VAULT

VIRGINIA ULTRASOUND

Regional Anesthesia + Vascular Access Training

Basic Ultrasound-Guided Upper Extremity Blocks

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Objectives

- Discuss the patient and surgical indications for ultrasound-guided regional anesthesia (UGRA) of the upper extremity
- Describe specific ultrasound landmarks for each of the upper extremity blocks
- Review the transducer axis, needle insertion plane, and local anesthetic requirements for each of the upper extremity blocks
- Explain potential side-effects and complications related to specific upper extremity blocks

Indications

- The choice to use UGRA is determined by many factors such as patient comorbidities, suitability of the technique for the proposed surgery, provider comfort in performing the procedure, as well the mental status of the patient. UGRA has many indications, including:
  - Primary anesthetic
  - Pain Management
  - History of severe PONV or risk of MH
  - Patient is too ill for general anesthesia
  - Physician (surgeon) preference

Contraindications

- There are certain instances where under no circumstances should regional anesthesia be considered. These are known as **absolute** contraindications. They include:
  - Patient refusal
  - Local infection at the site of the proposed block
  - Active bleeding an anticoagulated patient
  - Proven allergy to a local anesthetic

Contraindications

- Most contraindications to regional anesthesia are **relative**. The provider must determine the risk vs. benefit before proposing any procedure.
  - Respiratory compromise
  - Inability to cooperate/understand procedure
  - An anesthetized patient (adult population)
  - Bleeding diathesis secondary to an anticoogulant or genetic defect
  - Bloodstream infection
  - Preexisting peripheral neuropathy

Complications

- Although uncommon, regional anesthesia can result in complications such as:
  - Local anesthetic toxicity
  - Intra-arterial injection
  - Respiratory compromise
  - Parathesias and nerve damage
- Prior to performing any regional anesthetic, the risks and benefits should be discussed with the patient, allowing them to make an informed decision.

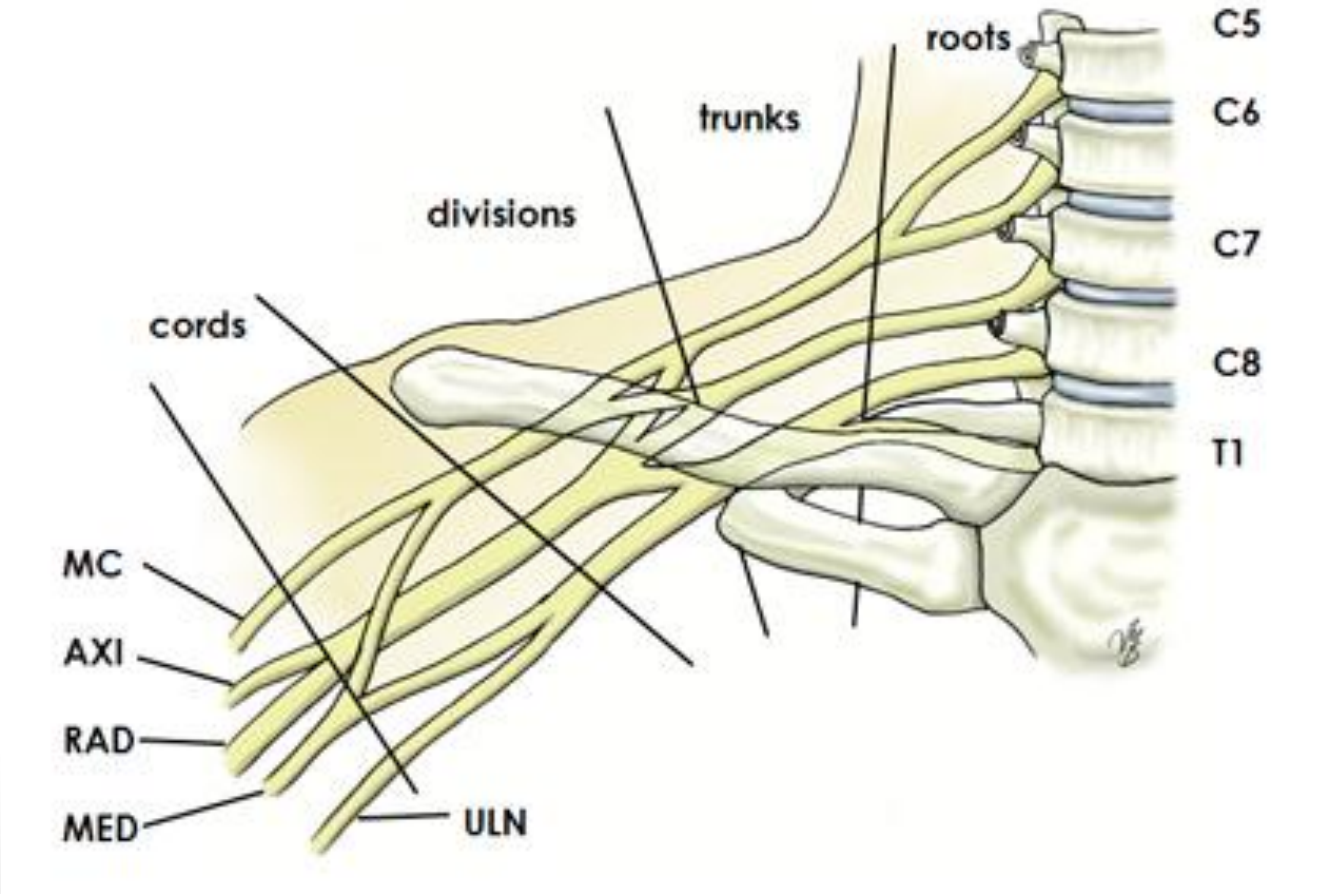
Prior to any procedure…

- Verify the correct patient
- Obtain informed consent
- Verify the correct procedure
- Verify the correct extremity
- Gather all necessary equipment
- Obtain baseline vital signs and monitor during the procedure
- Administer proper/adequate sedation

