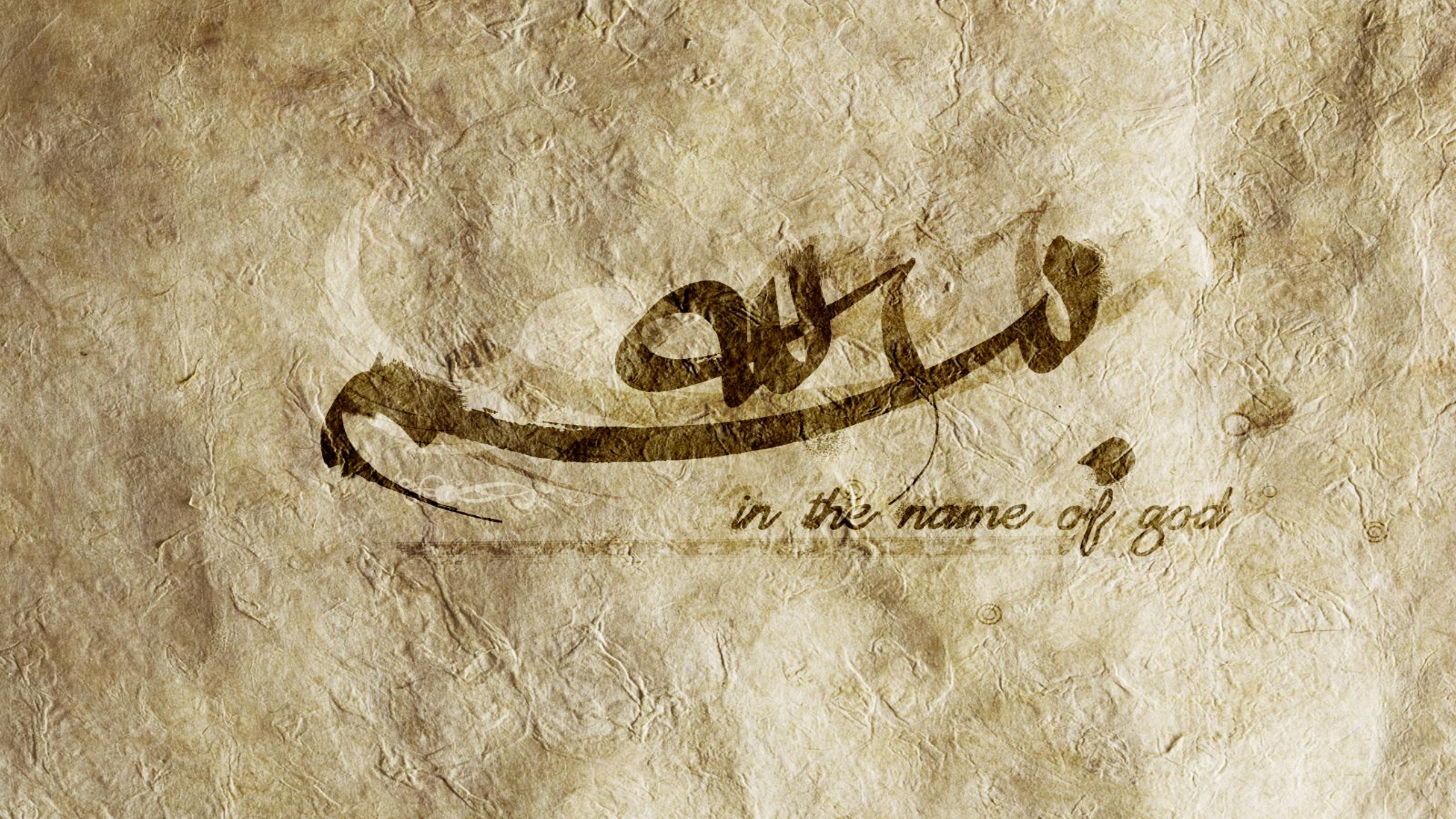
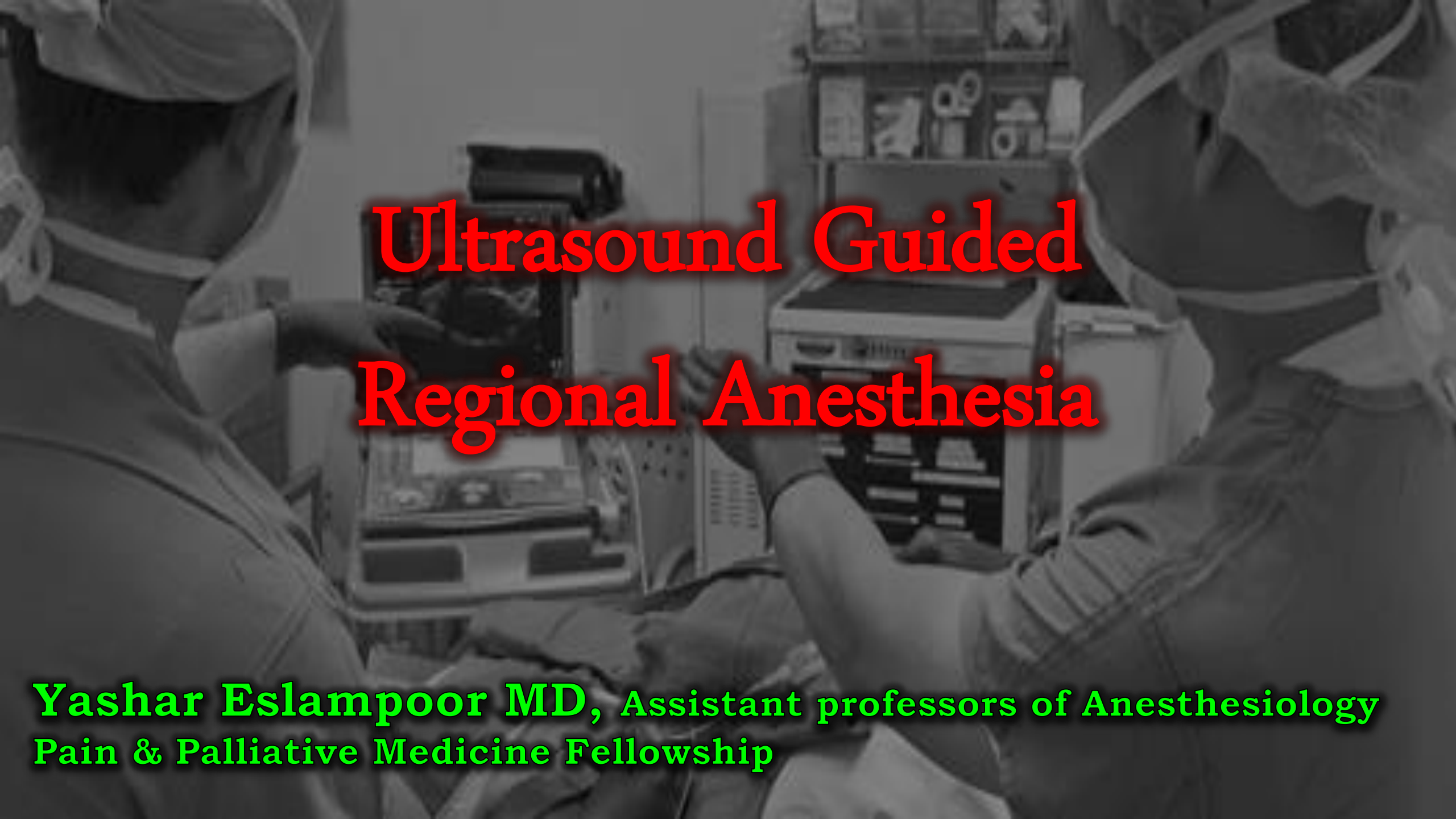

in the name of god



Ultrasound Guided Regional Anesthesia

Yashar Eslampoor MD, Assistant professors of Anesthesiology
Pain & Palliative Medicine Fellowship


Technology


Renaissance
in
Regional
Anaesthesia
SCANNAV
Peripheral Nerve Block
Supraclavicular Region
Compress tissues to obtain an optimal view. Veins are not highlighted.
SCM
Artery
Pleura
Back
Home
SCANNAV™
ANATOMY
Peripheral Nerve Block
HFL50xp/15-6 Nerve
MI: 0.6 TIS: 0.2
2.7 cm
PATIENT

History

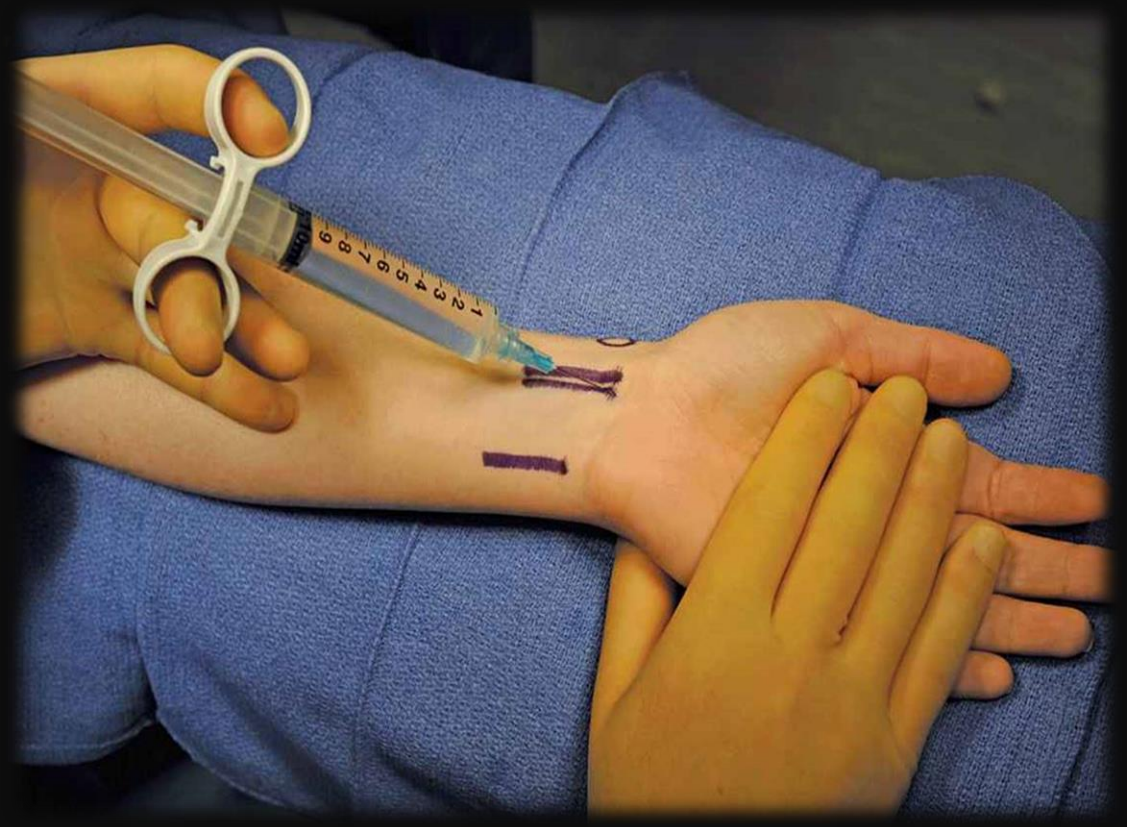
- Use of ultrasound in medicine began in the 1940's
- Ultrasound has many diagnostic and procedural uses
- Reports of placing regional blocks with ultrasound assistance started to appear around 1995

Techniques for Localizing Neural Structures

1. Paresthesia Techniques
2. Peripheral Nerve Stimulation
3. Ultrasound Guidance

Paresthesia Techniques

- A simple method that requires little specialized equipment
- Needle makes direct contact with a nerve
- Reliant on patient cooperation (only small doses of sedation are recommended)
- Disadvantage: Patient discomfort



Caution should be used when initiating the injection of LA to ensure that the needle is not intraneural.

Peripheral Nerve Stimulation

- Paresthesia technique was replaced in the 1980s with peripheral nerve stimulation
- Deliver small pulses of electric current to the end of a block needle
- Allowing patients to be more sedated during block placement

Ultrasound Guidance

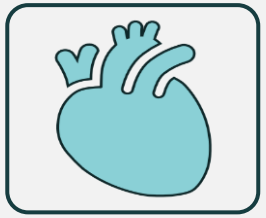
- Direct visualization of peripheral nerves, the block needle tip, and local anesthetic distribution.
- Guiding targeted drug injections and catheter placement.

Ultrasound-Guidedence

Gold standard for the safety of Regional Anaesthesia

The disadvantages are few but important:

- Availability
- Need For Additional Training



Reduced risk of LA systemic toxicity

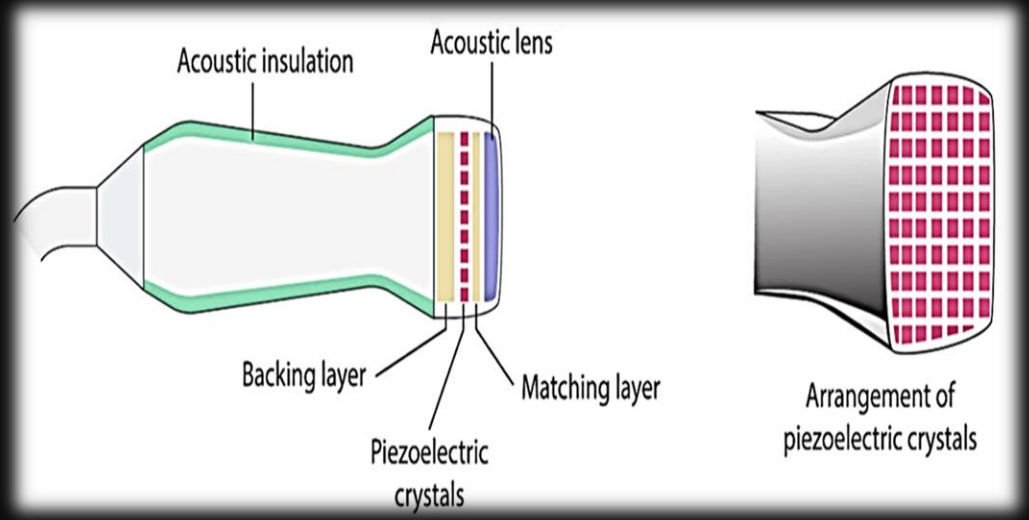
Shortens the time to perform the block

Reduces the number of needle insertions

Reduces accidental puncture of neighboring structures

Basic Ultrasound Physics and Ultrasound Machine Settings

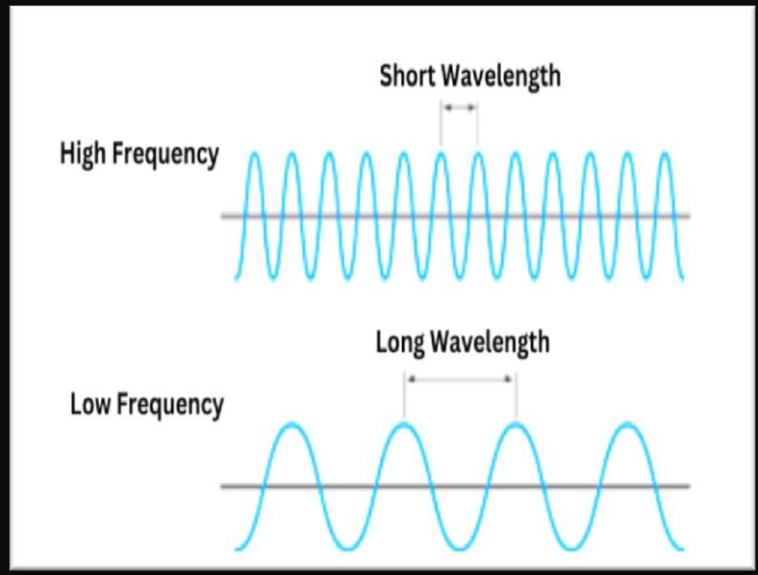
- Ultrasound is sound with a frequency above the audible range (>20,000 cycles per second)
- The frequencies used in clinical imaging are within the range of 1-20 MHz
- The source of the ultrasound wave is the piezoelectric crystal, located in the head of the transducer (probe)
- In general, the **higher the frequency**, the **better the image quality**, and the **lower the frequency**, the **better the penetration.**

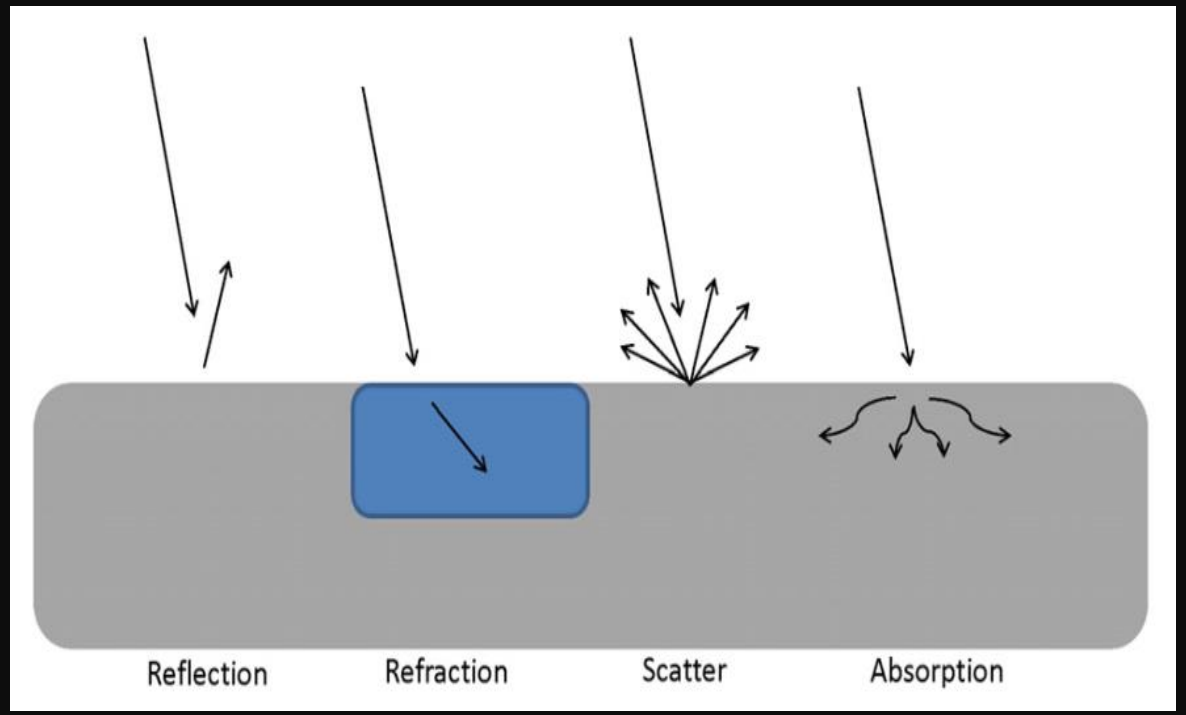


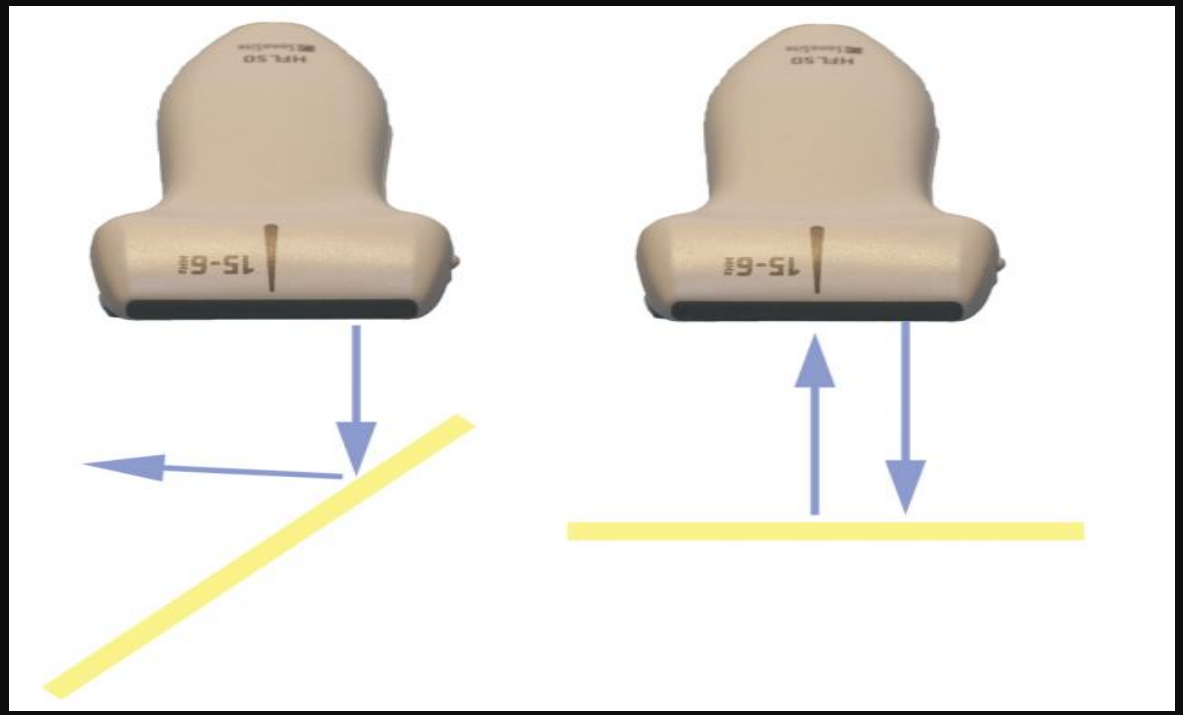
$$Frequency = \frac{Velocity}{Wavelength}$$

$$f = \frac{v}{\lambda}$$

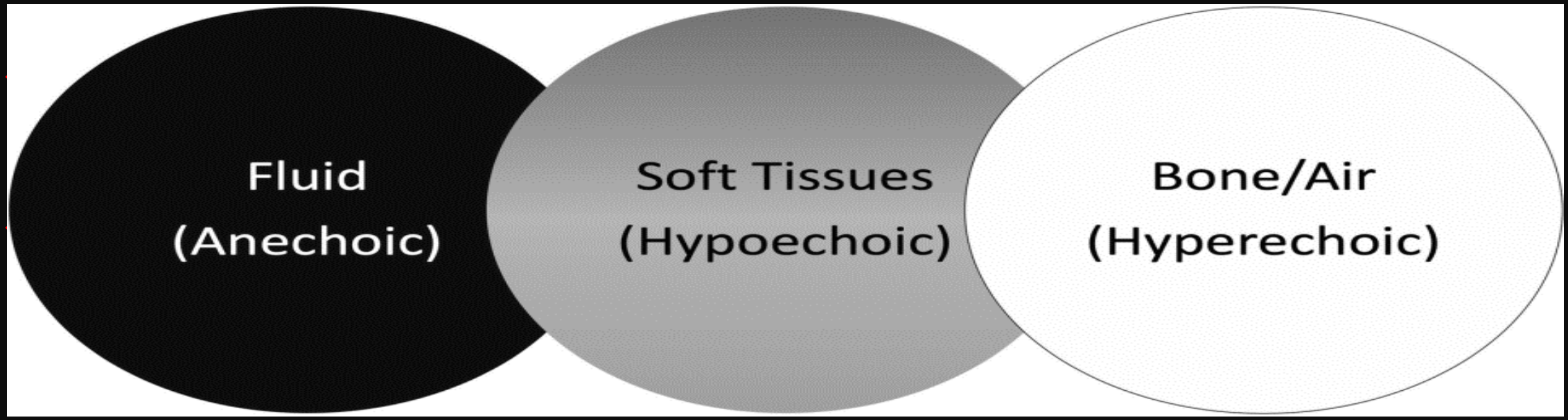
$$Unit\ of\ Frequency: Hz$$




Reflection
Refraction
Scatter
Absorption

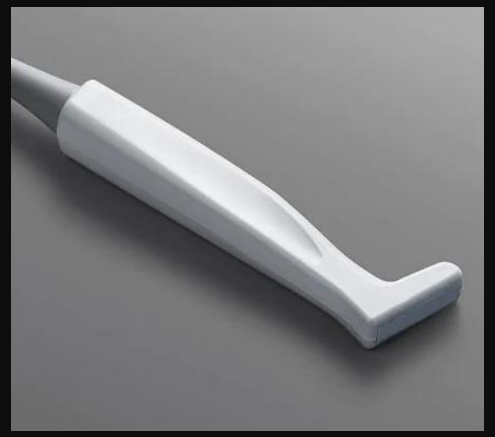


- Sound waves reflected at the interface of two tissues with different acoustic impedances generate echoes.
- Objects with a great difference in impedance will create a **white** (**hyperechoic**) picture
- Objects with a slight difference in impedance will create a **gray** (**hypoechoic**) picture
- Areas with no return of sound will be **black** (**anechoic**)



