  - Question: Patient fell down flight of stairs and traumatically broke wrist. They have COPD and are fully anticoagulated because of a cardiac issue. They have a poor airway, are NPO and scheduled for surgery. Could you do this case under regional anesthesia?
    - Answer: yes, options include supraclavicular, infraclavicular, axillary block
  - Follow-up Question: Which one would you choose?
    - Answer: axillary; 0% chance of hitting phrenic nerve and considered superficial block
      - Avoid affecting the phrenic nerve which is a problem with COPD → do not use supraclavicular block
      - Avoid difficulty with anticoagulation → do not use infraclavicular block
  - Follow-up Question #2: 45 minutes into case, patient starts complaining of tourniquet pain, how would you evaluate this?
    - Answer: do a physical exam. Assuming the patient is unable to move and feel hand and pain is limited to tourniquet, consider that there is a small part of medial upper arm area not covered by any brachial plexus nerve → covered by intercostobrachial nerve originating from lateral cutaneous branch of 2<sup>nd</sup> intercostal nerve at T2. Do supplemental block where create wheel around axilla using local anesthesia (similar to ankle block)

## Complications

- Most nerve injuries will resolve in two weeks on their own → nerve injury is usually a transient process
  - More than 90% of peripheral nerve injuries associated with blocks will resolve in 4 to 6 weeks
  - More than 99% of peripheral nerve injuries associated with blocks will resolve by 1 year
- Main factors affecting recovery:
  - Mechanism of nerve injury
  - Patient's comorbidities
- Only FDA approved adjunct for these blocks at the moment is epinephrine
- Question: what types of nerve injury can happen with nerve blocks?
  - Answer: 5 types of nerve injury ranging from neuropraxia to neurotmesis
  - **Neuropraxia** = temporary conduction block with preserved axons
  - **Neurotmesis** = complete transection from axon to epineurium
    - 1% risk where injury may not be transient
    - Layers of nerve from outside to inside: nerve, epineurium, perineurium surrounding fascicles, endoneurium holding myelinated axons
- Question: post-op day one patient who received outpatient elbow surgery under regional anesthesia calls in distress saying they cannot move arm. What do you do?
  - Answer: validate that this is a distressing time, get them to answer questions to direct their care
  - Review what type of block they received, type of local anesthetic used, adjuncts, time of block placed, preexisting conditions

- Read block note to see if they experienced paresthesia during procedure which may indicate nerve damage
- If there may be nerve damage, reassure patient that all function is usually back within 2 weeks and they will receive close follow-up
- Call patient every single day
- This is too early for EMG testing as degree of muscle denervation cannot be determined until axon degeneration is complete → this could take from 1 week to 4 weeks
- Consider getting neurological consult for patient

## Bier Block

- **Indications:** distal upper extremity procedures, don't need ultrasound to place block. Provides anesthesia for <1 hour cases for procedures below elbow
- Procedure:
  - Place double pneumatic tourniquet after IV is started in hand
  - Elevate and exsanguinated arm
  - Inflate proximal tourniquet
  - Inject 50mL of 0.5% lidocaine over 2-3 minutes
  - Time to onset is 5 minutes
  - After ~45 minutes, tourniquet pain will develop. At this time, inflate distal tourniquet and deflate proximal tourniquet
- Questions typically revolve around LAST syndrome management and maximum anesthetic dosage

## Superficial Cervical Plexus Blocks

- Provides anesthesia over clavicle and shoulder
- Historically good for carotid endarterectomy; however it is not sufficient and good cooperation with surgeon to supplement local anesthetic is required
- Mid clavicular # not covered w/ interscalene block
- With ultrasound, start with placement at the level of interscalene nerve block
  - Identify the sternocleidomastoid muscle on medial side of screen
  - Inject local underneath the muscle to raise it up
  - Infiltration will envelop superficial cervical plexus

## Summary

- Upper extremity blocks are the pillar of regional anesthesia
- They could also provide post-op analgesia that is an adjunct to multimodal analgesia
- Be safe about it
- Take into account perioperative factors to ensure best approach for patient management

#What do you do for these blocks?

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## References

For the ASRA guidelines on patients receiving antithrombotic or thrombolytic therapy: [Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines \(Fourth Edition\)](#)

For more information on the interscalene block: [Ultrasound-Guided Interscalene Brachial Plexus Block](#)

For more information on the supraclavicular block: [Ultrasound-Guided Supraclavicular Brachial Plexus Block](#)

For more information on the infraclavicular block: [Ultrasound-Guided Infraclavicular Brachial Plexus Block](#)

For more information on the axillary block: [Ultrasound-Guided Axillary Brachial Plexus Block](#)

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Notes by [April Liu](#)