The Brachial Plexus

- The brachial plexus consists of ventral rami of the C5 – T1 nerve roots and extends from the neck to axilla
- From central to the periphery, the roots exit the vertebral foramen and converge into trunks, divisions, cords, and branches
- With a few exceptions, the brachial plexus supplies sensory and motor innervation to the upper extremity

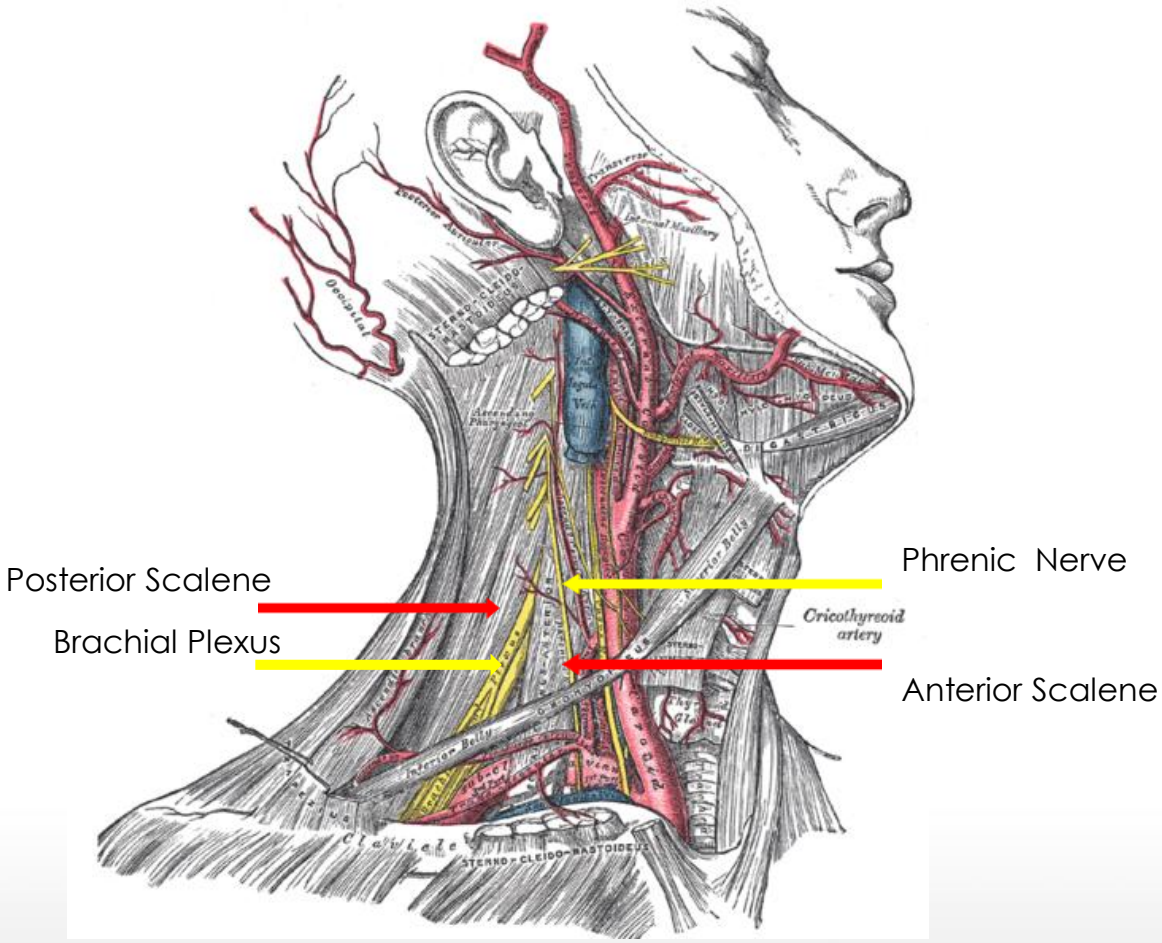
The Brachial Plexus



Interscalene

- The interscalene block is performed at the root level
- It is the primary upper extremity block for procedures involving the shoulder and proximal upper arm
- Nerve roots C5 - 7 are found in the interscalene groove between the anterior and middle scalene muscles near the level of the cricoid cartilage (C6) posterior the sternocleidomastoid muscle
- A catheter is usually placed for procedures involving the rotator cuff