Transducer Selection

In general, the higher the frequency, the better the image quality, and the lower the frequency, the better the penetration.



linear probes: High frequency with high resolution but poorer penetration
appropriate for many shallow blocks: interscalene, supraclavicular, infraclavicular, axillary, …

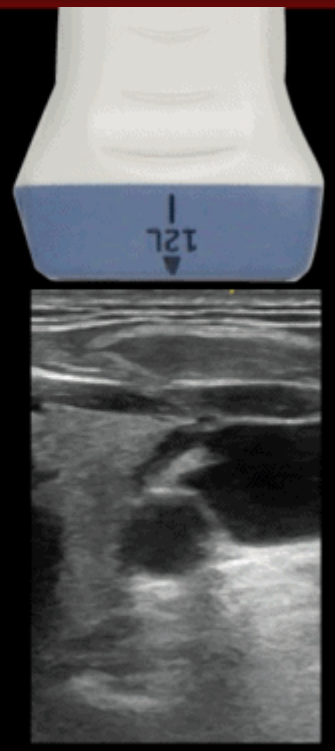
Curvilinear probes: Low frequency with low resolution but better penetration
useful for imaging of deeper structures: spine or paraspinous structures as well as the sciatic nerve

Linear Probe

High Frequency

Linear Footprint

Shallow Structures (< 8cm)



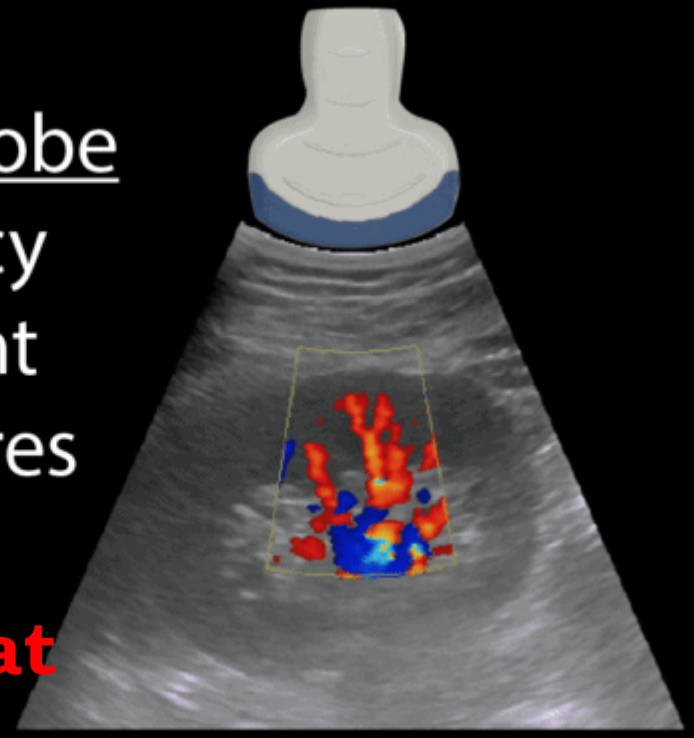
Rectangular Format

Curvilinear Probe

Low Frequency

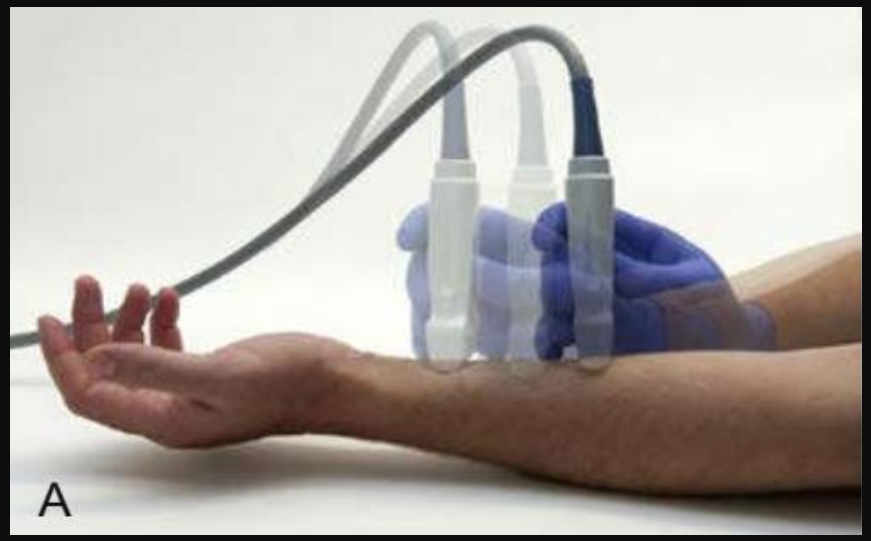
Wide Footprint

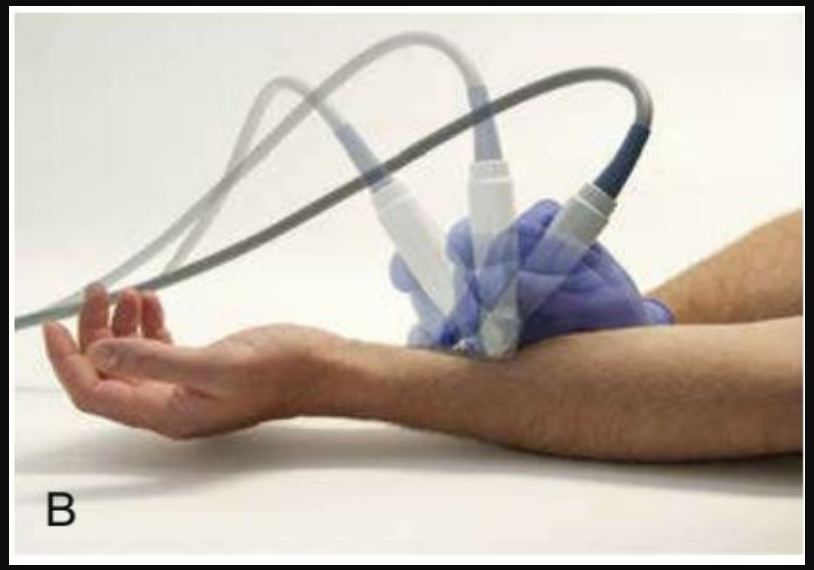
Deep Structures

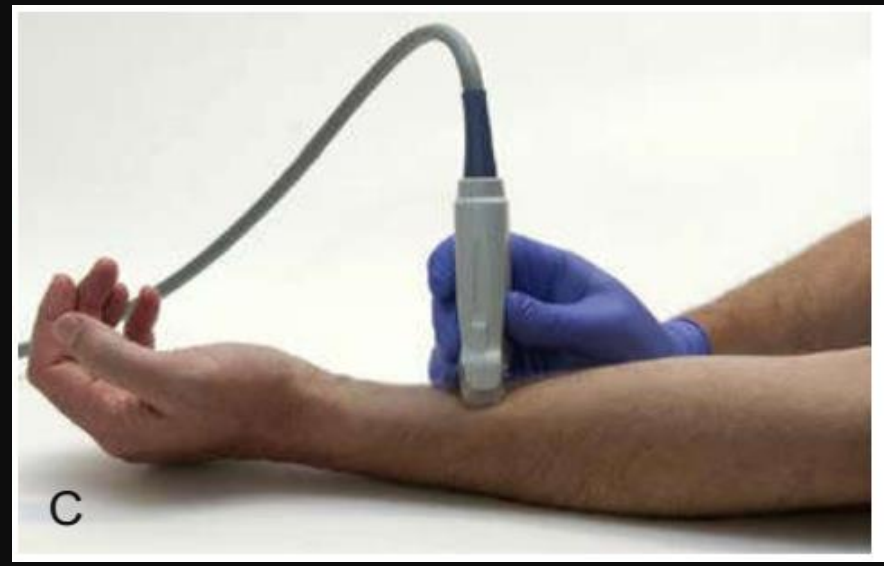


Sector Format

Transducer Manipulation




B


C


D


E

Nerves Visibility

- The fascicular echotexture is the most distinguishing feature of nerves (Honeycomb architecture)
- More central nerves, such as the cervical ventral rami, have fewer fascicles and can appear monofascicular on ultrasound scans.
- Ultrasound frequencies of 10 MHz or higher are required to distinguish tendons from nerves based on echotexture alone.
- Nerves can be round, oval, or triangular in shape. Although nerve shape can change along the nerve path
- Nerves are pathologically enlarged either in CharcotMarie-Tooth, type 1A, and diabetic neuropathy

How to Visualize Nerves and Needles

Peripheral nerves are usually viewed in short axis rather than long axis

In-Plane Approach

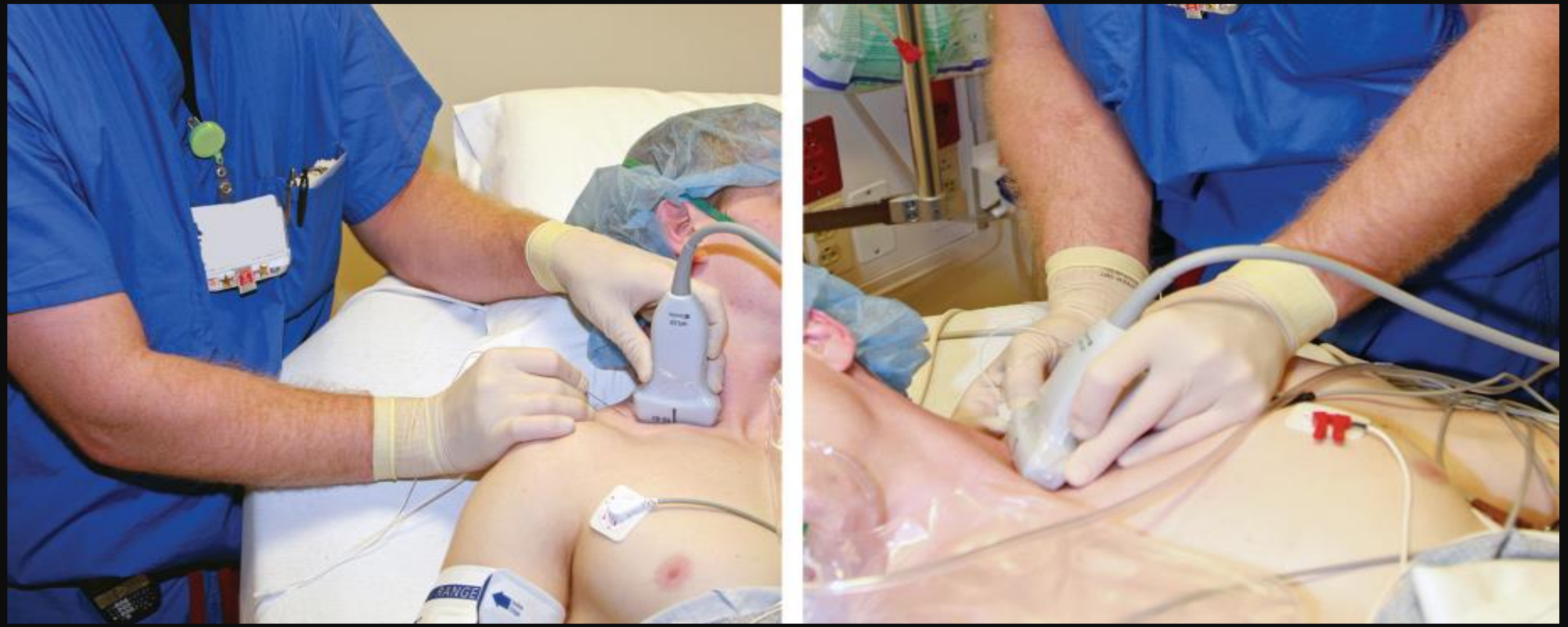
Out-of-Plane Approach

Ultrasound machine location:

Place the machine in line of sight, with the patient between the operator and the ultrasound machine

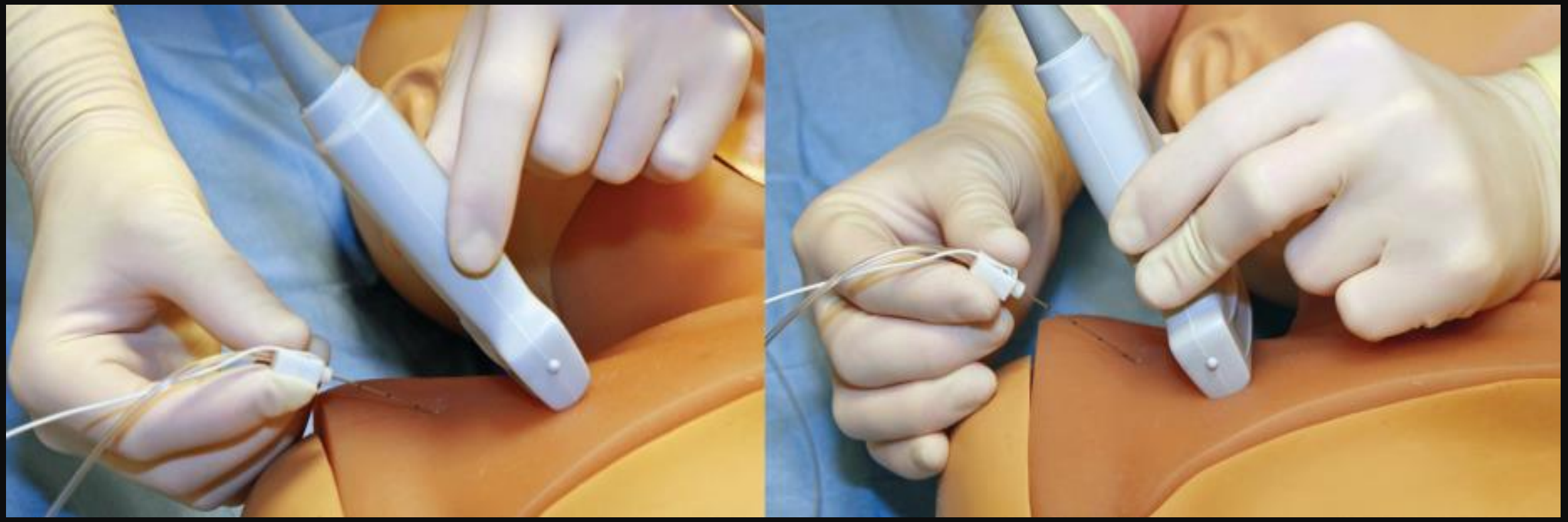
Which hand is advancing the needle?

Most operators use the dominant hand to advance the needle and the nondominant hand to hold the ultrasound probe, modifying their position if necessary to maintain this relationship



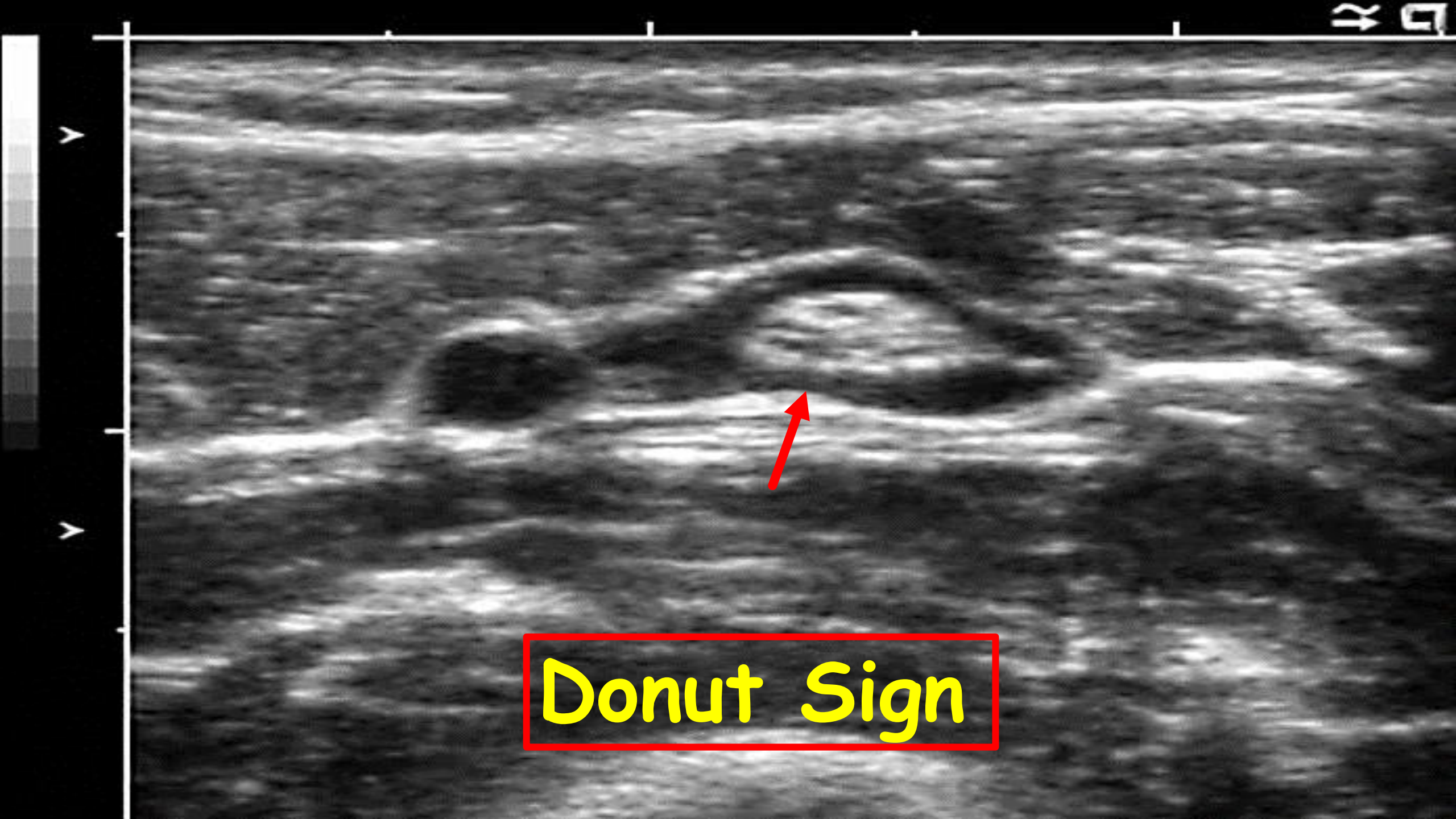
Can the operator's arms and hands rest comfortably during performance of the block to steady the probe and needle?