Interscalene



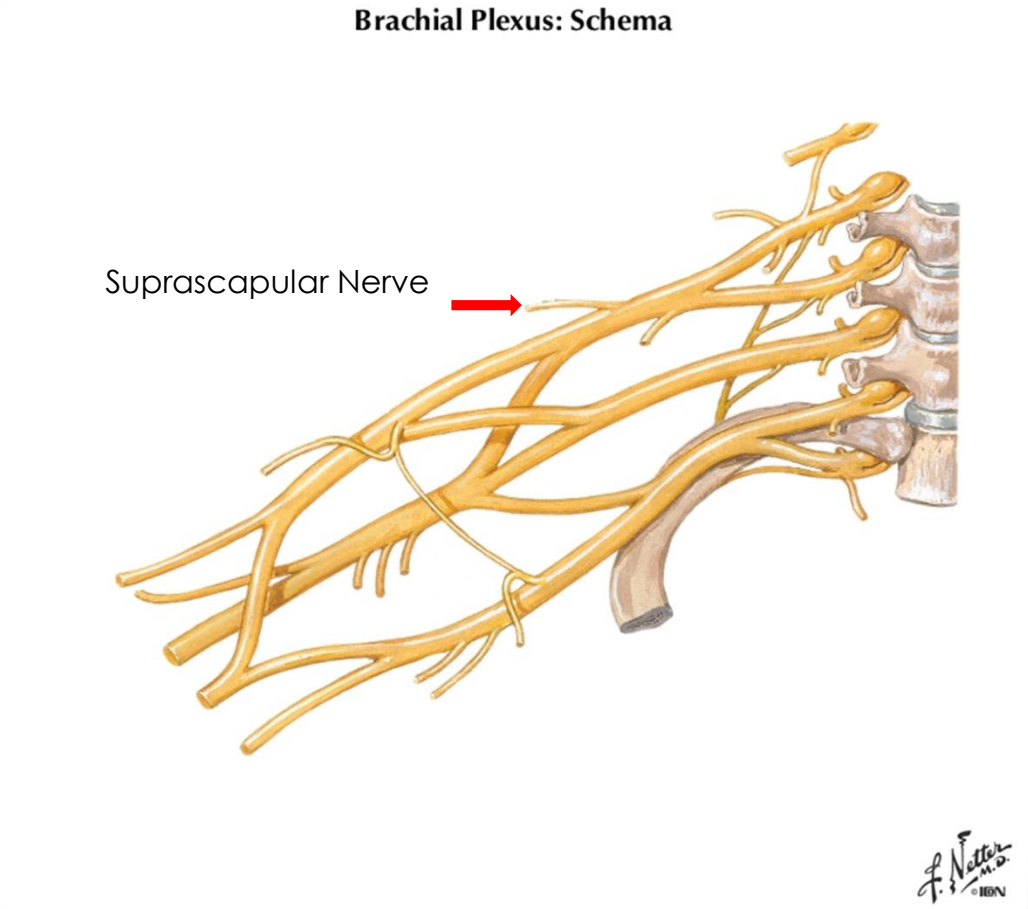
Interscalene

- Patient is placed in supine position with head turned to the non-operative side
- Transducer is placed either superior to clavicle in the mid fossa and moved cephalad, or at the level of the cricoid cartilage and moved laterally
- High frequency linear array transducer
- Short-axis, in-plane image
- 3 to 4 hypoechoic circles located between the anterior and middle scalene muscles
- 5cm needle is used
- 20 – 30cc's of local anesthetic injected

Interscalene

- Short-axis, in-plane image with posterior needle insertion
- Interscalene anatomy is variable, and the nerve roots may not appear in the interscalene groove
- For shoulder surgery the needle should pass between the C5-6 roots

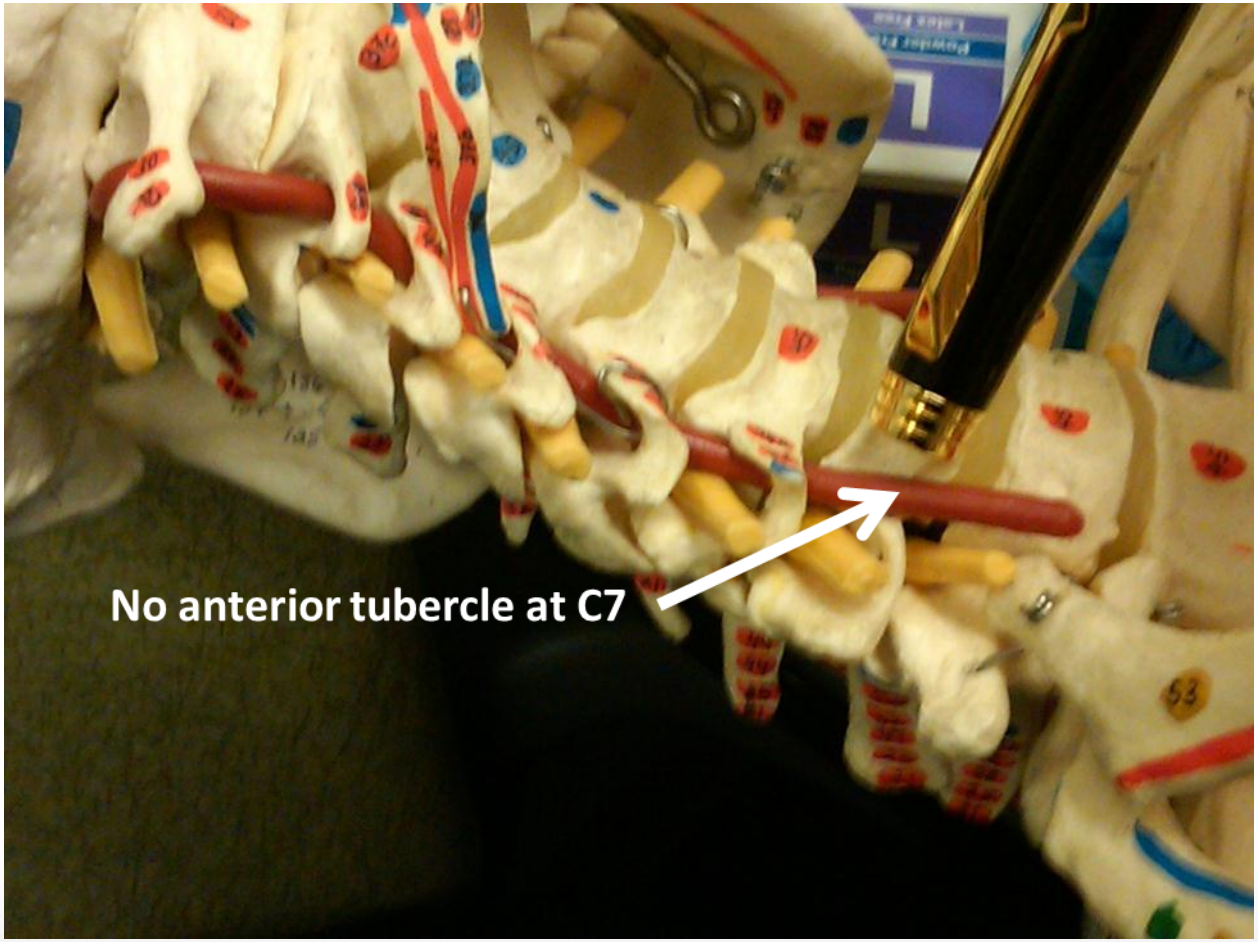
Interscalene



Interscalene (SC Approach)