Hold the base of the probe and use the little finger or hypothenar aspect of the hand to provide a stable platform



Equipment and Preparation


STERILE
Aquasonic
PARKER
Naropin
LOT
Mfg.
Use before
TS15100023
2015-10
2018-09
PROTEXIS™
Neoprene
8
REF 2D73DP80
CardinalHealth
Transept
CLEANSING SOL
FOR
ULTRASOUND
TRANSDUCERS
PARKER
ropivacaine 0.5%
lidocaine 1%
HFL50
15-6l


Donut Sign

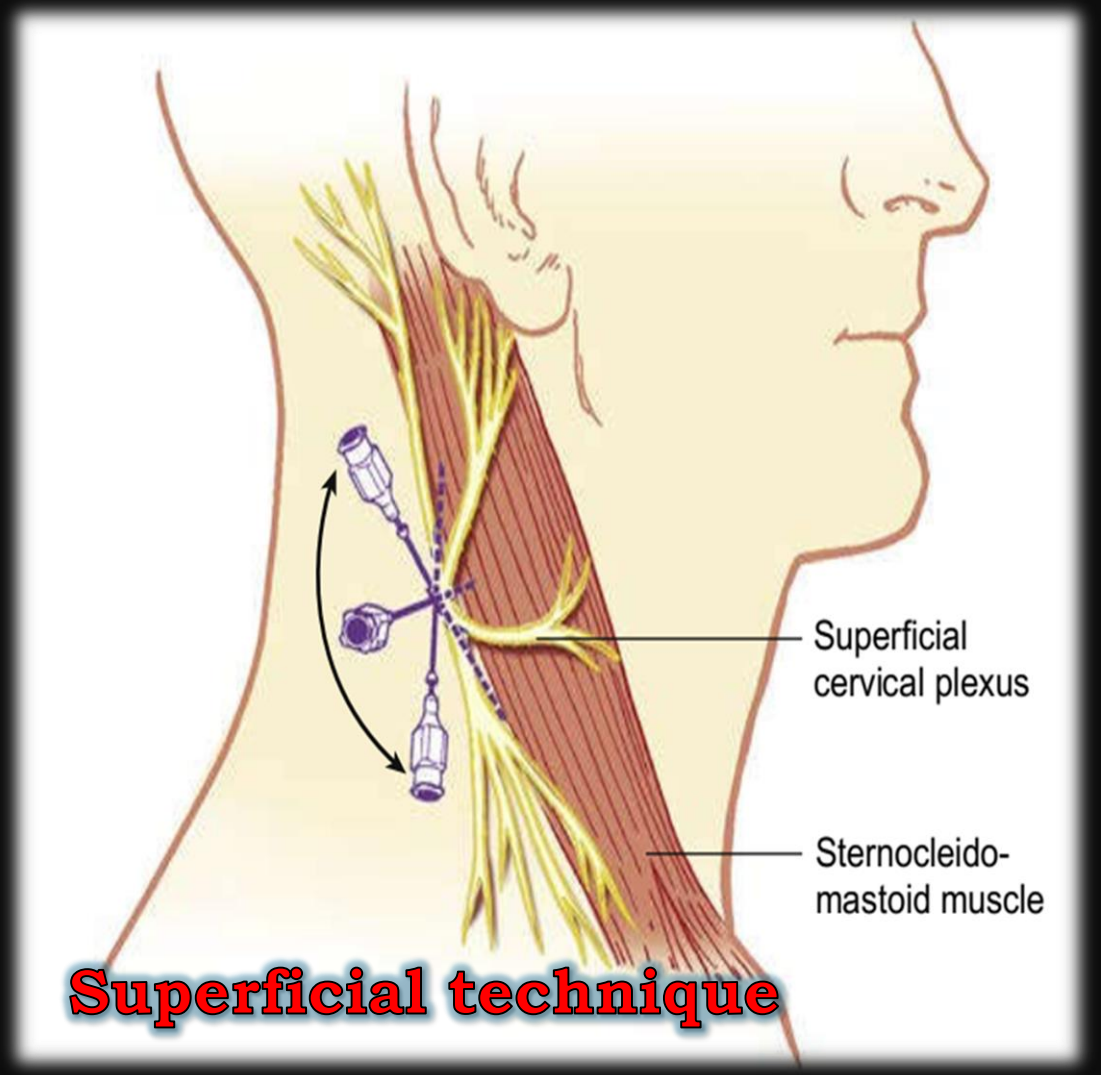
REGIONAL BLOCK TECHNIQUES

Cervical Plexus Blocks

- From the C1, C2, C3, and C4 spinal nerves
- Branches to the prevertebral muscles, strap muscles of the neck, and phrenic nerve.
- Deep cervical plexus: Musculature of the neck
- Superficial cervical plexus: Cutaneous sensation of the skin between the trigeminal innervation of the face and the T2 dermatome of the trunk
- The superficial sensory branches: lesser occipital, greater auricular, transverse cervical, and supraclavicular nerves,

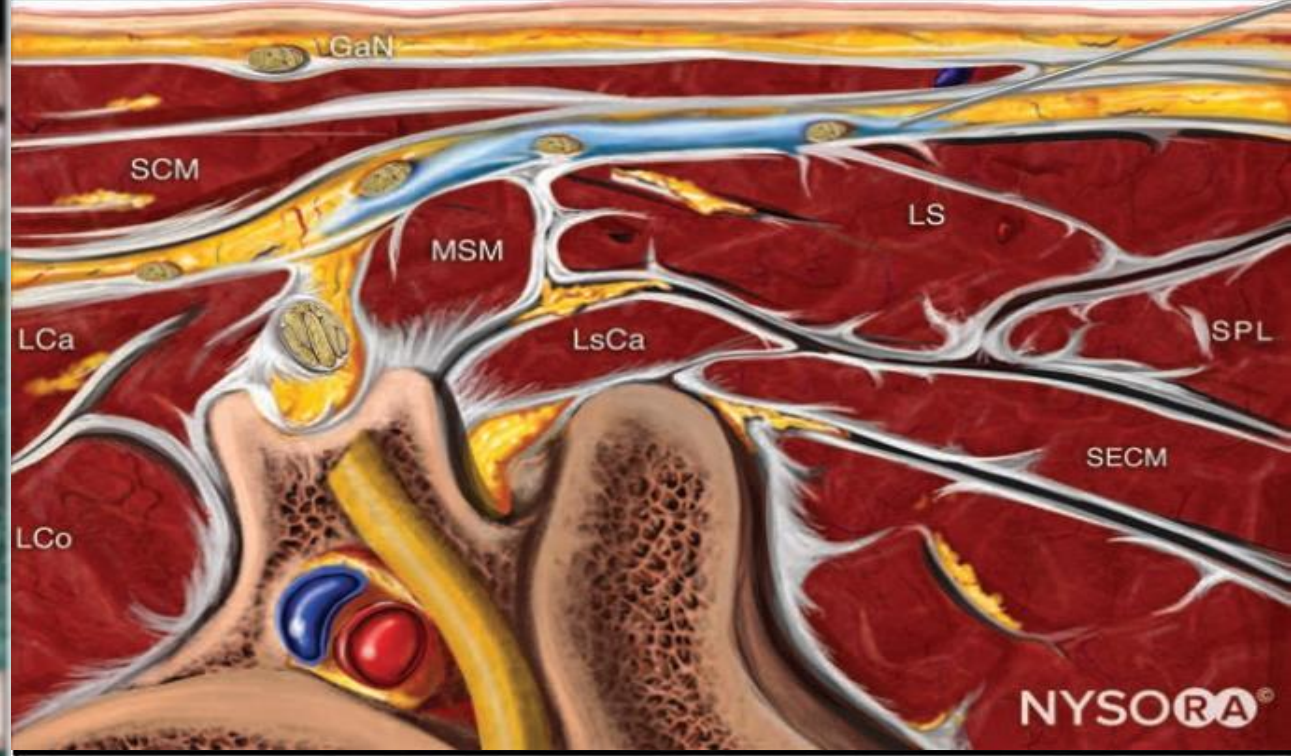
- Anesthesia for lymph node dissections, plastic surgery, carotid endarterectomy.
- continuously monitor the awake patient's neurologic status in endarterectomy
- Bilateral blocks for tracheostomy and thyroidectomy
- Three common approaches :

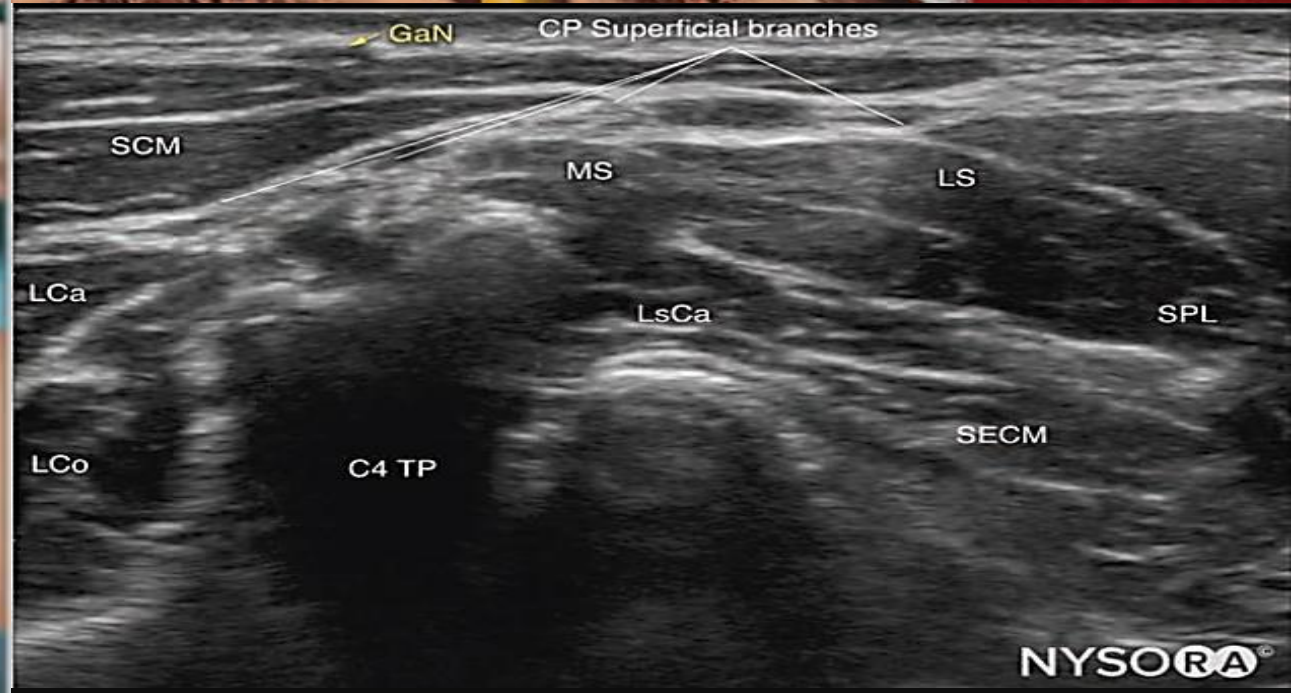
1. Deep injection technique (C2-C4 paravertebral block)
2. Intermediate technique
3. Superficial technique



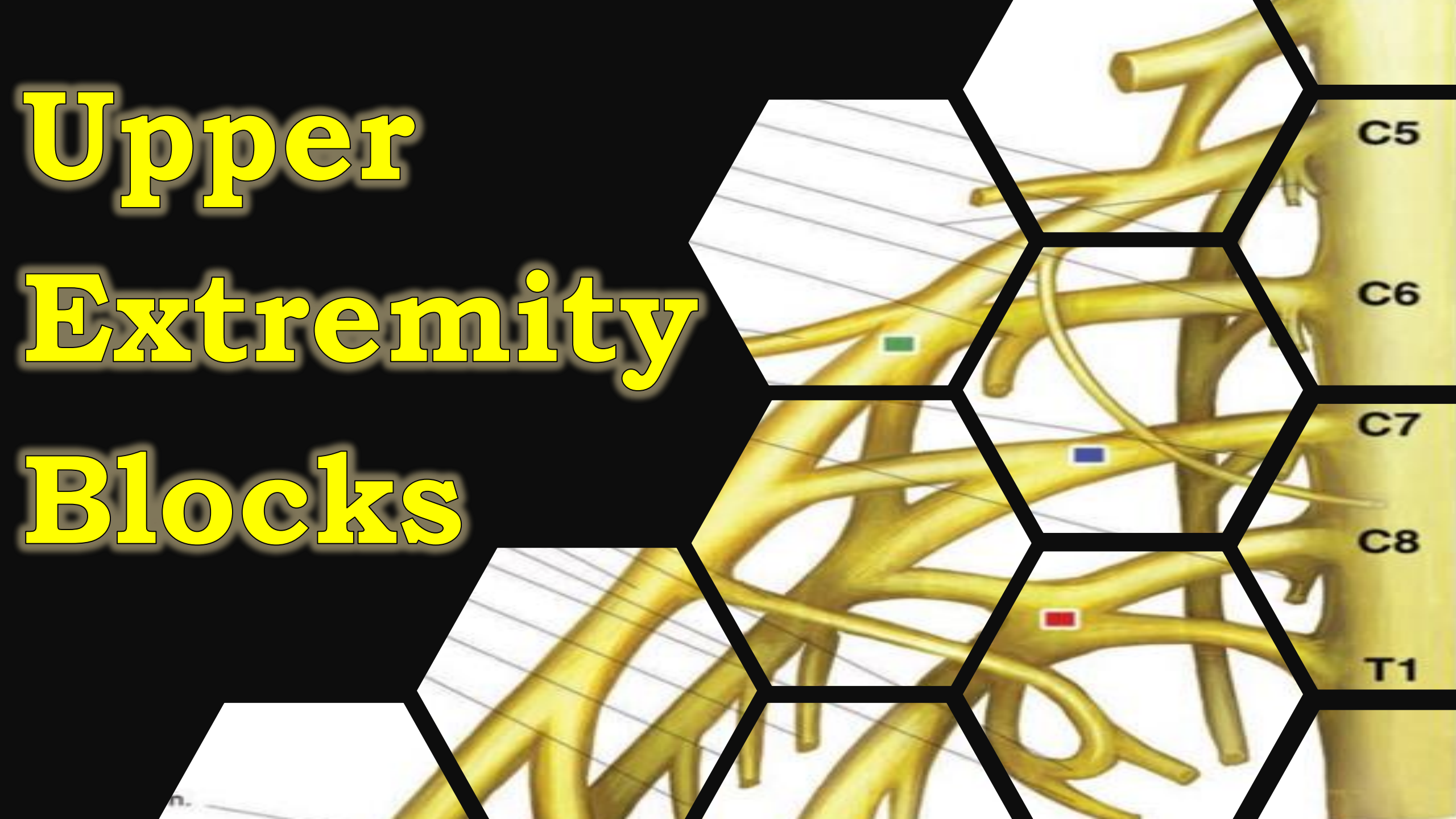
Bilateral deep injection techniques are not recommended (potential respiratory failure and airway obstruction)

Intermediate technique





Upper Extremity Blocks



Supraclavicular

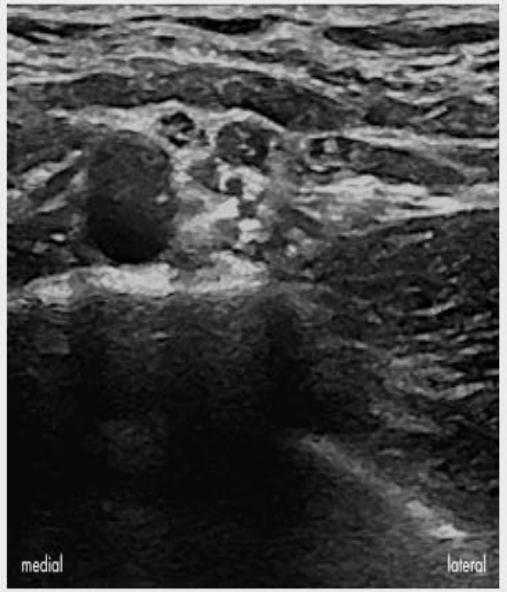
Supraclavicular
humerus, elbow, hand surgery

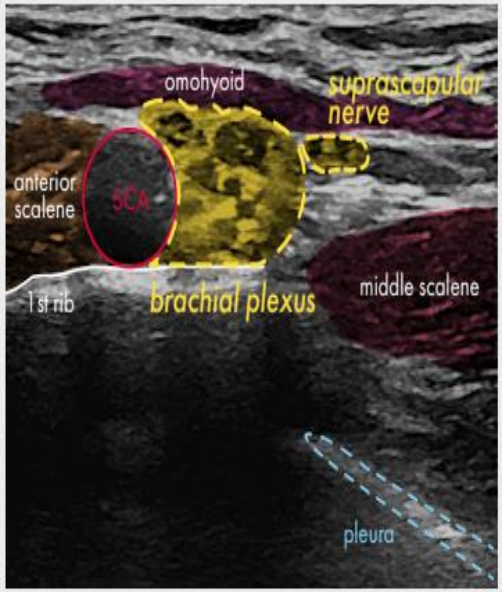
Identify: The subclavian artery lying on the first rib with underlying pleura. The brachial plexus appears as a honeycombed structure lateral and superficial to the artery.

Target: Using an in-plane needle approach from the lateral end of the probe. You may need to make 2-3 injections in the brachial plexus sheath to ensure LA spread to all components including the "corner pocket" between the artery and rib.

Tips: Rotate the lateral end of the probe a little posteriorly to optimise the image; keep the 1st rib in view beyond the needle tip to protect against pneumothorax.

Avoid: Pneumothorax: avoid needle tip penetrating beyond the first rib - it is vital to keep the tip in view throughout.





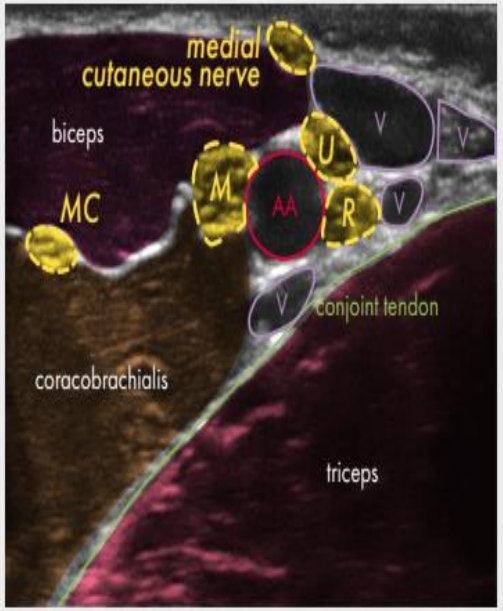
Axillary

Identify: The axillary artery and veins (often multiple). The conjoint tendon of teres major and latissimus dorsi is important: the four target nerves (musculocutaneous, median, ulnar, radial) will lie above that tendon. The medial cutaneous n of the forearm lies between median and ulnar just beneath the deep fascia.

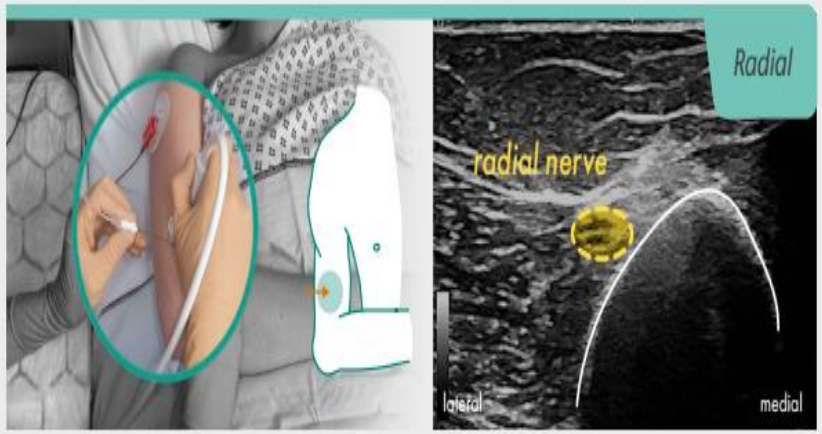
Target: Using an in-plane approach from the lateral end of the probe target each nerve in turn (we block them in order: MC, R, U, M to preserve the ultrasound view).

Tips: Scan distally to confirm each nerve identity (median n stays with brachial artery, ulnar n moves medially and superficially to the cubital tunnel, radial n dives deep towards the medial border of humerus with the profunda brachii artery); a nerve stimulator can be used to confirm nerve identity; expect variation in the position of nerves.

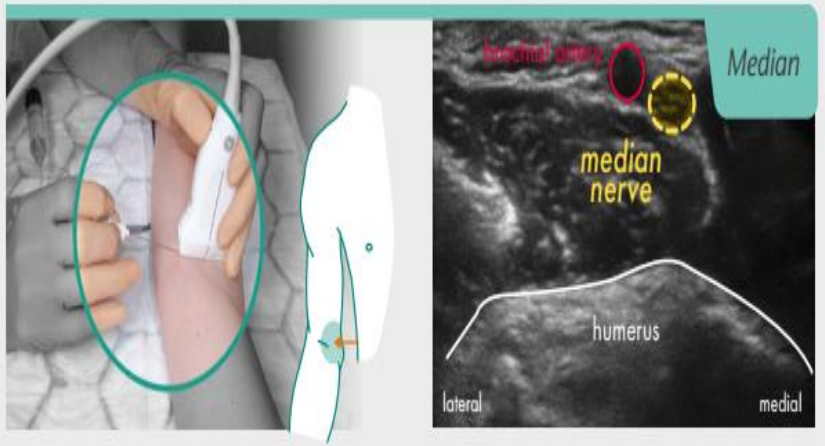
Avoid: Intravascular injection (multiple vessels) - watch the ultrasound for injectate spread with each injection; avoid intrafascicular nerve trauma.



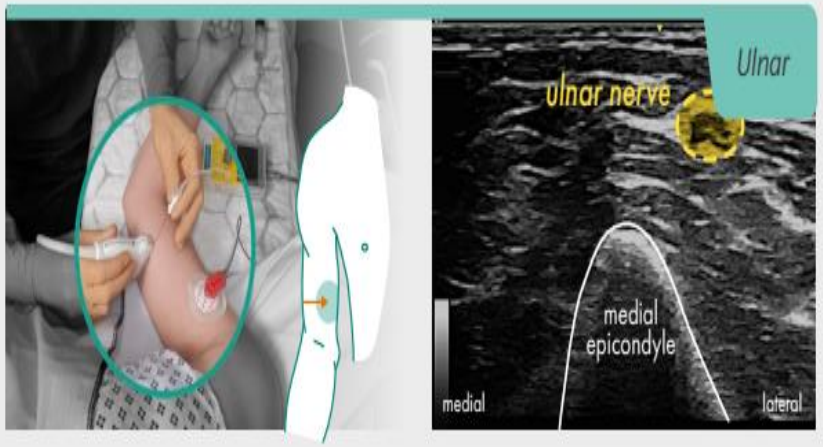
Peripheral Nerves



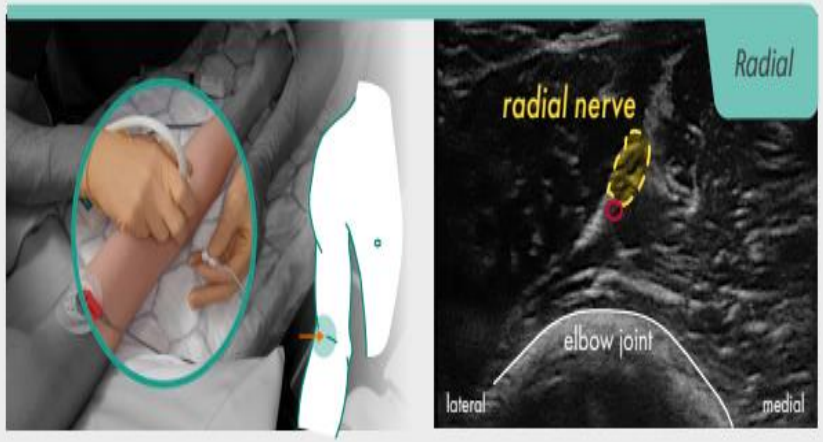
Proximal: Flex the elbow, place the probe over the lower 1/3 of the humerus in an axial plane, look for the rounded appearance of the nerve looping around the distal humerus.



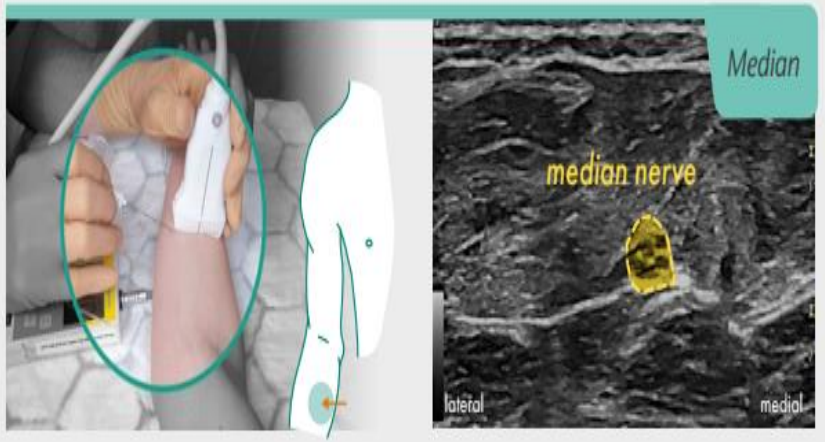
Proximal: Extend the elbow, the nerve lies medial to the brachial artery just above the elbow skin crease.



Proximal: On the medial side of the distal humerus, above the medial epicondyle, locate the nerve before the nerve enters the cubital tunnel. Do not block the nerve in the tunnel itself.



Distal: Extend the elbow, place the probe over the lateral half of the elbow crease. The radial nerve here has a characteristic spindle shape (2 components + artery).



Distal: At the mid-forearm level the nerve is a hyperechoic, honeycombed structure at the centre of 3 fascial planes. There may be an accompanying artery which should be avoided.

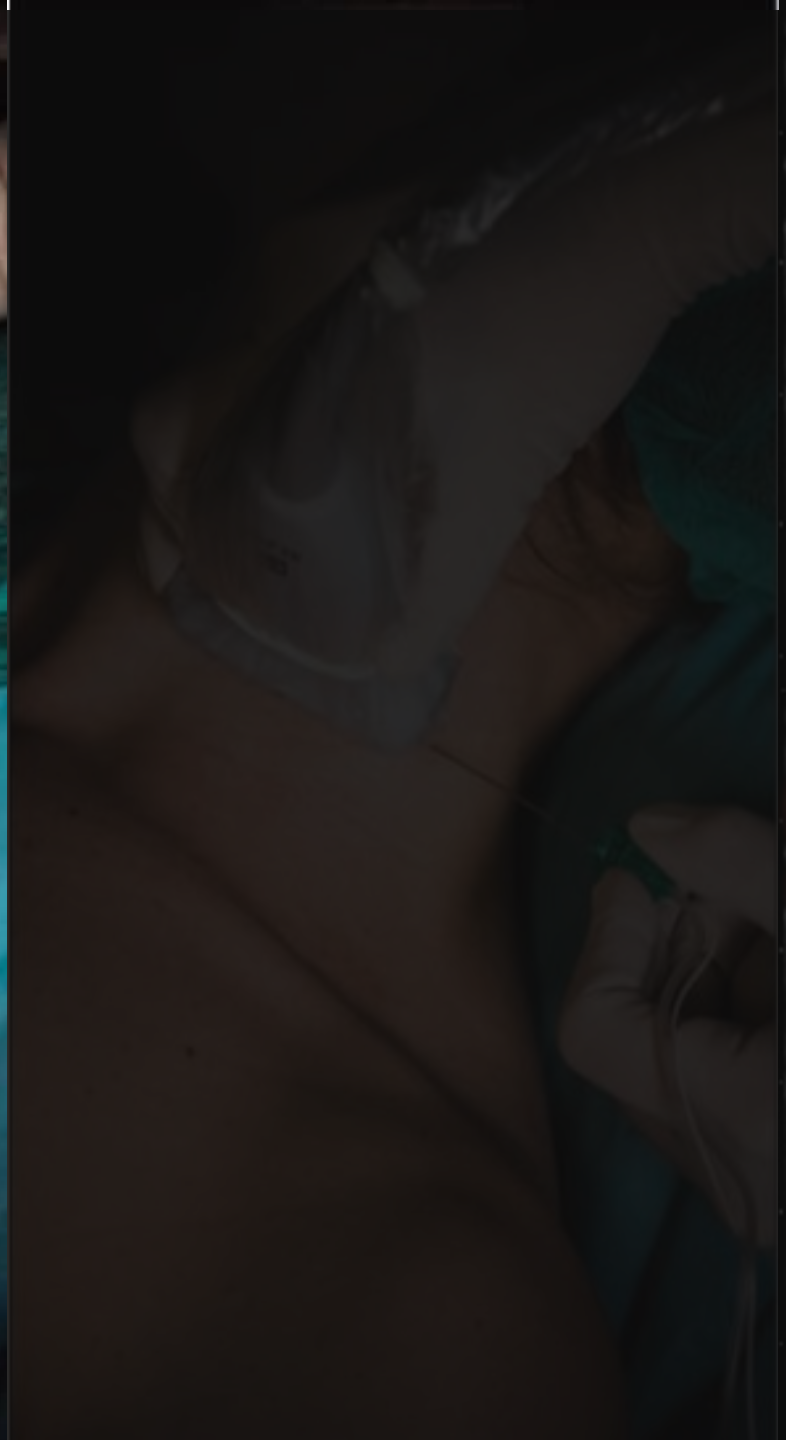
Distal: Nerve lies on the medial side of the ulnar artery. Starting at the wrist, scan proximally until they separate.

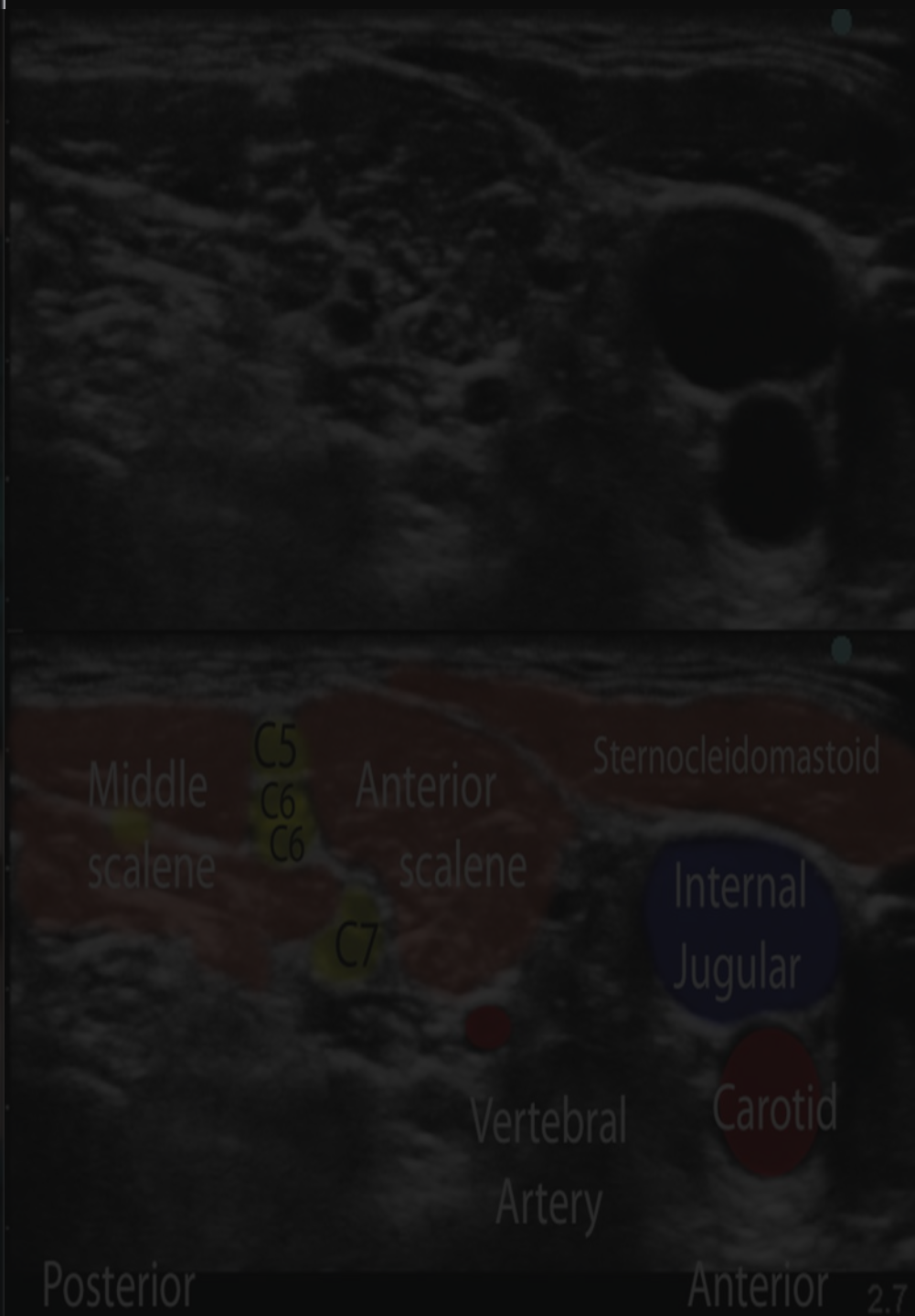
The Interscalene brachial plexus block

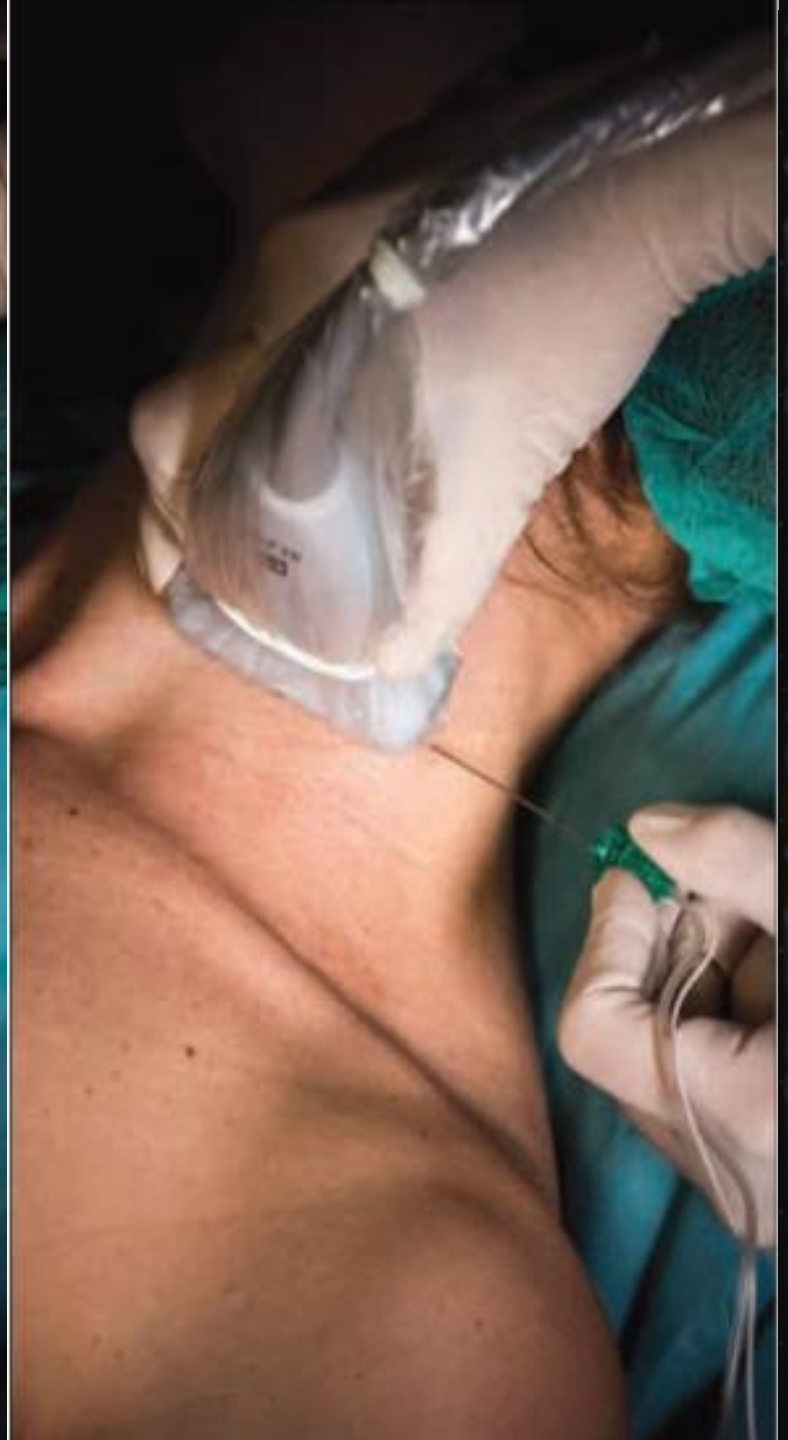
- **Indications:** Anesthesia and analgesia for shoulder, upper arm and clavicle surgery
- Goal: LA spread around the superior and middle trunks of the brachial plexus, between the anterior and middle scalene muscles
- **Probe**: High-frequency linear probe
- **Local anesthetic** : Usually 10 to 30 mL
- US-guidance has improved the block's success and reduced the volume of LA
- The most common adverse effect of the interscalene block:

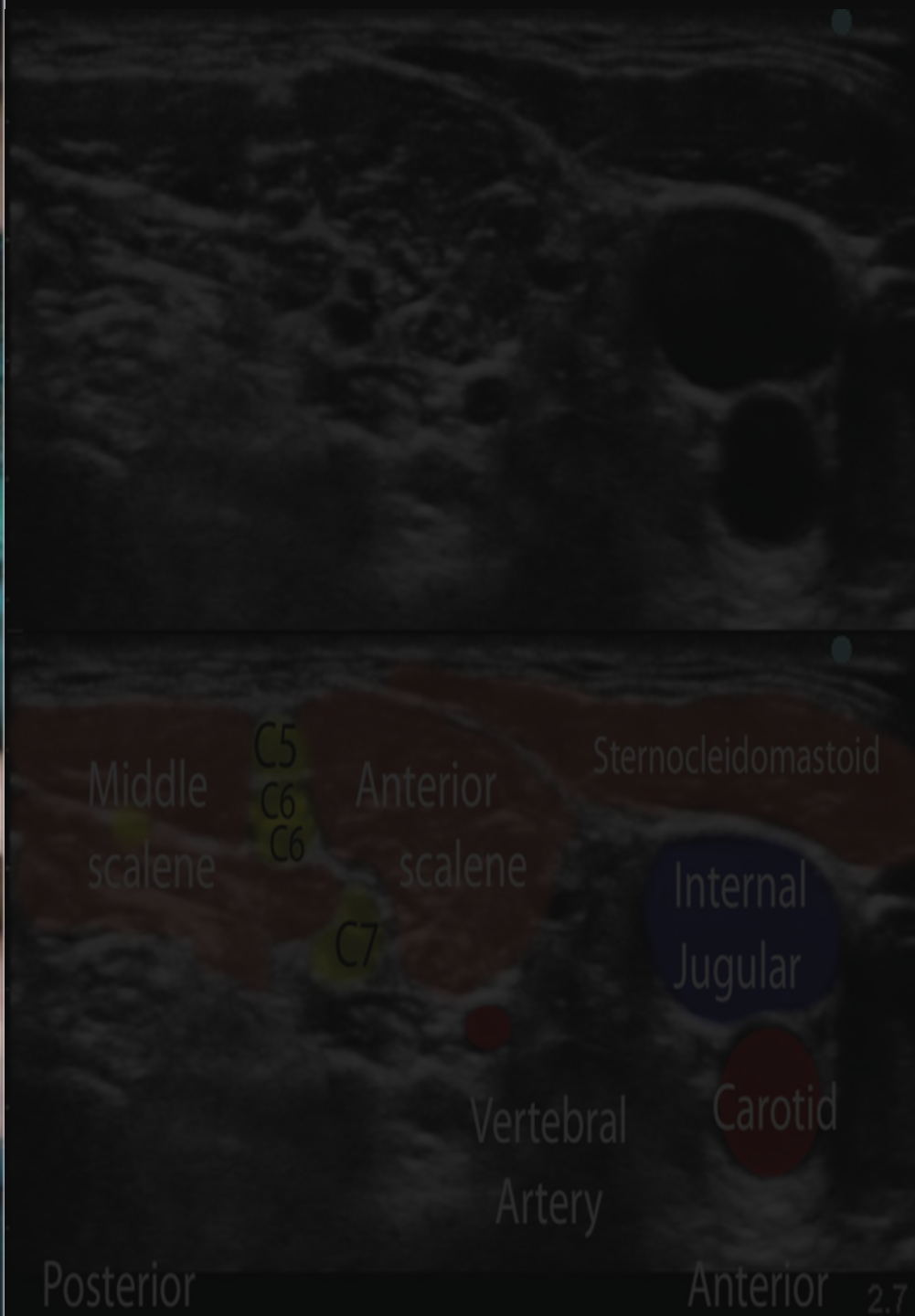
  Ipsilateral phrenic nerve block with consequent hemi-diaphragmatic palsy

  (Should be used with caution in patients with respiratory insufficiency)

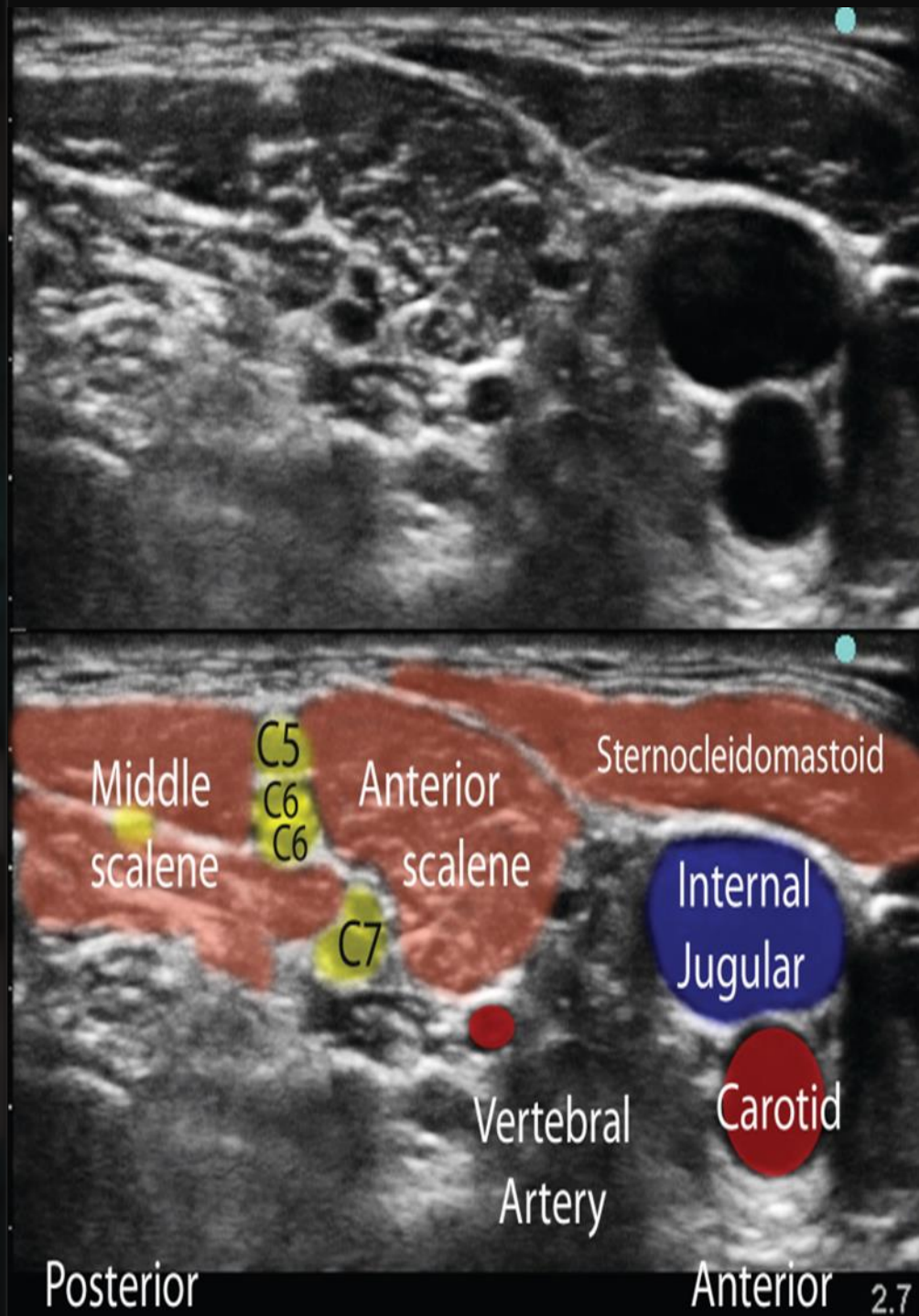



C5
C6
C6
Middle scalene
Anterior scalene
Sternocleidomastoid
Internal Jugular
C7
Vertebral Artery
Carotid
Posterior
Anterior
2.7



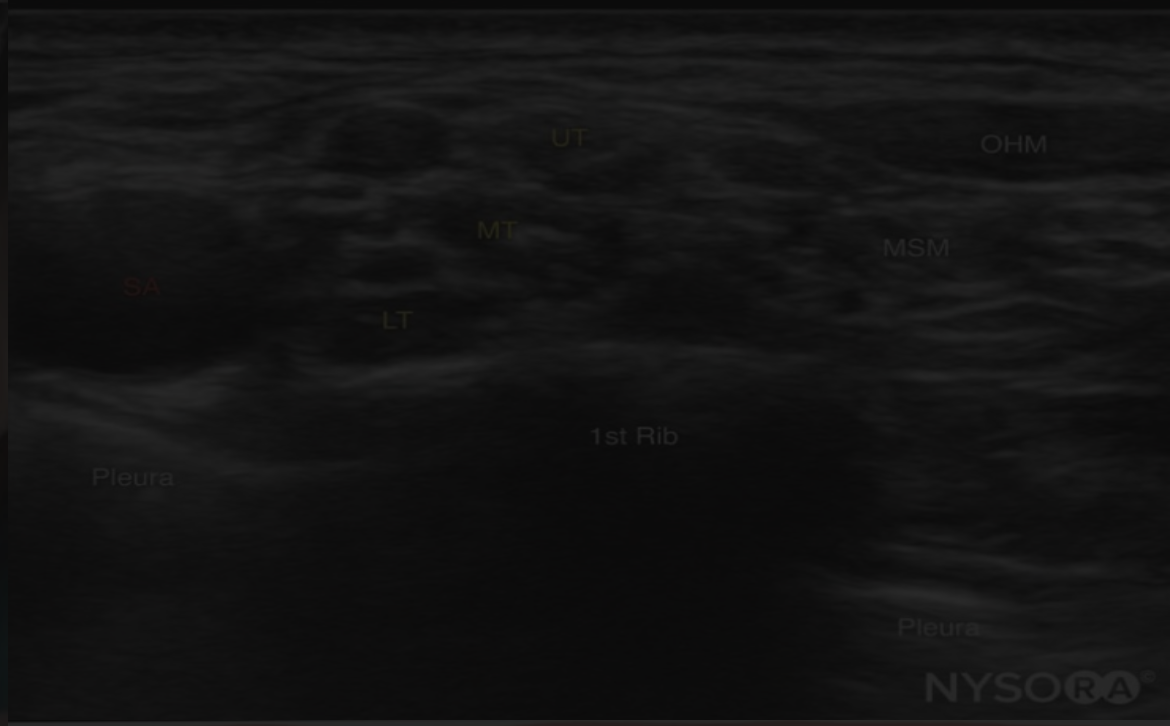

C5
C6
C6
Middle scalene
Anterior scalene
Sternocleidomastoid
Internal Jugular
C7
Vertebral Artery
Carotid
Posterior
Anterior
2.7