Interscalene (IJ Approach)

Interscalene Anatomy

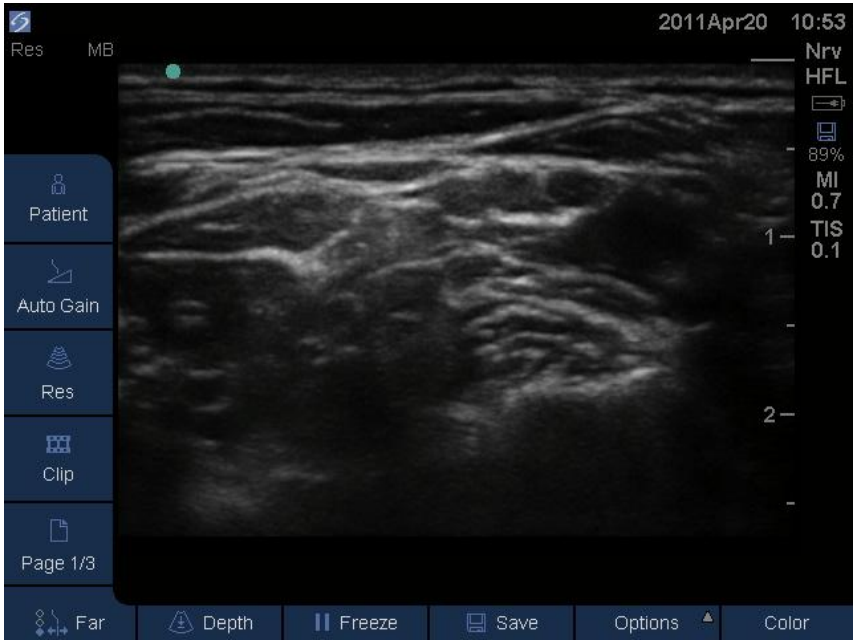


Interscalene (U/S anatomy)

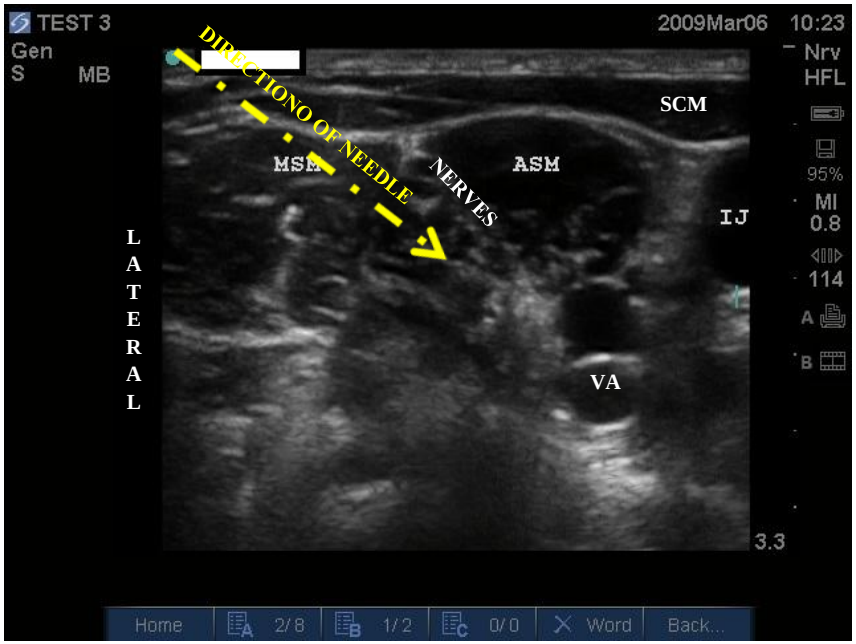
Interscalene (U/S anatomy)

"Normal"

"Abnormal"