Stoplight Sign

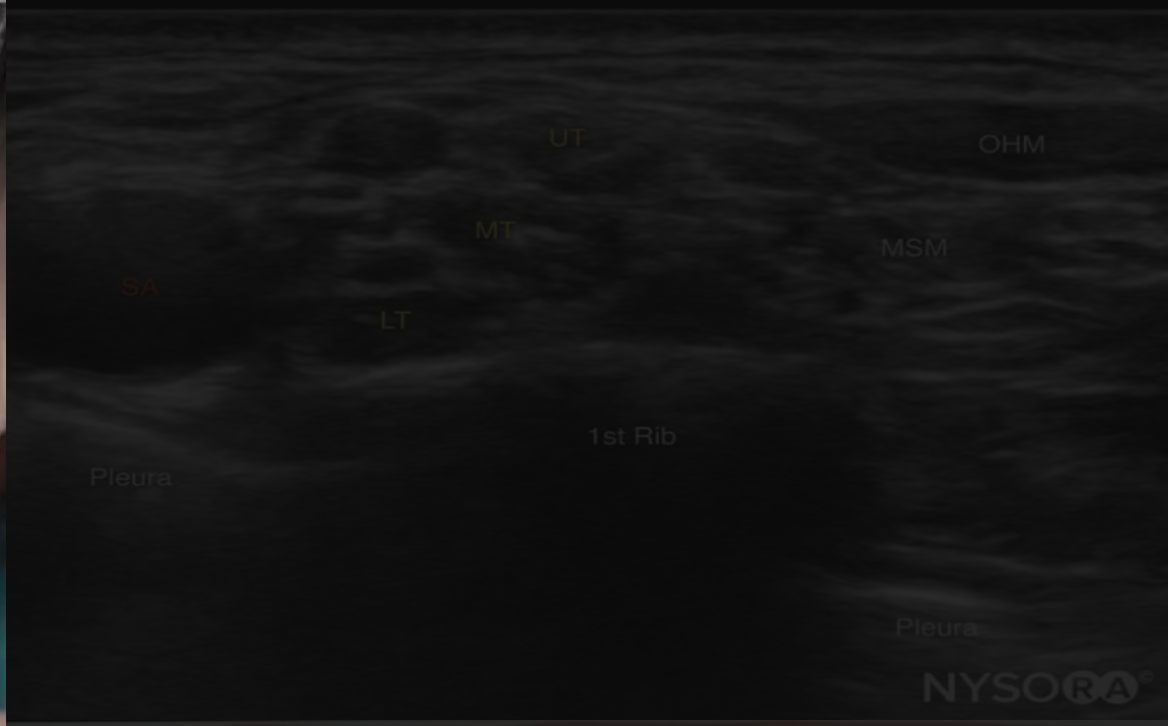


The Supraclavicular brachial plexus block

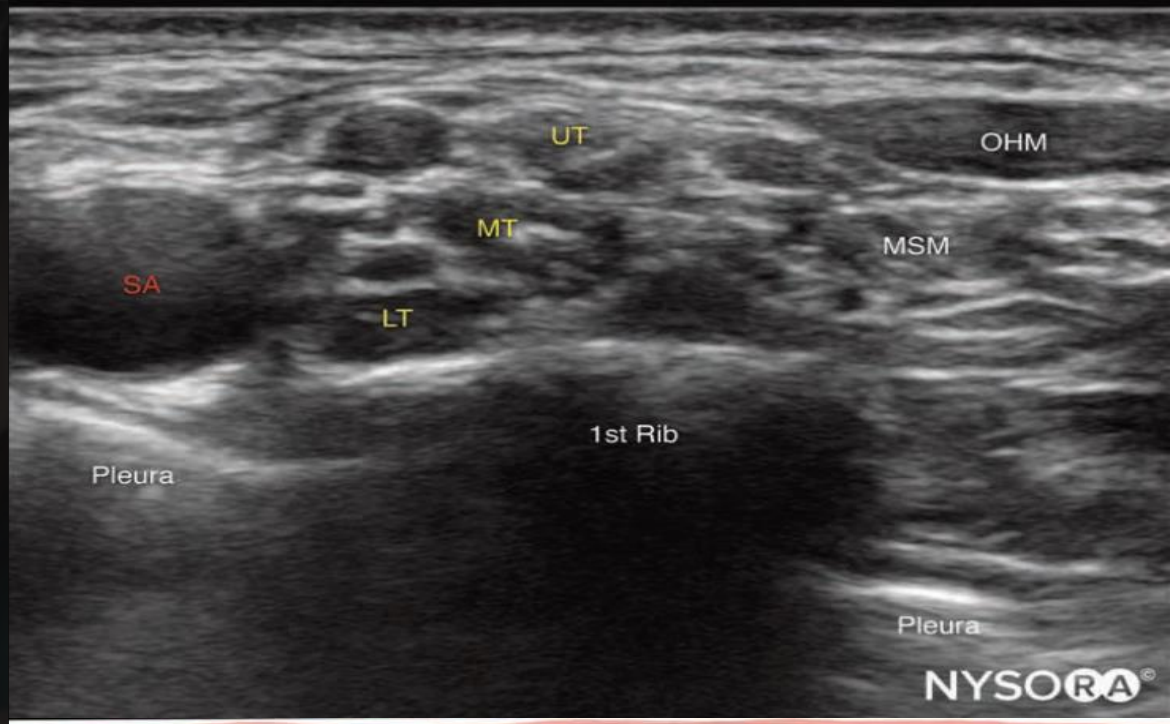
- **Indications:** Anesthesia and analgesia for procedures distal to the shoulder: arm, elbow, forearm, and hand surgery
- **Goal:** Injection of the LA around the trunks and divisions
- **Probe:** High-frequency linear probe
- **Local anesthetic choice:** 15 to 30 mL
- Pneumothorax is an uncommon but potentially life-threatening complication
- US guidance can visualize the plexus and avoid the vascular structures and the pleura

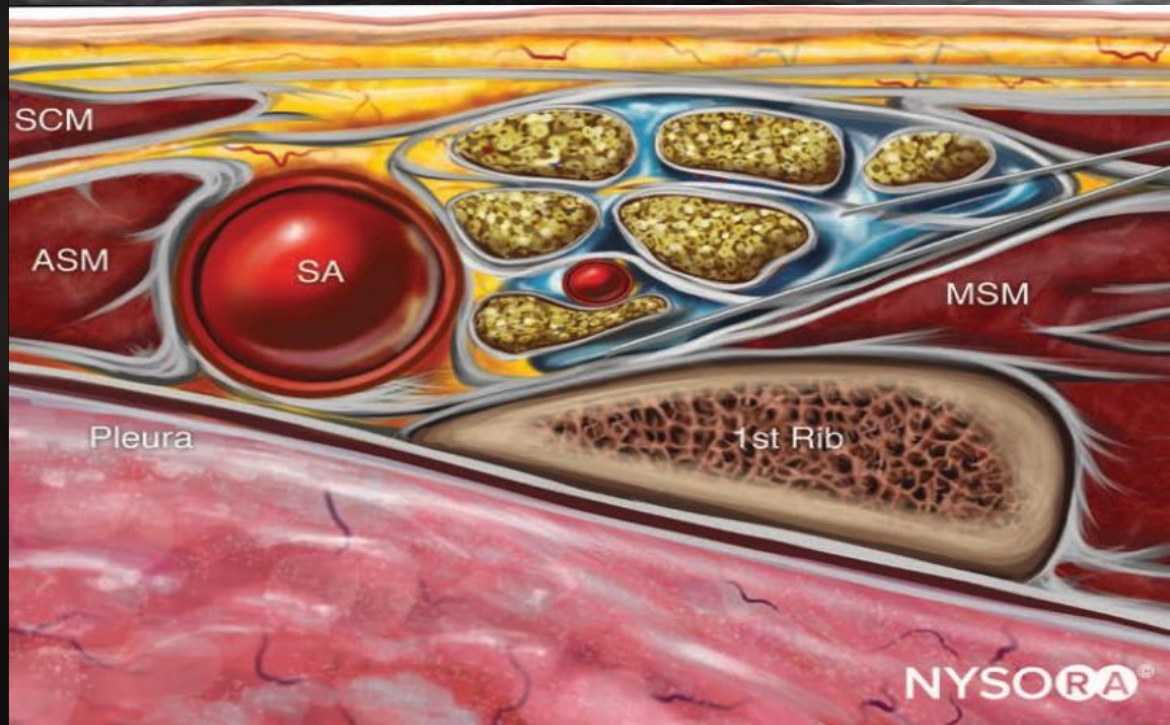

UT
OHM
MT
MSM
SA
LT
1st Rib
Pleura
Pleura
NYSORA


SCM
ASM
SA
MSM
Pleura
1st Rib
NYSORA


UT
OHM
MT
MSM
SA
LT
1st Rib
Pleura
Pleura
NYSORA


SCM
ASM
SA
MSM
Pleura
1st Rib
NYSORA


UT
OHM
MT
MSM
SA
LT
1st Rib
Pleura
Pleura
NYSORA


SCM
ASM
SA
MSM
Pleura
1st Rib
NYSORA

Suprascapular Nerve Blocks

- A alternative to interscalene block for analgesia of the shoulder region

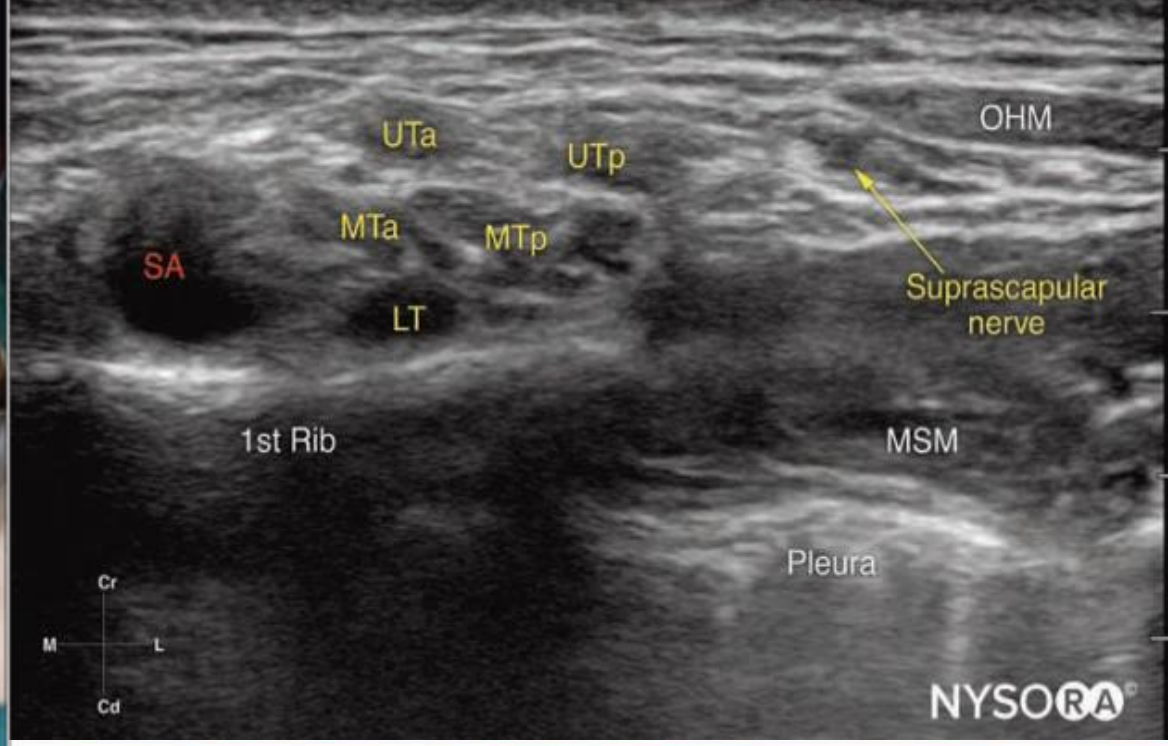
- The advantage of this approach:
  1. Chance of phrenic nerve block is reduced.
  2. Other nerves of shoulder joint (axillary nerve, lateral pectoral nerve) also can be blocked.

- The anterior approach to SSN block is more shallow than the more traditional block at the suprascapular notch (20-40 mm depth).

- The SSN (mixed-motor and sensory nerve originates from the superior trunk (C5 and C6 nerve roots and often C4)

Anterior Suprascapular Nerve Block

- The preferred lung-sparing block alternative to interscalene nerve block
- The anterior SSN block is performed in the supine position or Alternatively in a seated position
- **Probe:** A high-frequency linear transducer
- **Local anesthetic:** approximately 5 to 10 ml deep into omohyoid muscle


UTa
UTp
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SA
Suprascapular nerve
LT
1st Rib
MSM
Pleura
Cr
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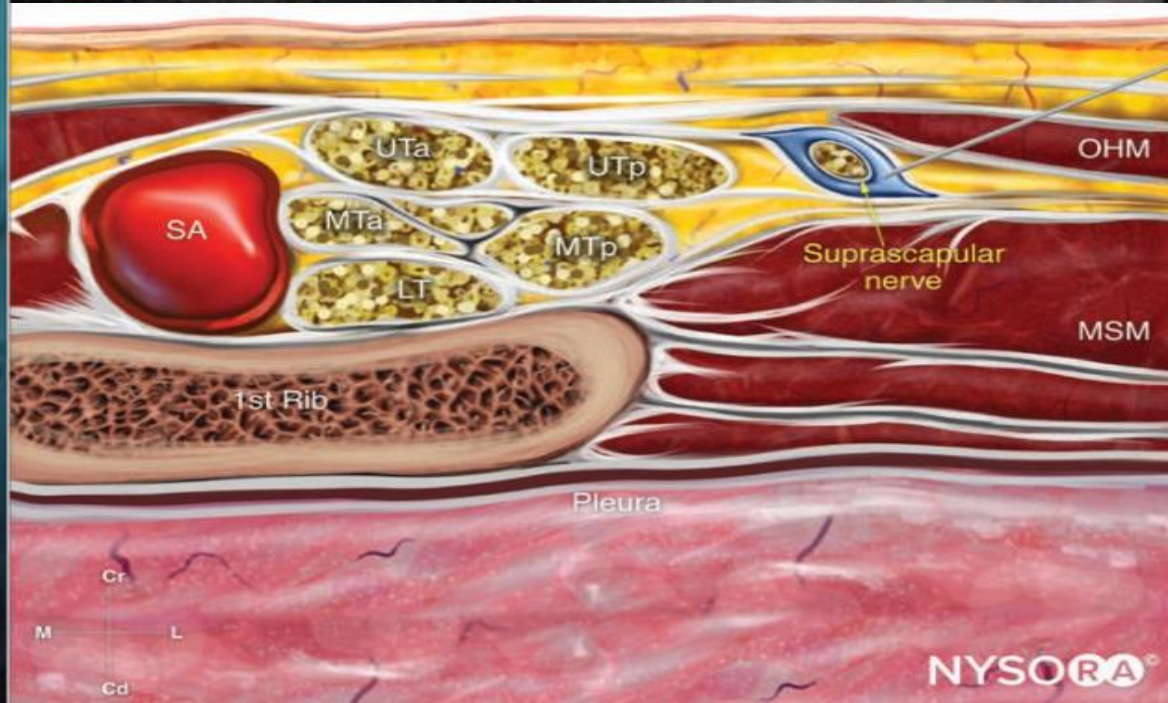
L
Cd
NYSORA


UTa
UTp
OHM
SA
MTa
MTp
Suprascapular nerve
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1st Rib
Pleura
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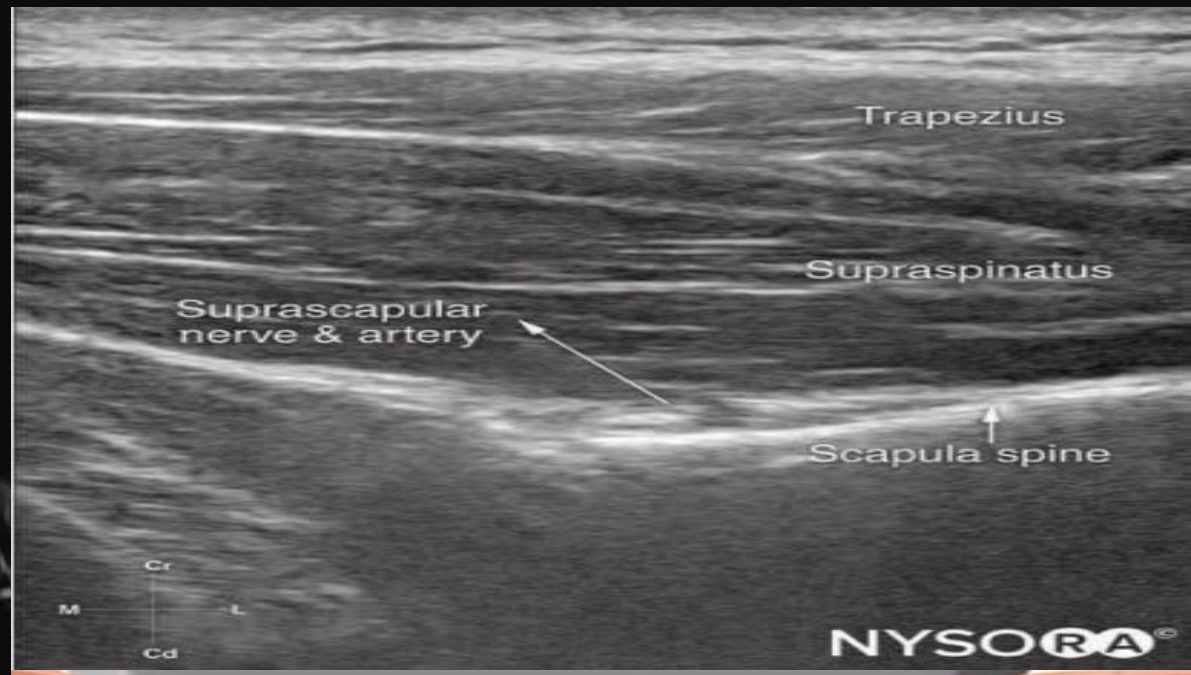
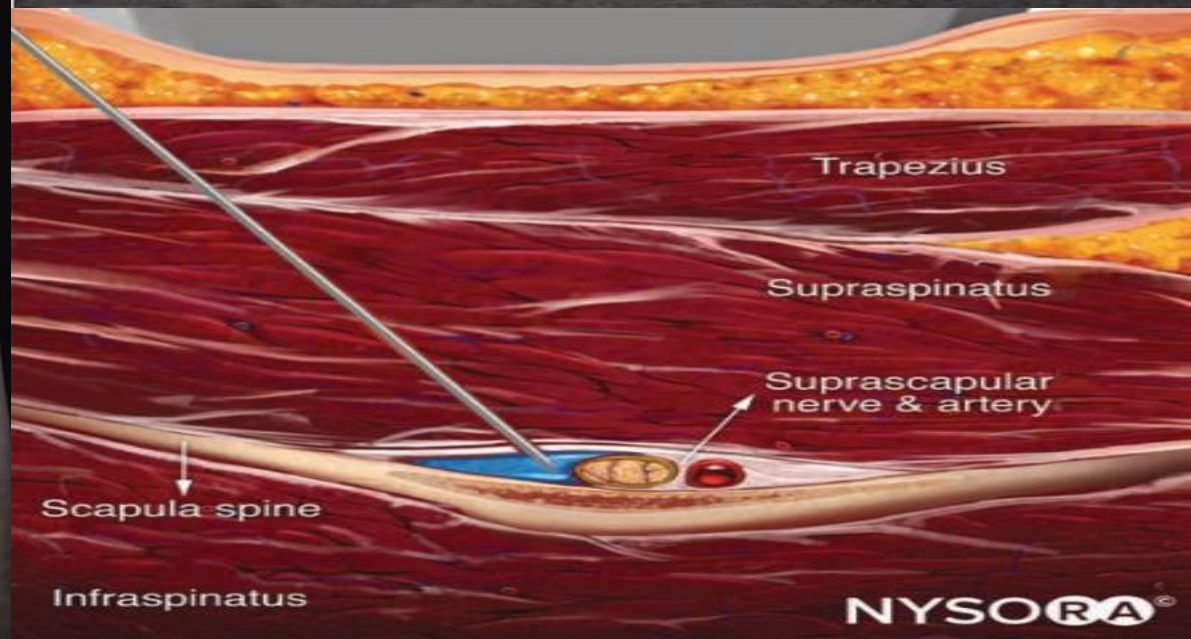
NYSORA

Posterior Approach in the Supraspinous Fossa





Shoulder Block (Suprascapular Nerve Plus Axillary Nerve Block)

Indications: Analgesia of the shoulder in patients with respiratory compromise or where an interscalene block is contraindicated

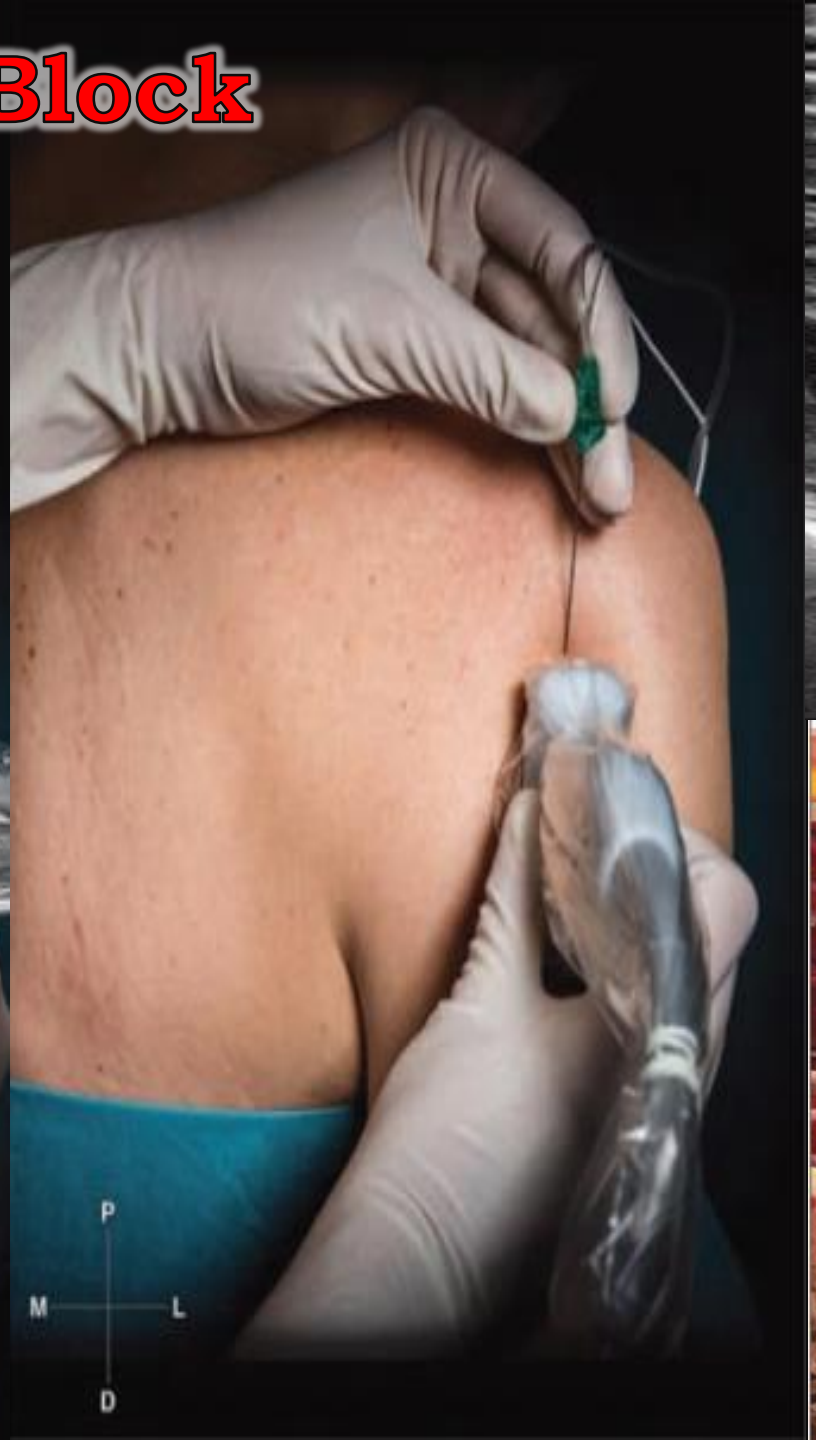
Goal: LA injection for the suprascapular and axillary nerves

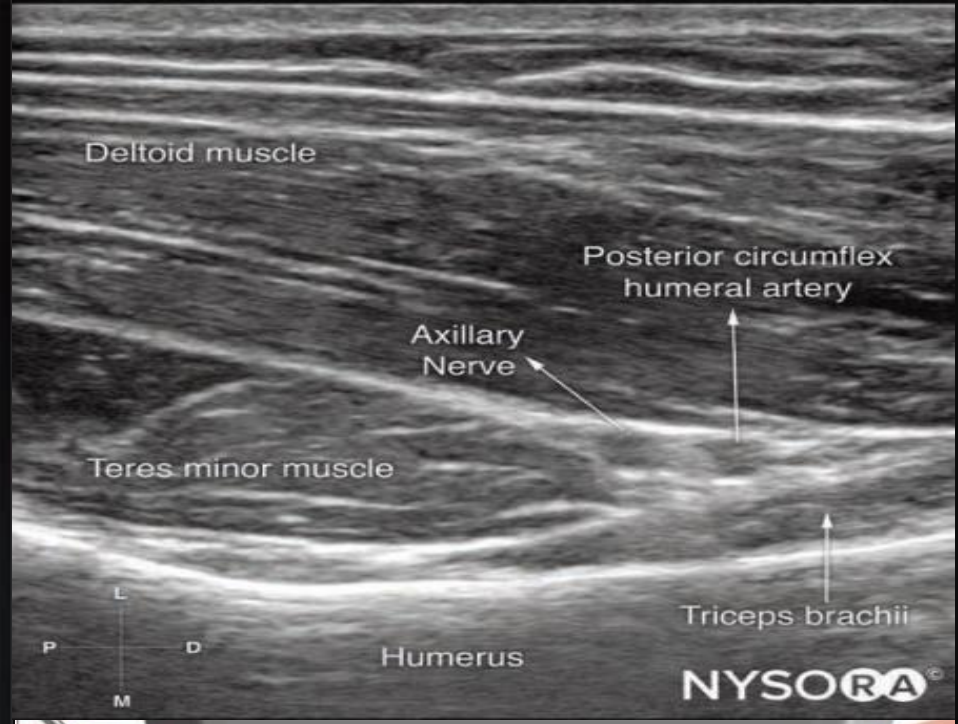
Local anesthetic volume: 5 to 10 mL per injection site

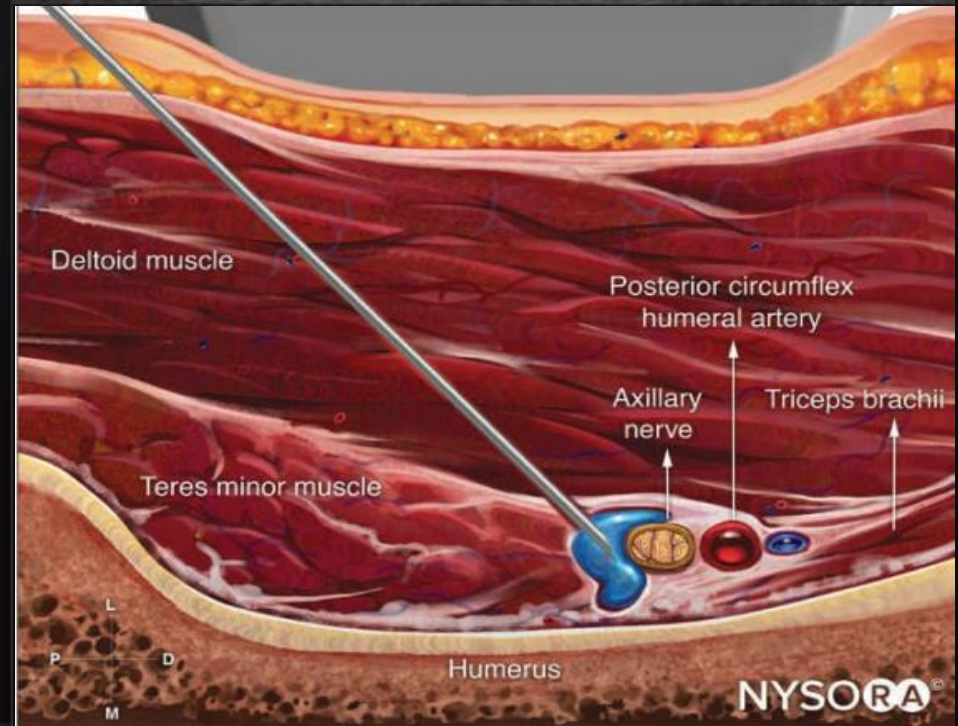
Suprascapular nerve block: motor block of the supraspinatus and infraspinatus muscles, and a sensory block of the posterior aspect of the shoulder.

Axillary nerve block: motor block of the deltoid muscle (abduction of the shoulder), teres minor, long head of the triceps, and a sensory block of the anterior shoulder joint and the skin over the deltoid muscle

Axillary Nerve Block

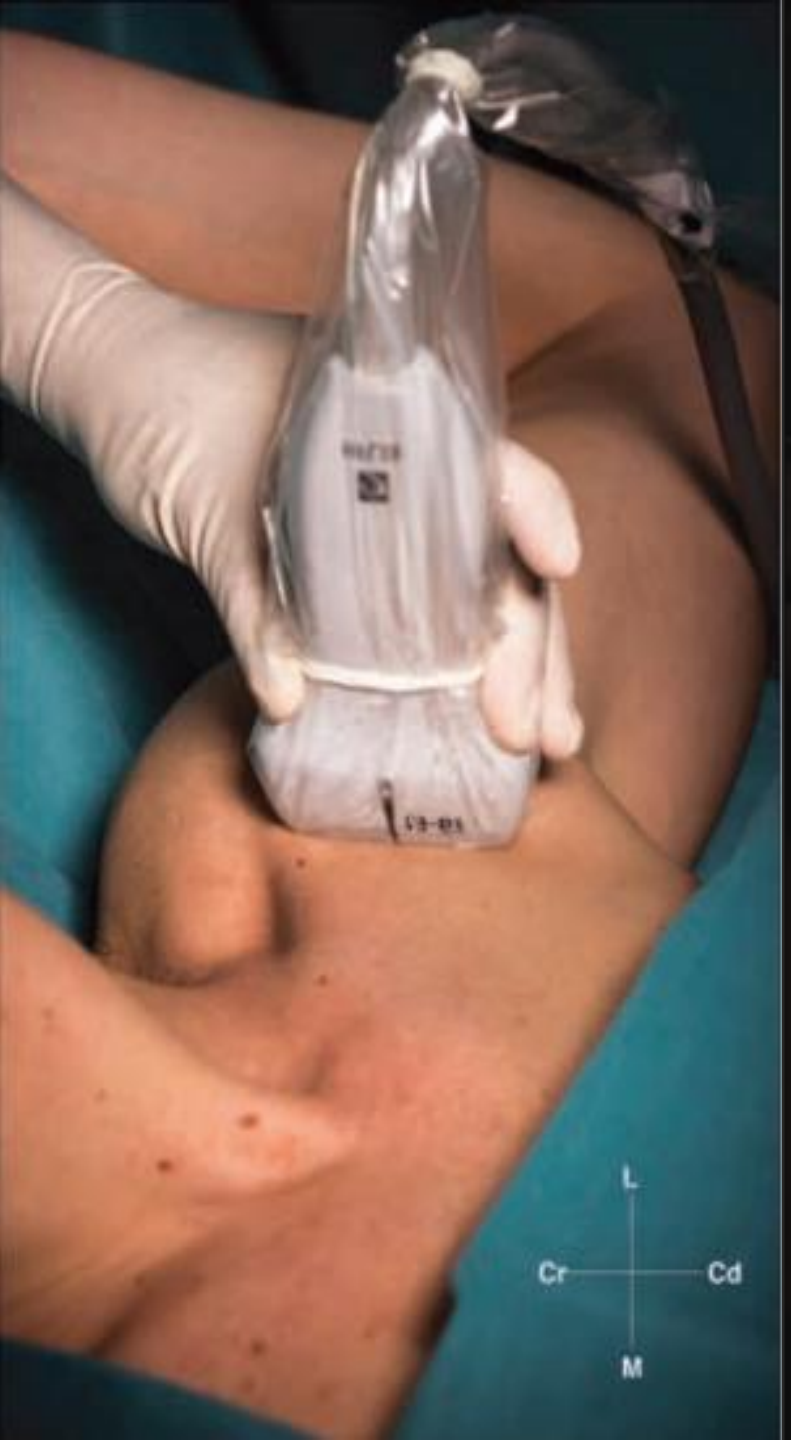


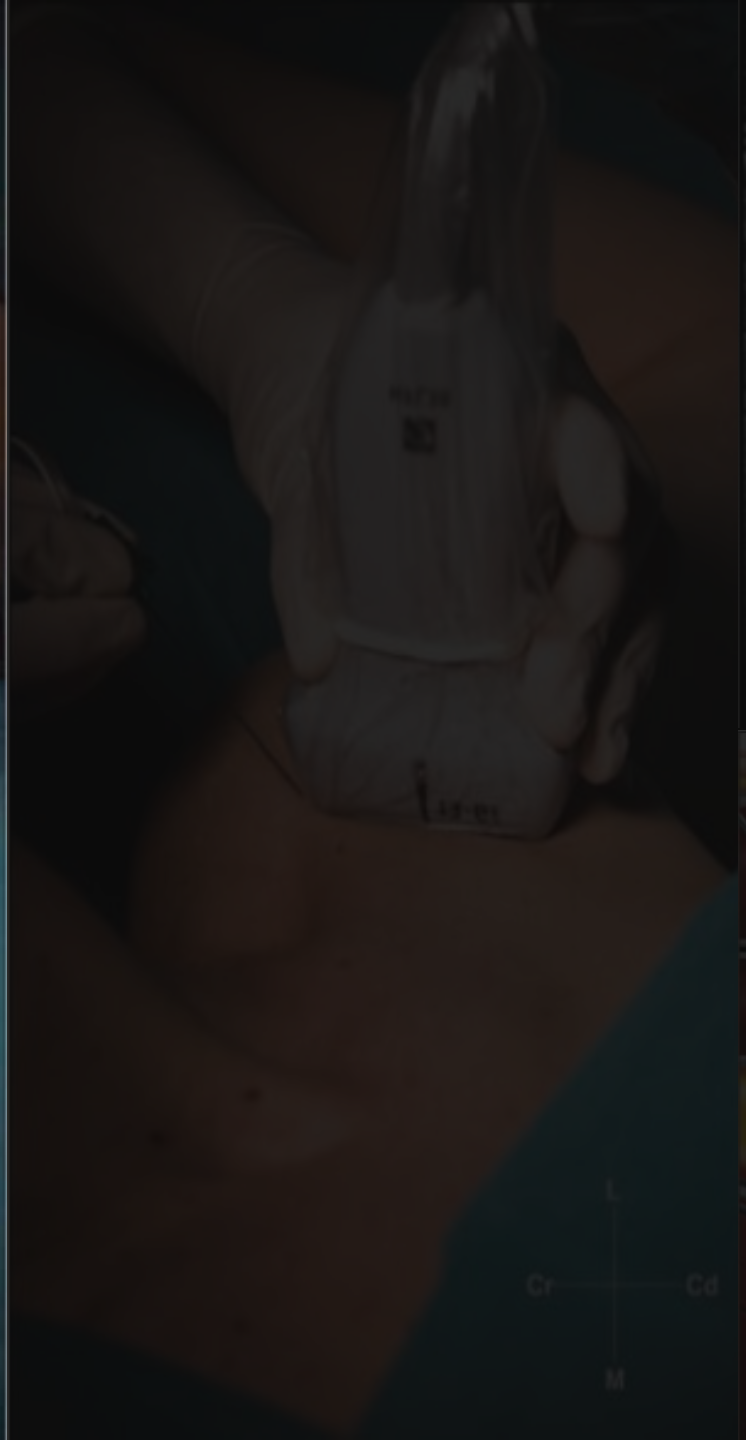




Infraclavicular brachial plexus block

- **Indications:** Surgery on the arm, elbow, forearm, and hand
- **Goal:** LA spread around the axillary artery next to the medial, posterior, and lateral cords of the brachial plexus
- Complete brachial plexus anesthesia
- The disadvantages: infraclavicular block is a deeper block
- Without respiratory symptoms according to phrenic nerve palsy
- Abduction of the arm is not absolutely necessary (suitable for patients with painful fractures or requiring arm immobilization)
- Suitable for catheter placement (musculature of the chest wall)
- Risk of Pneumothorax