Interscalene



Interscalene Injection

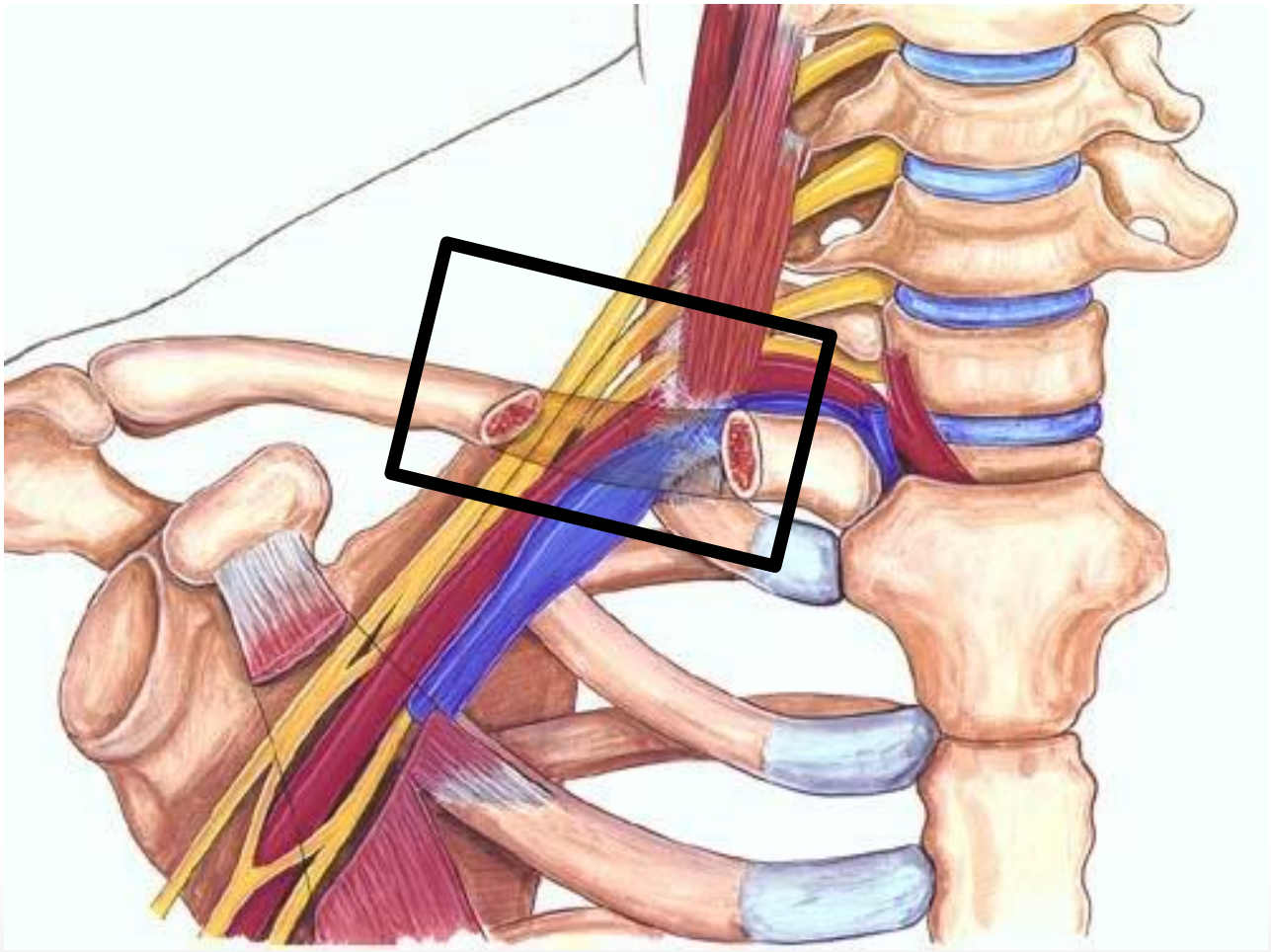
Interscalene

- Because the phrenic nerve also lies in the interscalene groove, it is also frequently blocked, resulting in hemiparesis of the diaphragm
- It is important to avoid injecting local anesthetic immediately adjacent to the transverse process because of the risk of unintentional epidural or spinal injection
- Horner's syndrome (myosis, ptosis, and anhidrosis) may occur because of the close proximity of the stellate ganglion

Supraclavicular

- The supraclavicular block is performed at the trunk and division level
- It is a reliable upper extremity block for procedures involving the upper arm and hand
- The trunks/divisions are found lateral to the subclavian artery and superior to the first rib
- A catheter can be placed at this level for post-operative pain management

Supraclavicular



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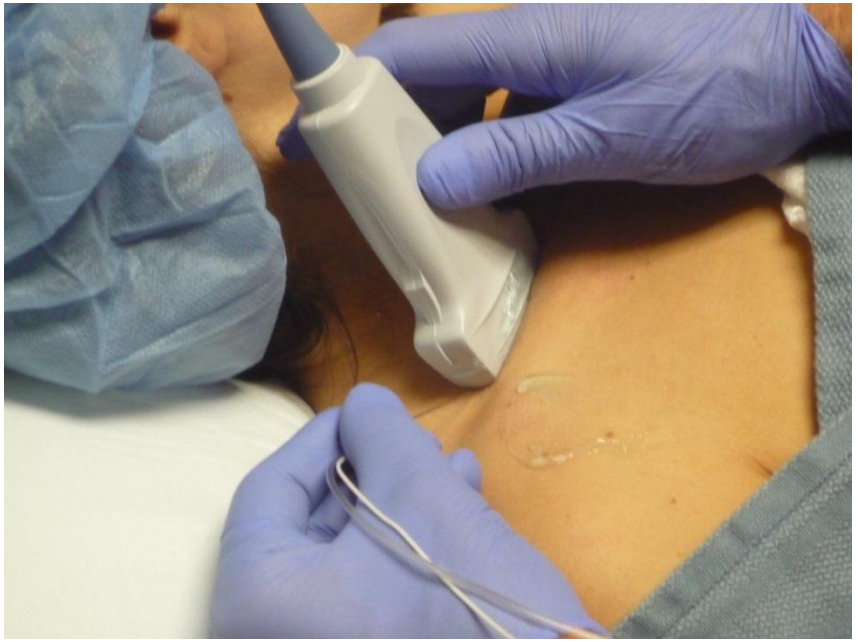
Supraclavicular

- Patient is placed in supine position with their head turned to the non-operative side
- Transducer placed supraclavicular fossa
- High frequency linear array transducer
- SAX in-plane image
- Nerves appear as a group of hypoechoic circles lateral to subclavian artery, superior to first rib
- 5cm needle is used
- 20 – 30cc's of local anesthetic injected

Supraclavicular

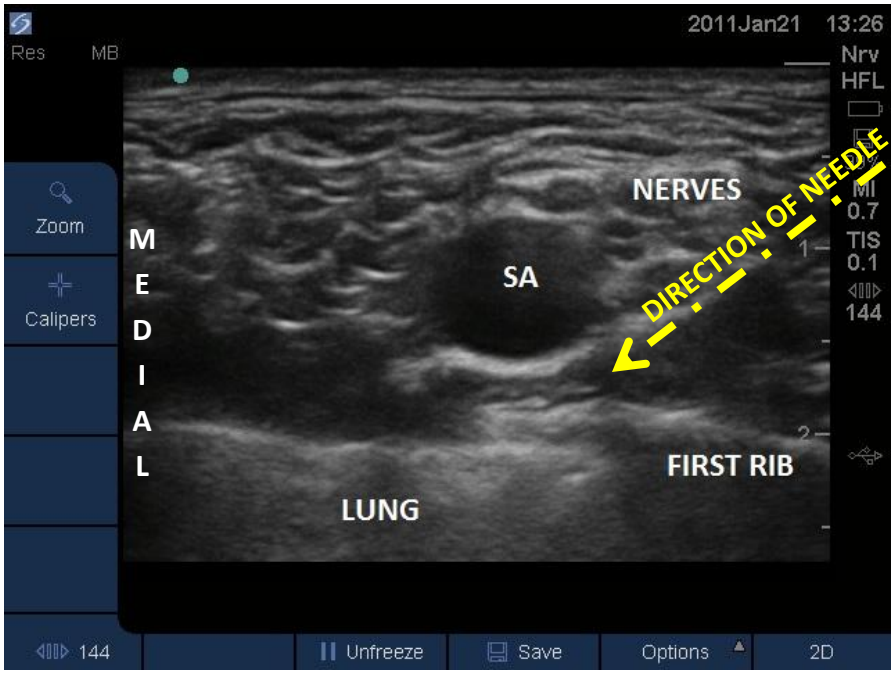
- With ultrasound, it is an excellent choice for surgeries of the upper extremity that do not involve the shoulder
- Once placed in the fossa, the transducer is rocked until 1st rib lies inferior to the nerves and artery, and superior to the pleura



Supraclavicular (anatomy)

Supraclavicular

- SAX In-plane image, needle enter from lateral position
- The most complete block is achieved when local anesthetic is placed above the first rib and below the nerve bundle



Supraclavicular Block

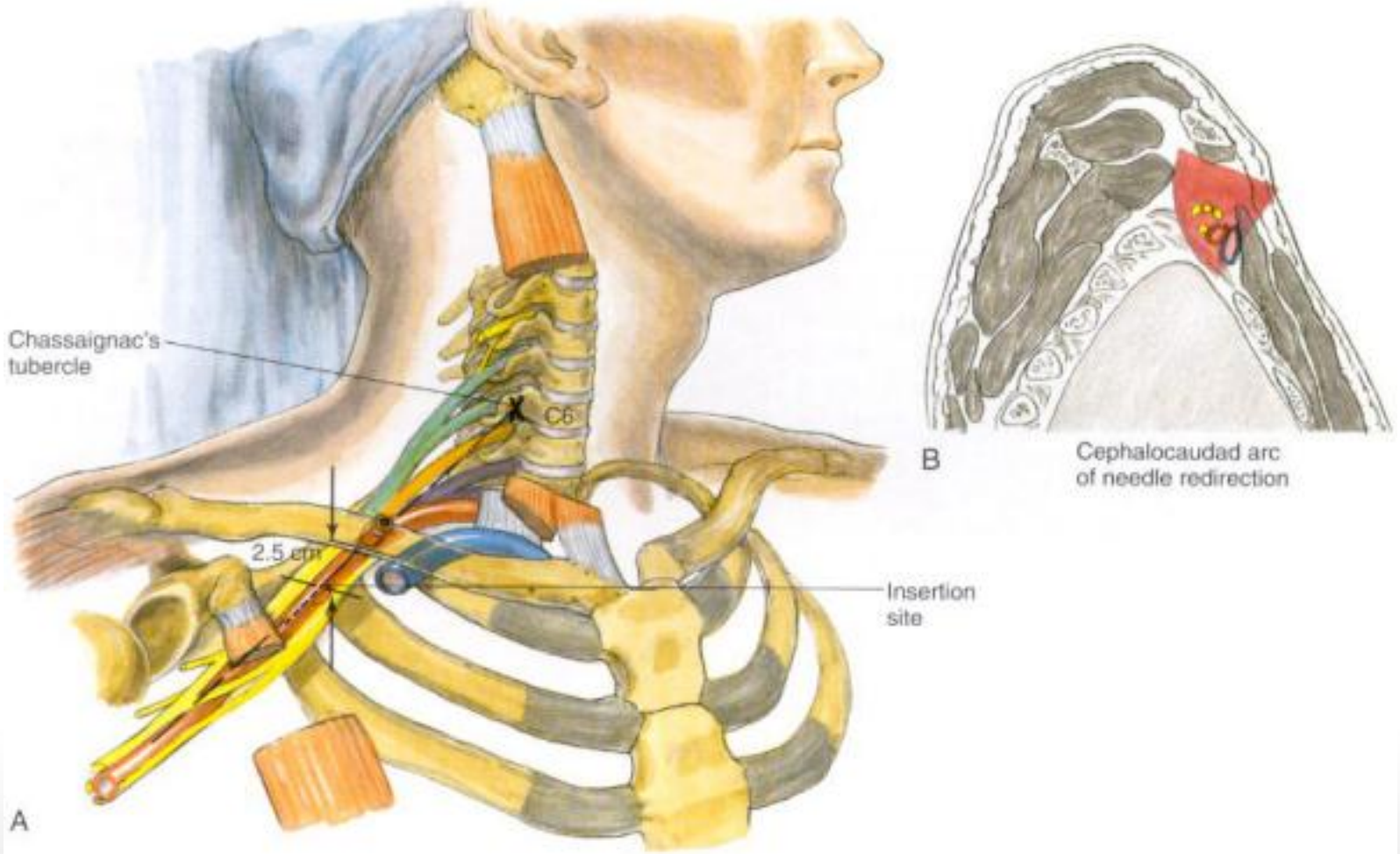
Supraclavicular

- As with the Interscalene block there is increased risk of phrenic nerve paralysis and stellate ganglion block
- Because of the proximity of the subclavian artery and lung, there is the possibility for inadvertent arterial puncture and pneumothorax

Infraclavicular

- The infraclavicular block is performed at the cord level
- It is an good alternative to the supraclavicular block, and may be preferred in patients with severe chronic obstructive pulmonary disease (COPD) or respiratory insufficiency
- The lateral, posterior and medial cords are arranged superior and lateral, posterior, and posterior and medial around the axillary artery