L
Cr
Cd
M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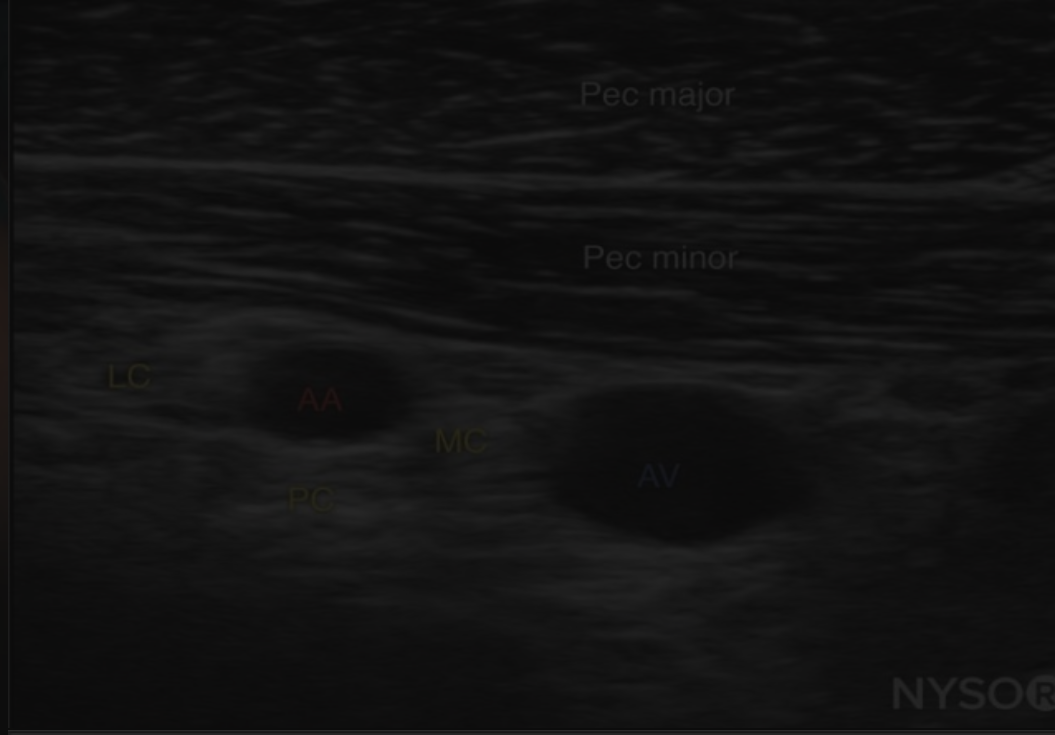
Pec major
Pec minor
LC
AA
MC
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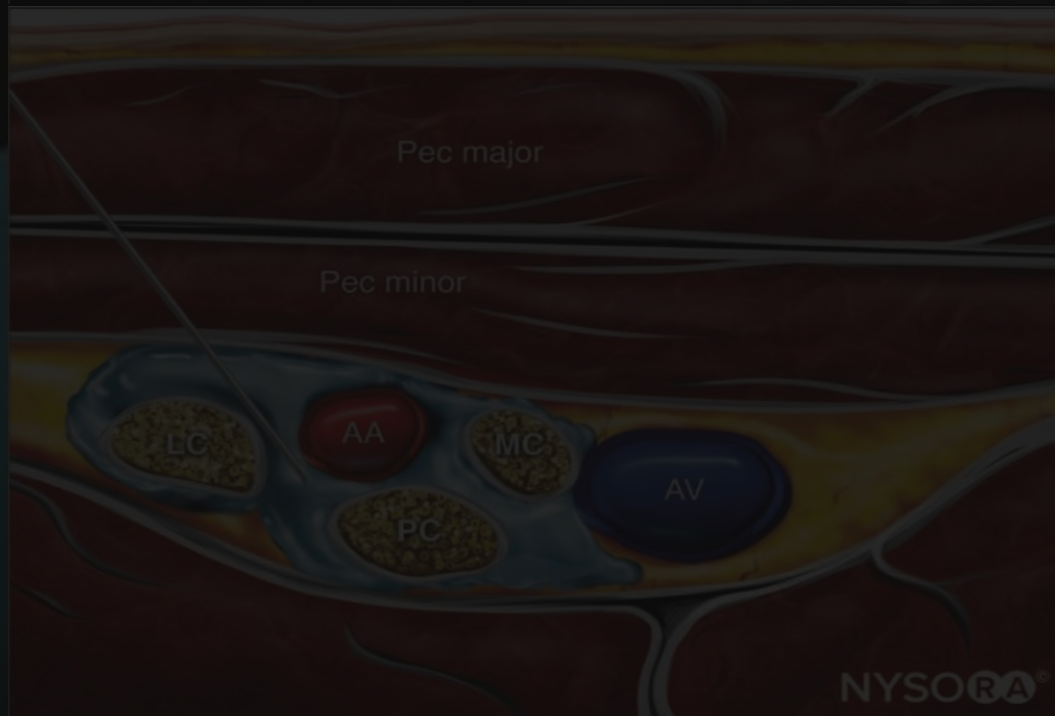
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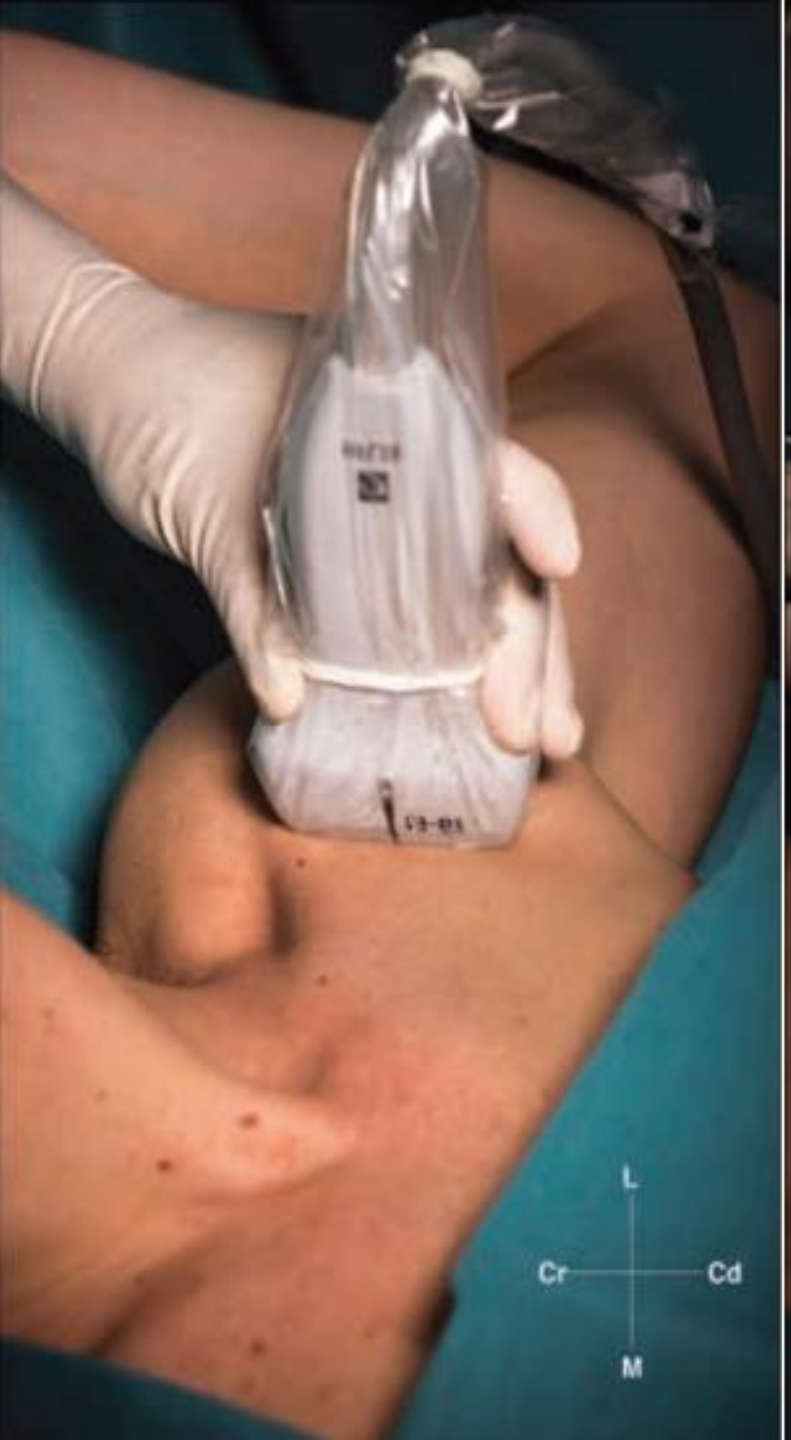
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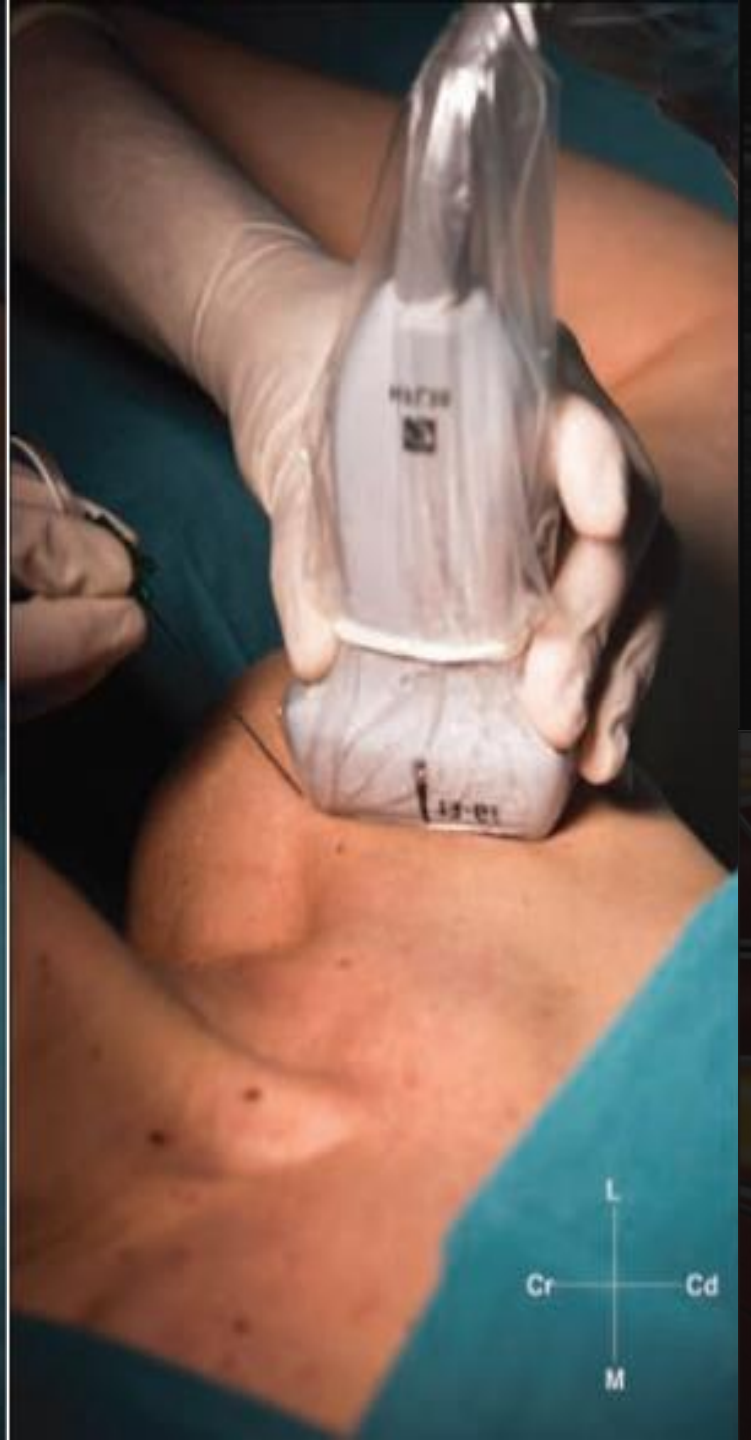
L
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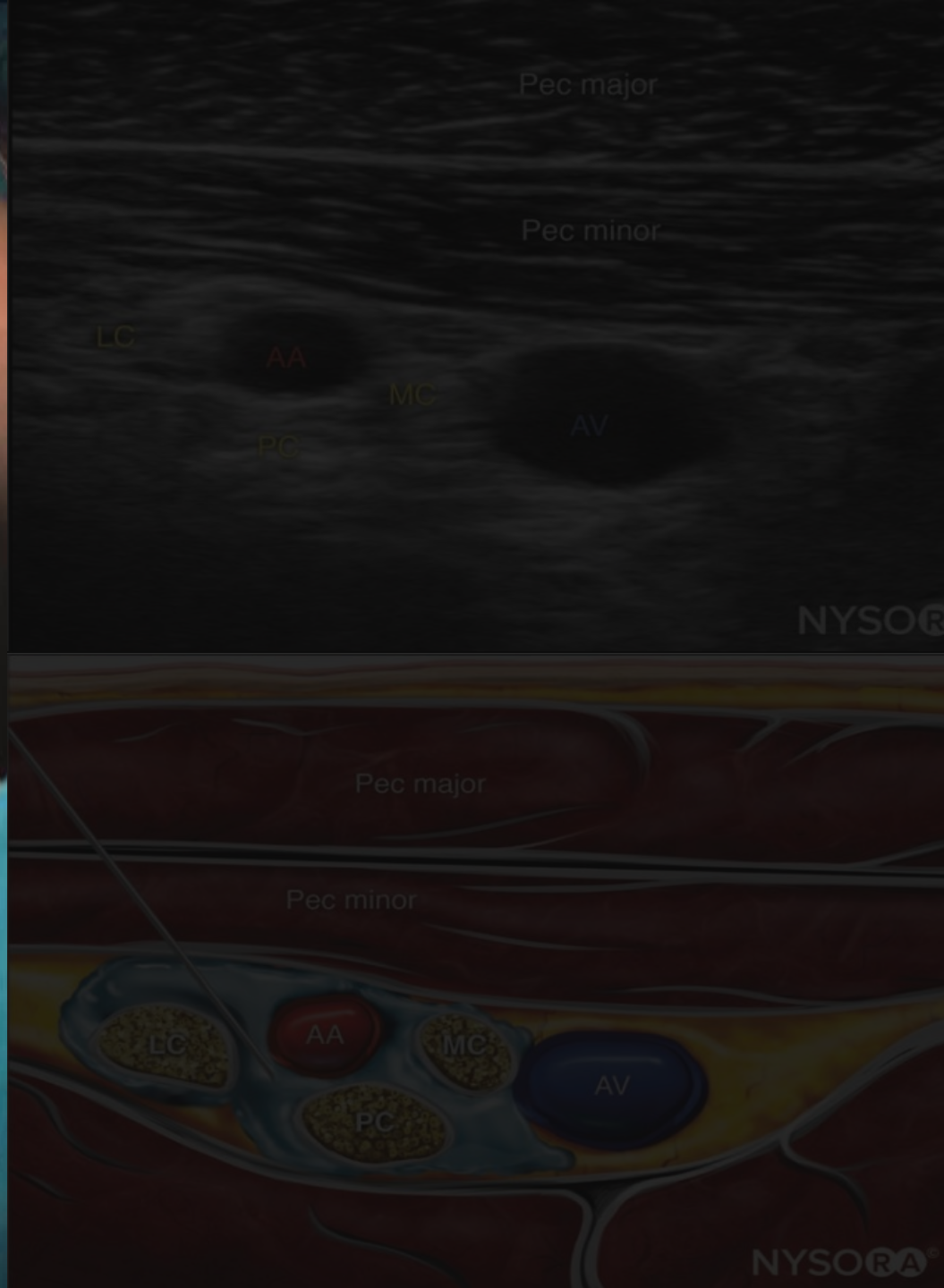
Pec major
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AV
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NYSORA
Pec major
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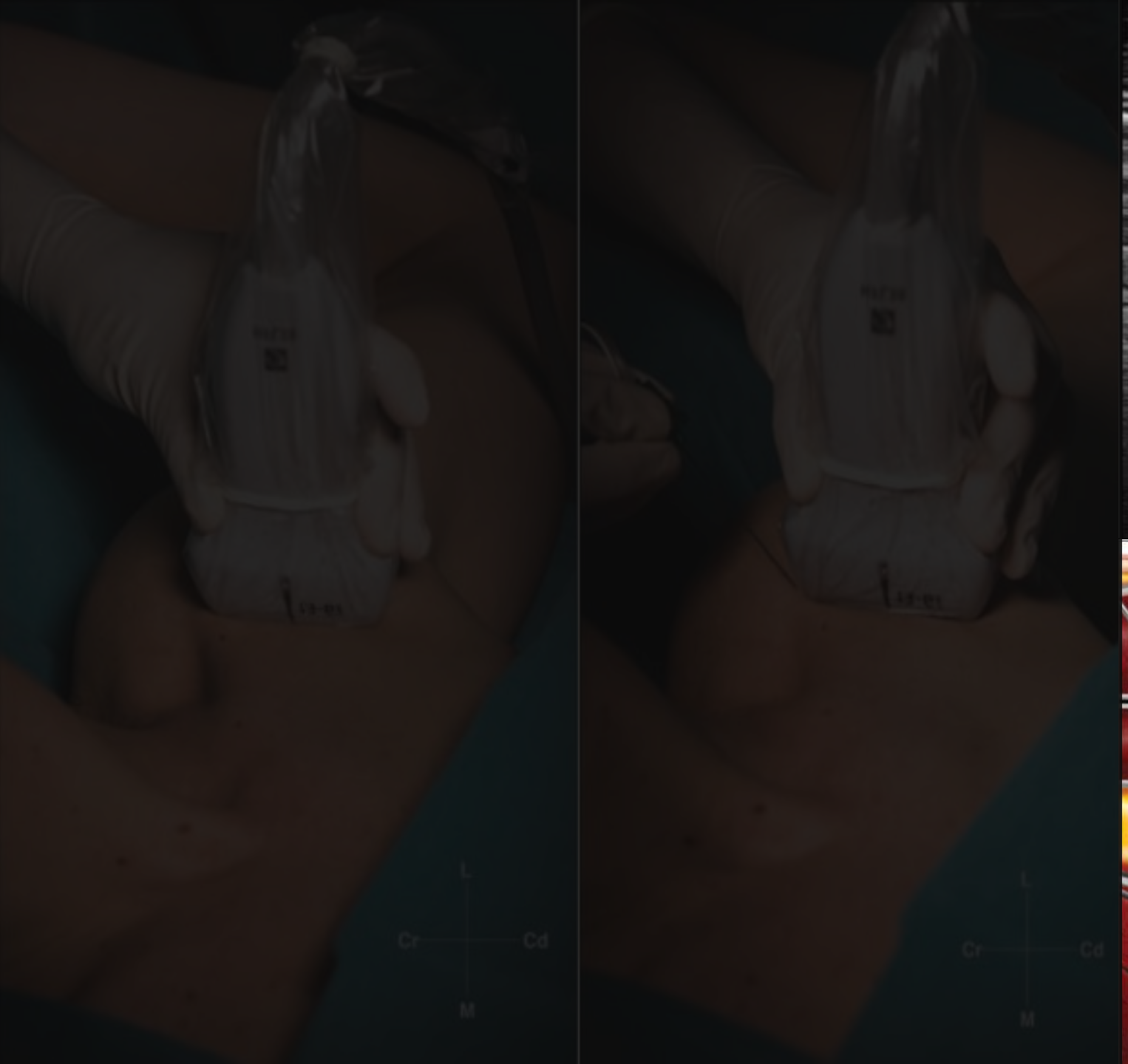
NYSORA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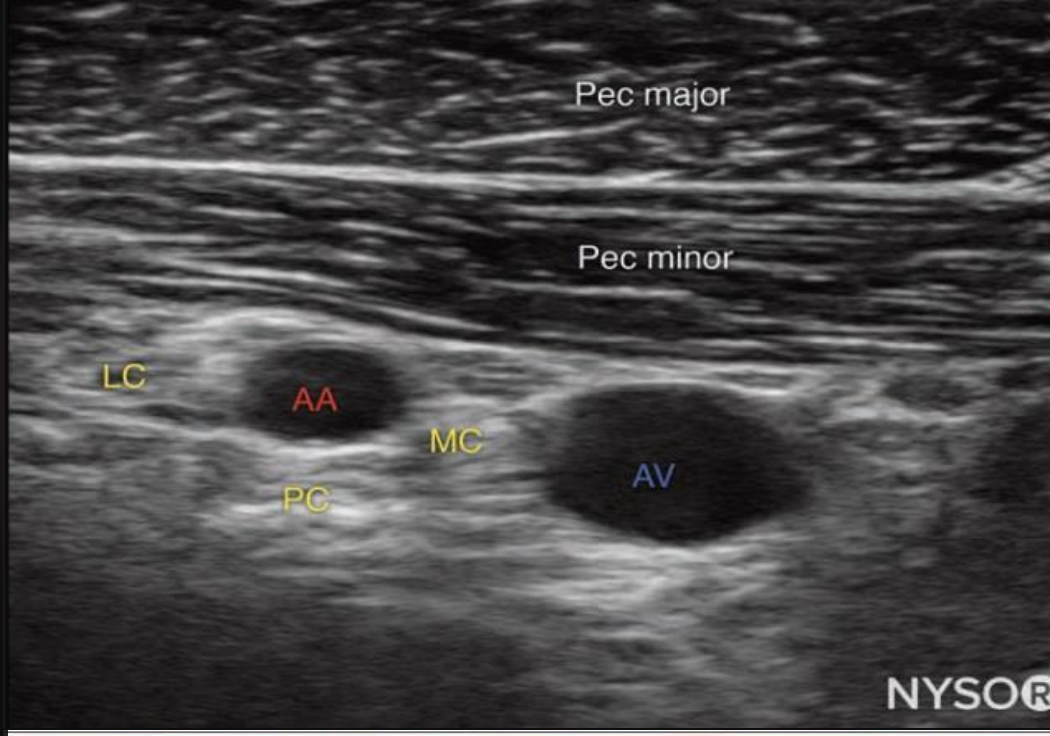
Pec major
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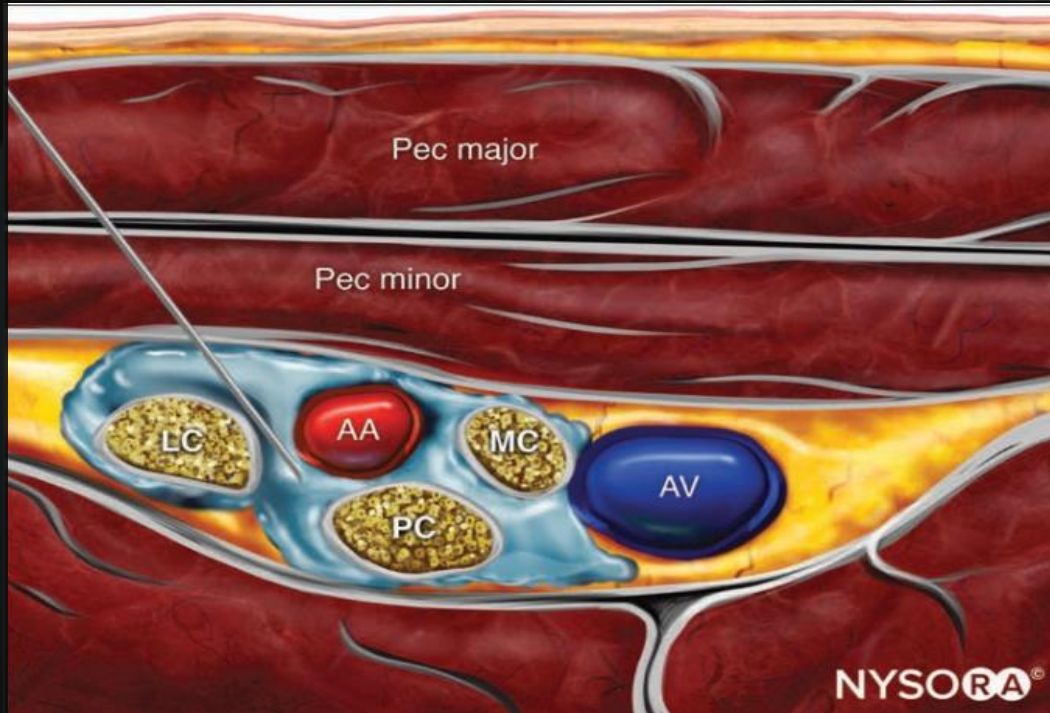
Pec major
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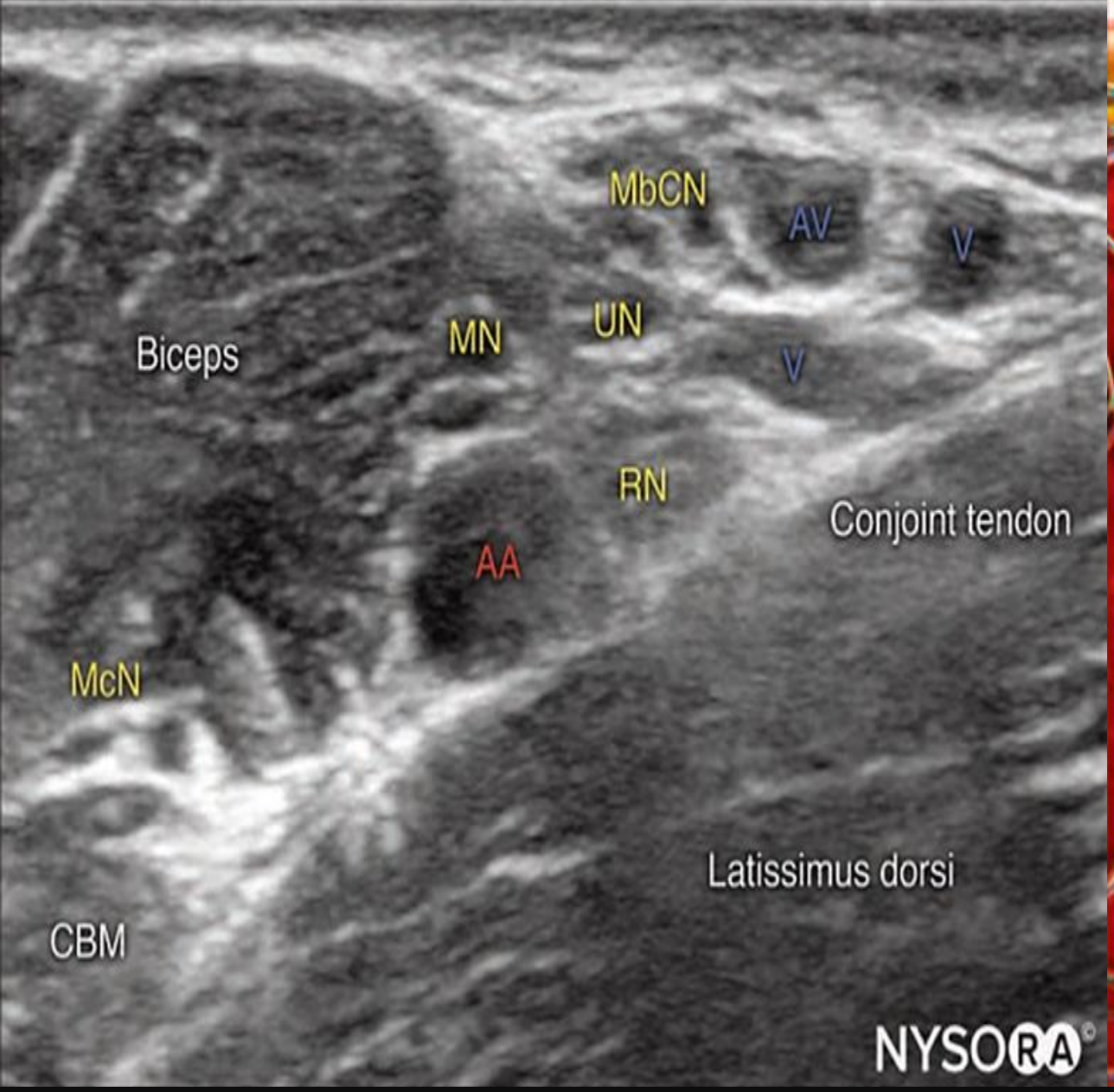
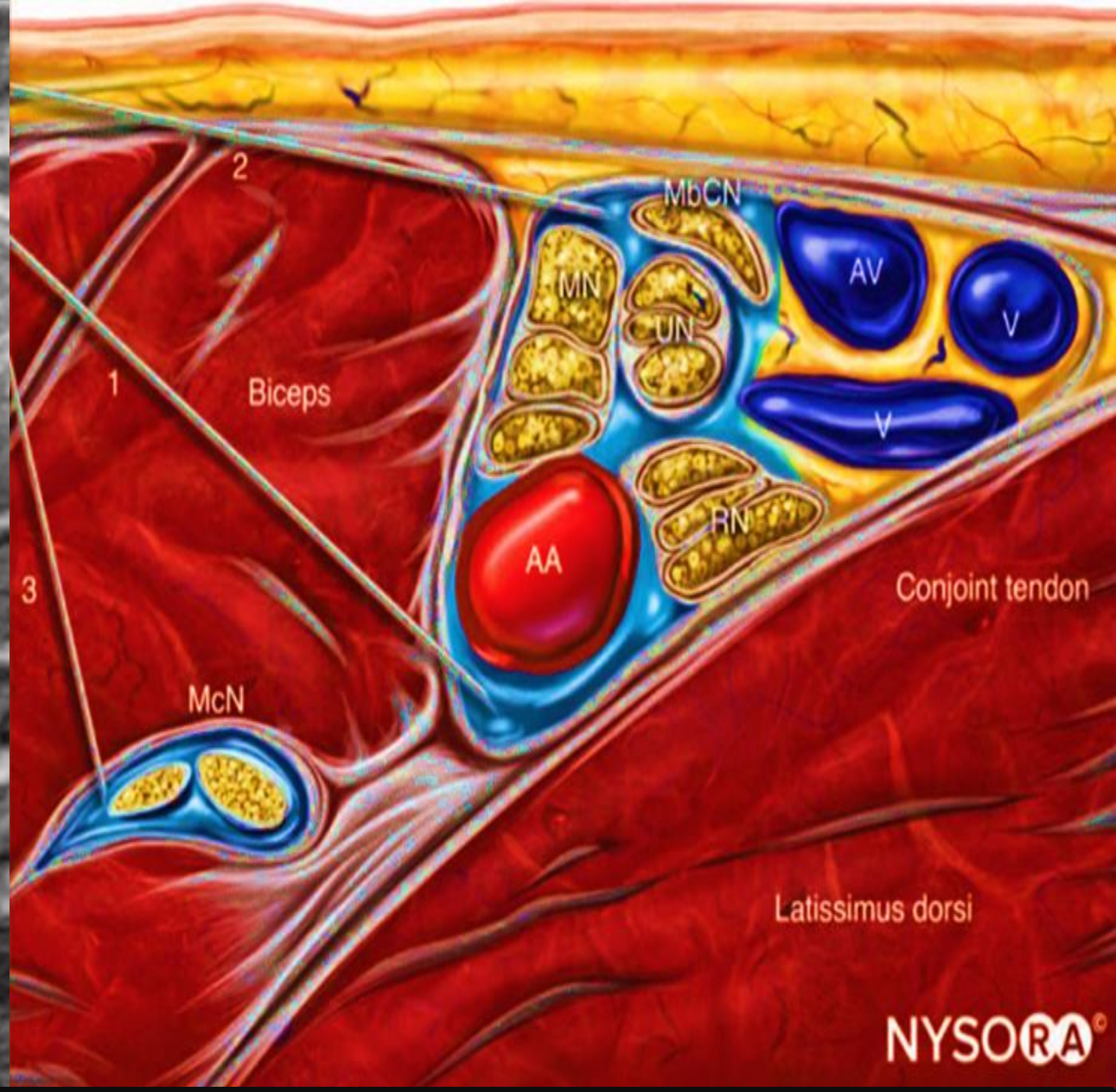
NYSORA

The Axillary brachial plexus block

- **Indications:** Elbow, forearm, and hand surgery
- **Goal:** LA spread around the axillary artery next to the **median**, **ulnar**, **radial** nerves. Separate injection for the **musculocutaneous** nerve (between the biceps and coracobrachialis muscle)
- US monitoring of the LA spread has improved the success rate of the axillary block, including the musculocutaneous nerve
- **Probe:** High-frequency linear probe
- **Patient Position:** supine with the arm abducted at the shoulder 90 degrees and the elbow flexed.
- **Local anesthetic choice:** 20 to 30 mL of local anesthetic in divided doses





If required, the medial skin of the upper arm (intercostobrachial nerve T2) can be anesthetized by an additional subcutaneous injection just distal to the axilla

Lower Extremity Blocks

Supraclavicular

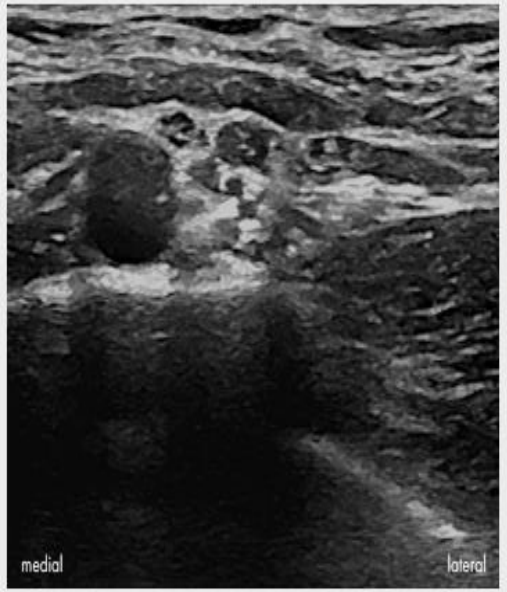
Supraclavicular
humerus, elbow, hand surgery

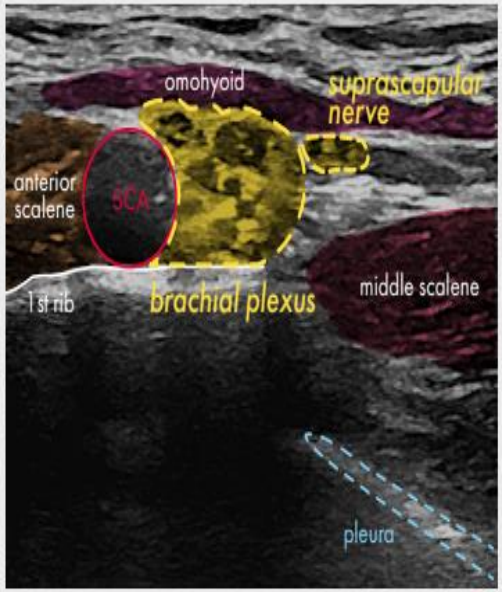
Identify: The subclavian artery lying on the first rib with underlying pleura. The brachial plexus appears as a honeycombed structure lateral and superficial to the artery.