Infraclavicular



Infraclavicular

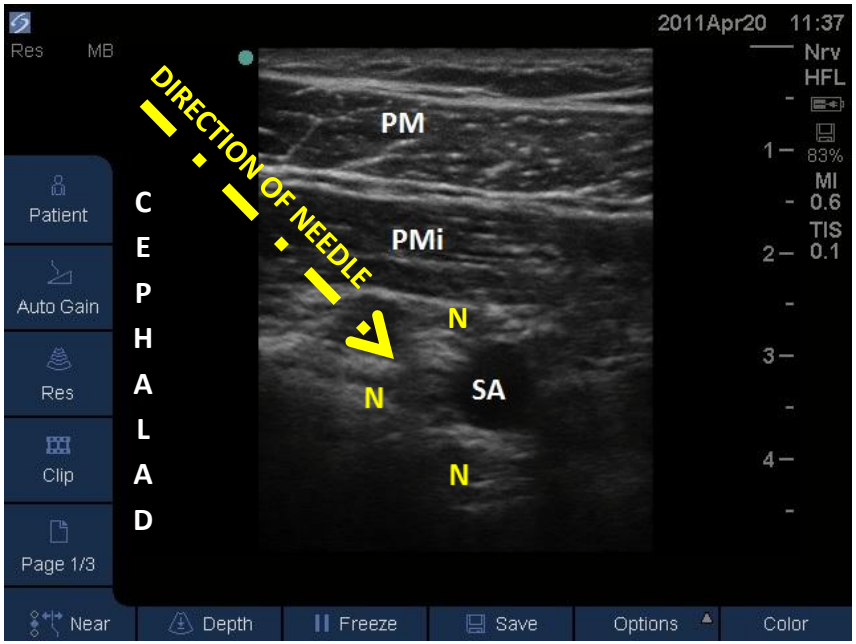
- Patient is placed in supine position with their head turned to the non-operative side
- Transducer is placed perpendicular to the clavicle just medial to the coracoid plexus
- Mid frequency linear or curved array transducer
- SAX in-plane image
- Nerves are arranged around the axillary artery
- 5 –10cm needle is used
- 20 – 30cc's of local anesthetic injected

Infraclavicular

- It is good for procedures in the distal upper arm and hand, while at the same time sparing the phrenic nerve
- This block should be judiciously reserved for patients suffering from severe chronic obstructive pulmonary disease (COPD)

Infraclavicular

Infraclavicular

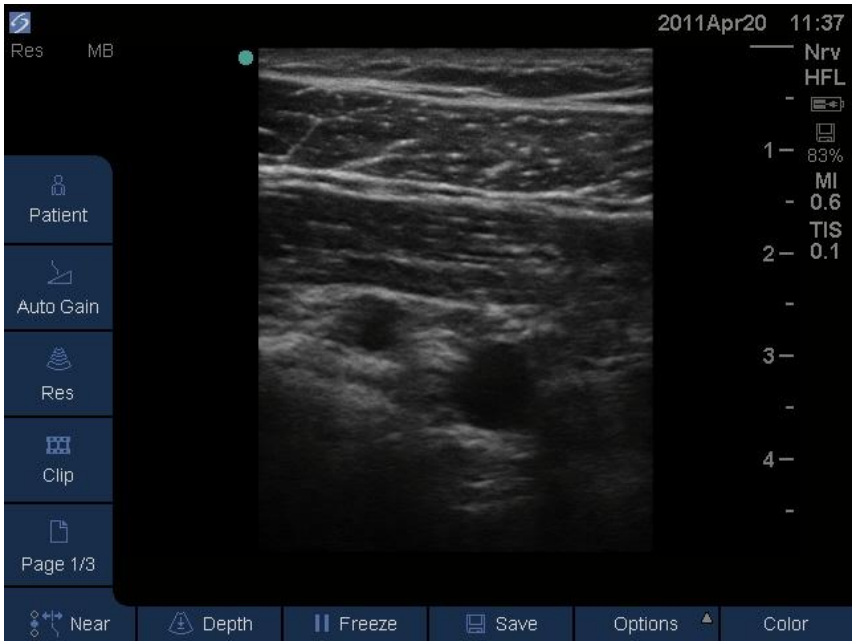


- Because two large muscle groups must be traversed to perform this block, it can be uncomfortable for the patient
- The greatest success with this block is achieved when local anesthetic is deposited posteriorly causing a circumferential spread around the artery

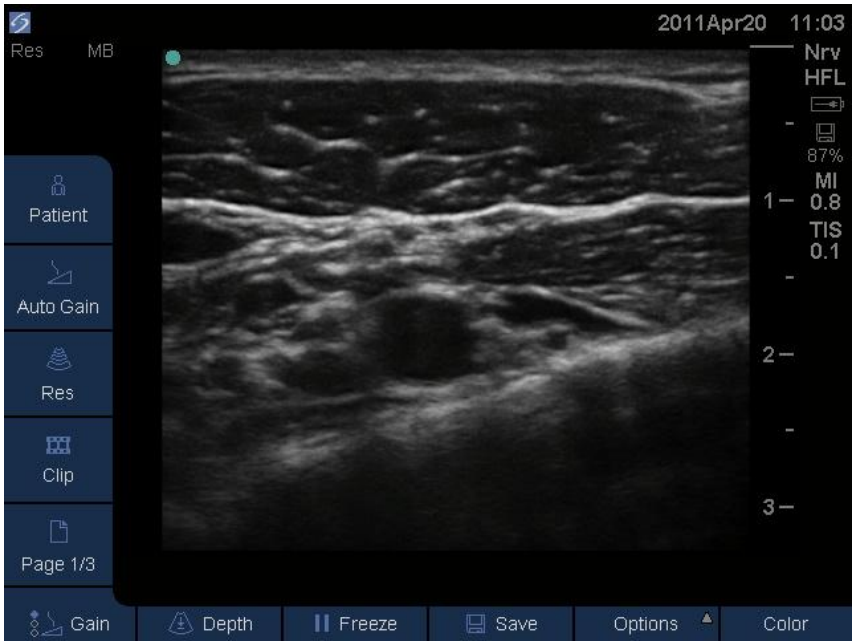
Infraclavicular

- Sliding the needle medially increased the potential for pneumothorax and hemothorax
- The thoraco-acromial artery and pectoral veins pass between the pectoral muscles. Doppler may be used to help identify these to prevent inadvertent puncture

Infraclavicular



Infraclavicular



Axillary

- The axillary block is directed at the terminal branches of the brachial plexus
- It is an excellent block for procedures below the elbow
- Once a mainstay of regional anesthesia for the upper extremity, ultrasound has made it less attractive because other blocks can be done as efficiently with minimal complications

Axillary

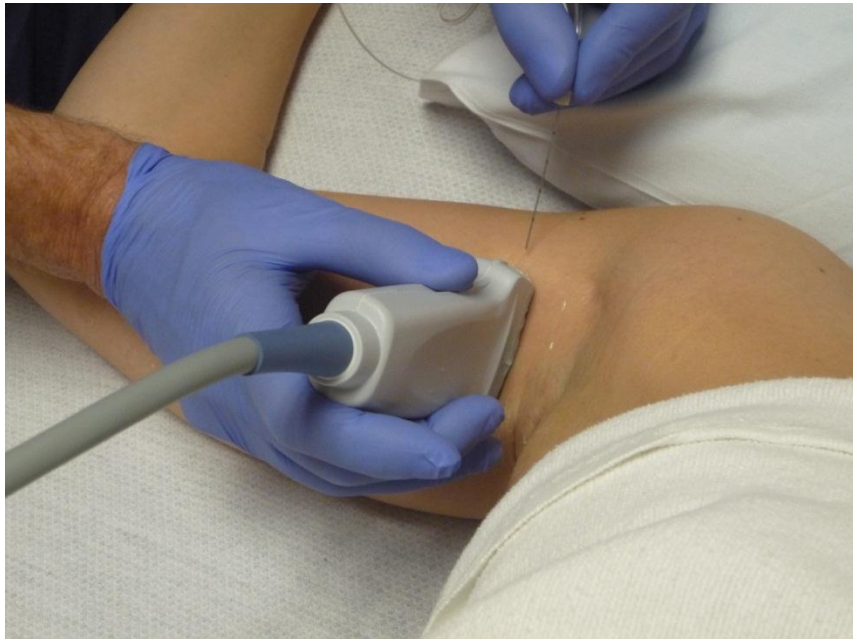
- Patient is placed in the supine position with head turned to the non-operative side, operative arm abducted and rotated externally
- Transducer is placed perpendicular to the axillary artery in the crease formed by the biceps muscle and pectoris major
- High frequency linear array transducer
- Short-axis, in-plane image

Axillary

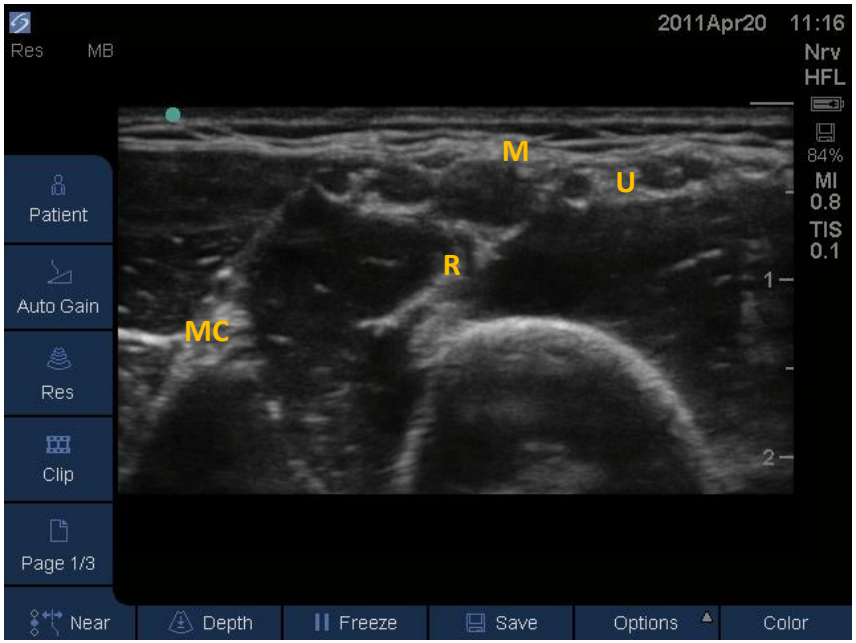
- The radial, ulnar and median nerves are located around the axillary artery. The musculo-cutaneous nerve has already left the sheath and lies within the coracobrachialis muscle
- 5cm needle is used
- 20 – 30cc's of local anesthetic injected around the four nerves. Circumferential spread around the axillary artery is a reliable sign of a successful block

Axillary

- Image the axillary artery in short-axis. The needle can be inserted from either side of the transducer
- A nerve stimulator may be helpful in identifying specific nerves
- There are multiple veins located around the artery. Be cautious



Axillary



- Compressing the veins may decrease the risk of vascular puncture
- It is advantageous to block the radial nerve first because it tends to lie deeper than the median and ulnar
- Slide the transducer distally to appreciate each of the nerves, then follow them proximally to their origin

Axillary (Ulnar)

Axillary (Median)

Axillary (Radial)

Axillary (Musculocutaneous)

Axillary

- Complications of an axillary block are not common, however there is an increased risk of vascular puncture because several needle sticks are required to achieve adequate local anesthetic distribution
- Repeated parathesias from multiple needle punctures may result in neuropathies

Questions ?

References

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