Target: Using an in-plane needle approach from the lateral end of the probe. You may need to make 2-3 injections in the brachial plexus sheath to ensure LA spread to all components including the "corner pocket" between the artery and rib.

Tips: Rotate the lateral end of the probe a little posteriorly to optimise the image; keep the 1st rib in view beyond the needle tip to protect against pneumothorax.

Avoid: Pneumothorax: avoid needle tip penetrating beyond the first rib - it is vital to keep the tip in view throughout.





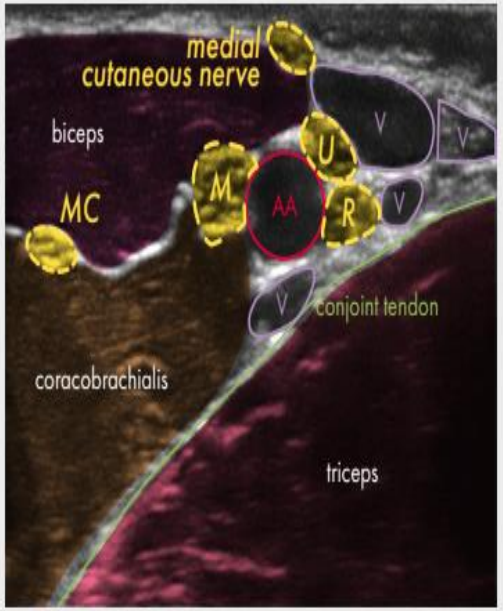
Axillary

Identify: The axillary artery and veins (often multiple). The conjoint tendon of teres major and latissimus dorsi is important: the four target nerves (musculocutaneous, median, ulnar, radial) will lie above that tendon. The medial cutaneous n of the forearm lies between median and ulnar just beneath the deep fascia.

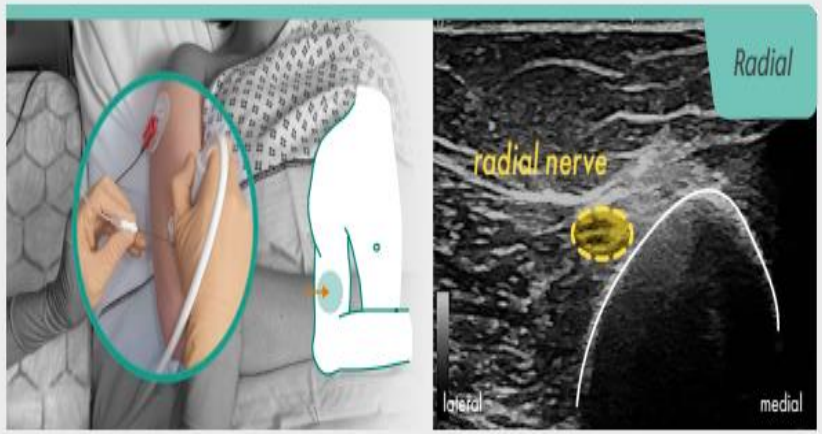
Target: Using an in-plane approach from the lateral end of the probe target each nerve in turn (we block them in order: MC, R, U, M to preserve the ultrasound view).

Tips: Scan distally to confirm each nerve identity (median n stays with brachial artery, ulnar n moves medially and superficially to the cubital tunnel, radial n dives deep towards the medial border of humerus with the profunda brachii artery); a nerve stimulator can be used to confirm nerve identity; expect variation in the position of nerves.

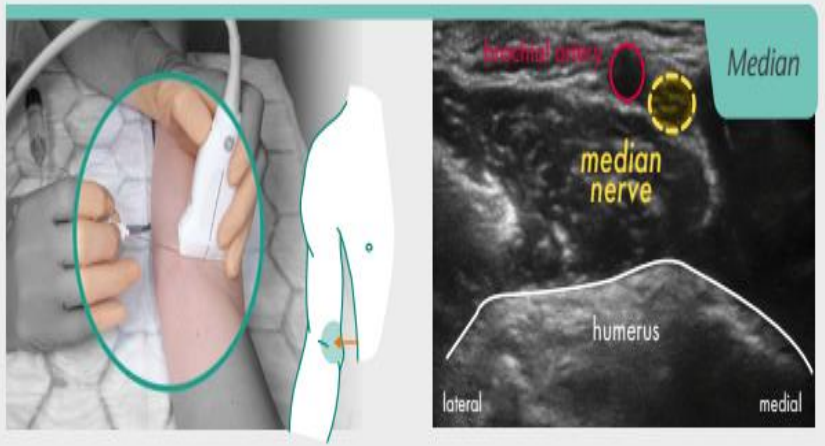
Avoid: Intravascular injection (multiple vessels) - watch the ultrasound for injectate spread with each injection; avoid intrafascicular nerve trauma.



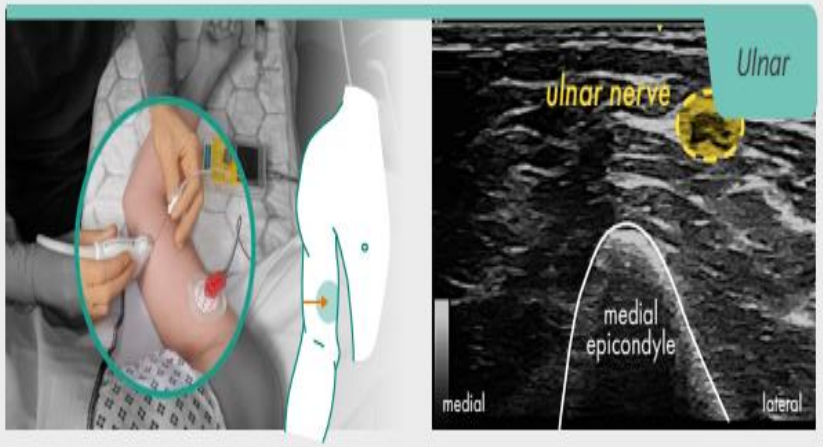
Peripheral Nerves



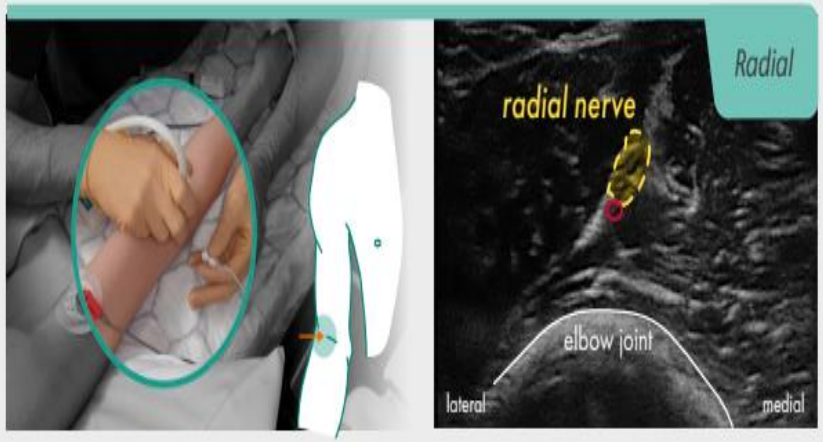
Proximal: Flex the elbow, place the probe over the lower 1/3 of the humerus in an axial plane, look for the rounded appearance of the nerve looping around the distal humerus.



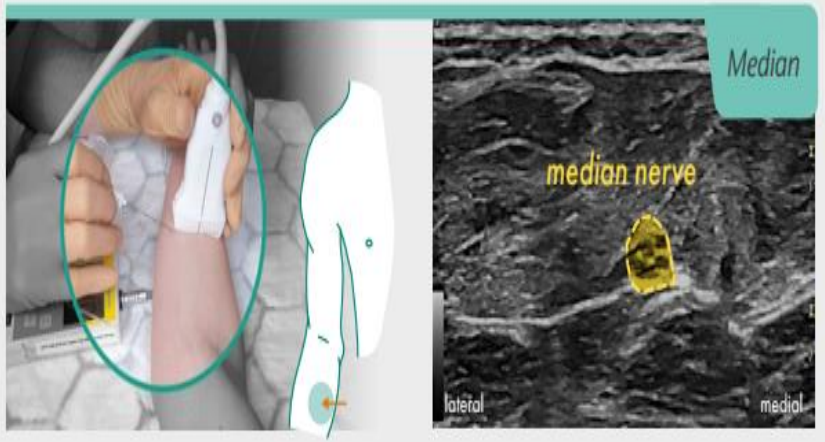
Proximal: Extend the elbow, the nerve lies medial to the brachial artery just above the elbow skin crease.



Proximal: On the medial side of the distal humerus, above the medial epicondyle, locate the nerve before the nerve enters the cubital tunnel. Do not block the nerve in the tunnel itself.



Distal: Extend the elbow, place the probe over the lateral half of the elbow crease. The radial nerve here has a characteristic spindle shape (2 components + artery).



Distal: At the mid-forearm level the nerve is a hyperechoic, honeycombed structure at the centre of 3 fascial planes. There may be an accompanying artery which should be avoided.

Distal: Nerve lies on the medial side of the ulnar artery. Starting at the wrist, scan proximally until they separate.

Femoral

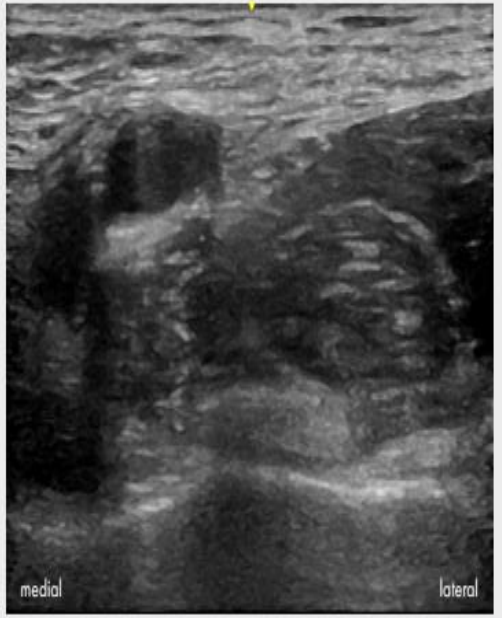
Femoral – femoral shaft, quadriceps mechanism, knee surgery

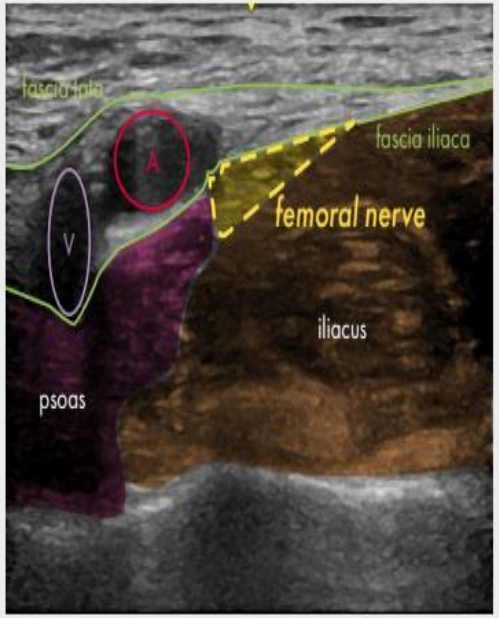
Identify: The femoral artery, iliacus and psoas muscles and fascia iliaca. Identify the indentation between the two components of iliopsoas. The nerve lies lateral to the artery, usually flattened between the fascia and muscle and it can take on a variety of shapes.

Target: Using an in-plane approach from the lateral end of the probe, local anaesthetic injection must be beneath the fascia iliaca; ensure the spread of LA surrounds the nerve.

Tips: Choose a proximal site before the nerve branches immediately below the inguinal ligament (if the femoral artery has divided then you are too distal). The nerve is usually more visible following injection of LA. Quadriceps weakness will affect active rehabilitation and mobility.

Avoid: Superficial injection, distal injection, intravascular injection.





Subgluteal

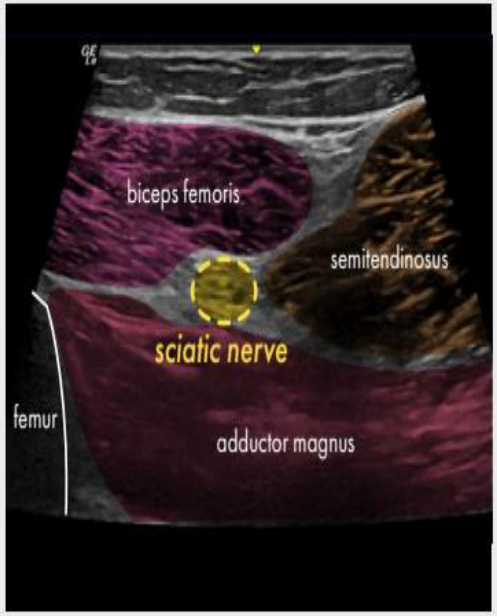
Subgluteal – a proximal approach to the sciatic nerve for surgery below the knee, an alternative to the popliteal approach when access is limited; the posterior cutaneous nerve of the thigh will not be blocked

Identify: At this level the sciatic nerve lies between biceps femoris laterally and semitendinosus medially. Deep to the nerve is the adductor magnus muscle and there is usually a clear fascial plane between this and the superficial muscles. The nerve is rarely round, more usually flattened or triangular in cross section.

Target: Using an in-plane approach from the lateral end of the probe with a longer needle, aim for circumferential spread of LA around the sciatic nerve.

Tips: Trace the nerve up from the popliteal fossa if necessary; tilt the probe to optimize visibility (anisotropy). Track the spread of LA proximally and distally to ensure complete coverage of the nerve. Block onset can be delayed due to the size of the target.

Avoid: Check for arteries crossing obliquely deep to the sciatic nerve.



Obturator

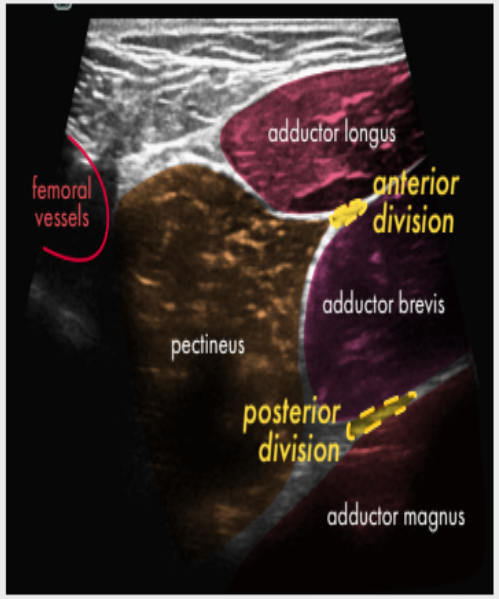
Obturator- supplement for hip, knee or bladder surgery

Identify: the femoral artery, then slide the probe medially to locate the pectineus muscle and the 3 layers of adductor muscles (longus, brevis and magnus from superficial to deep). The anterior and posterior divisions of the nerve appear as hyperechoic structures in the intermuscular fascial planes as shown.

Target: Using in-plane approach from the lateral end of the probe with a minimum 80mm echogenic needle, make an injection in the fascial plane for each division. The nerves will be more obvious following injection.

Tips: Abduct and externally rotate the limb if possible. Probe tilt is useful to highlight the nerves. A linear ultrasound probe is sufficient but a curvilinear can be required for a large leg. A more proximal target can be achieved by tracking and tilting the probe in a cephalad direction - the divisions will unite deep to pectineus muscle and a single injection here will result in a complete block including the branches to the hip joint. The knee is supplied by the posterior division.

Avoid: The needle entry point may overlie the femoral vessels, avoid puncturing them.

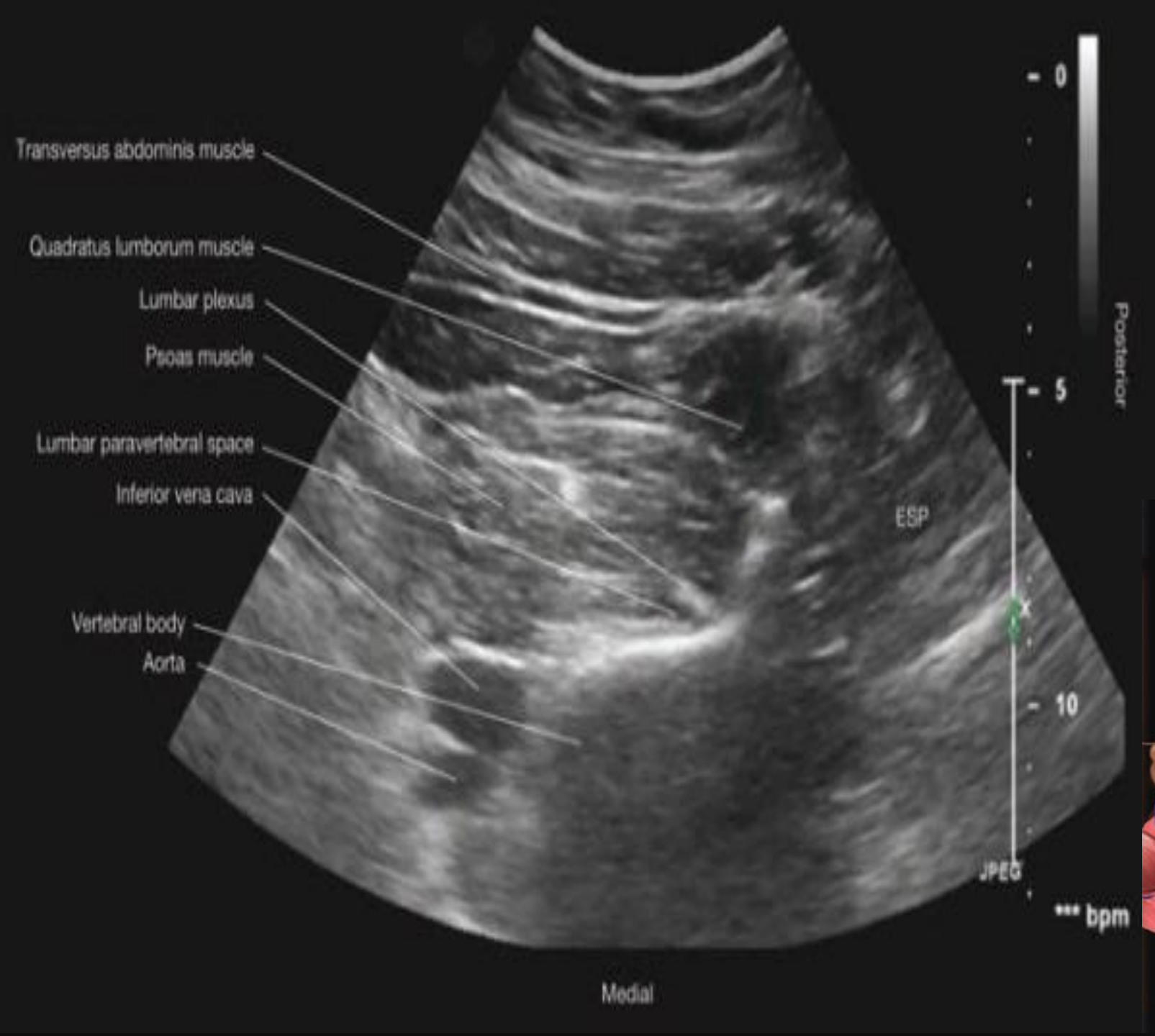


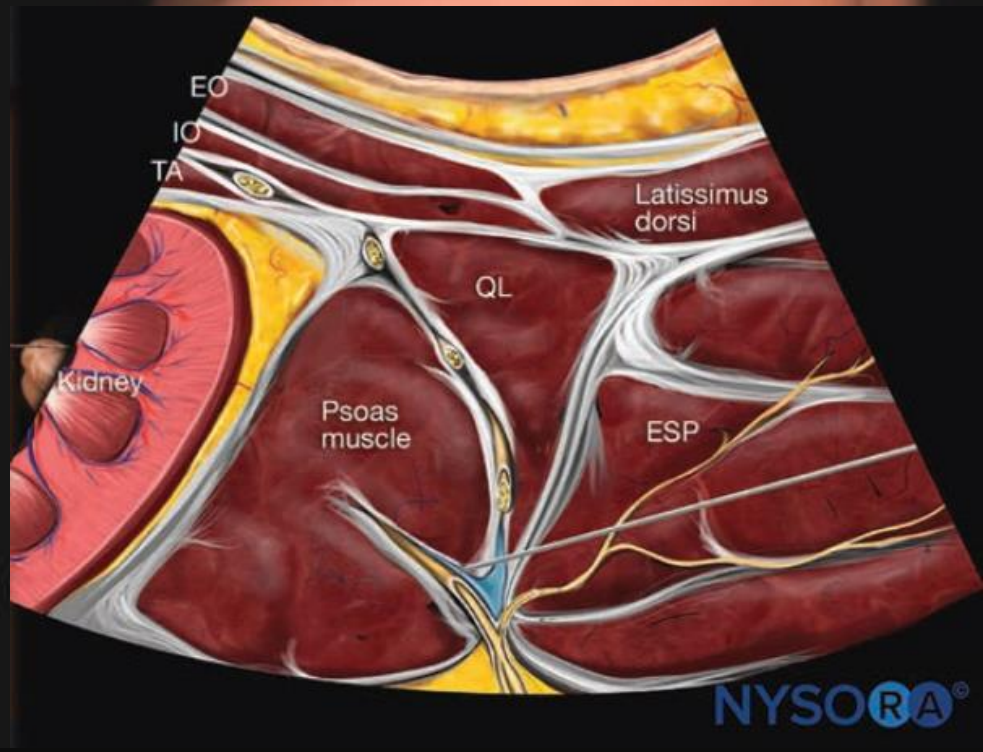
Lumbar Plexus Block

- Block of the lumbar plexus (femoral, lateral femoral cutaneous, and obturator nerves) in the psoas muscle compartment.
- **Indications:** Anesthesia and analgesia for the hip, knee, and lower extremity surgery.
- **Goal:** Spread of LA around the lumbar plexus in the psoas muscle compartment
- US images of the psoas compartment can be challenging (its deep location and the complexity of the sonoanatomy)
- Relatively high failure rate and epidural spread.
- LA toxicity and hematomas because of the vascularity of the lumbar paravertebral region


0
5
10
Transverse process
L2
L3
L4
Lumbar plexus
Psoas muscle
Trident Sign
NYSORA

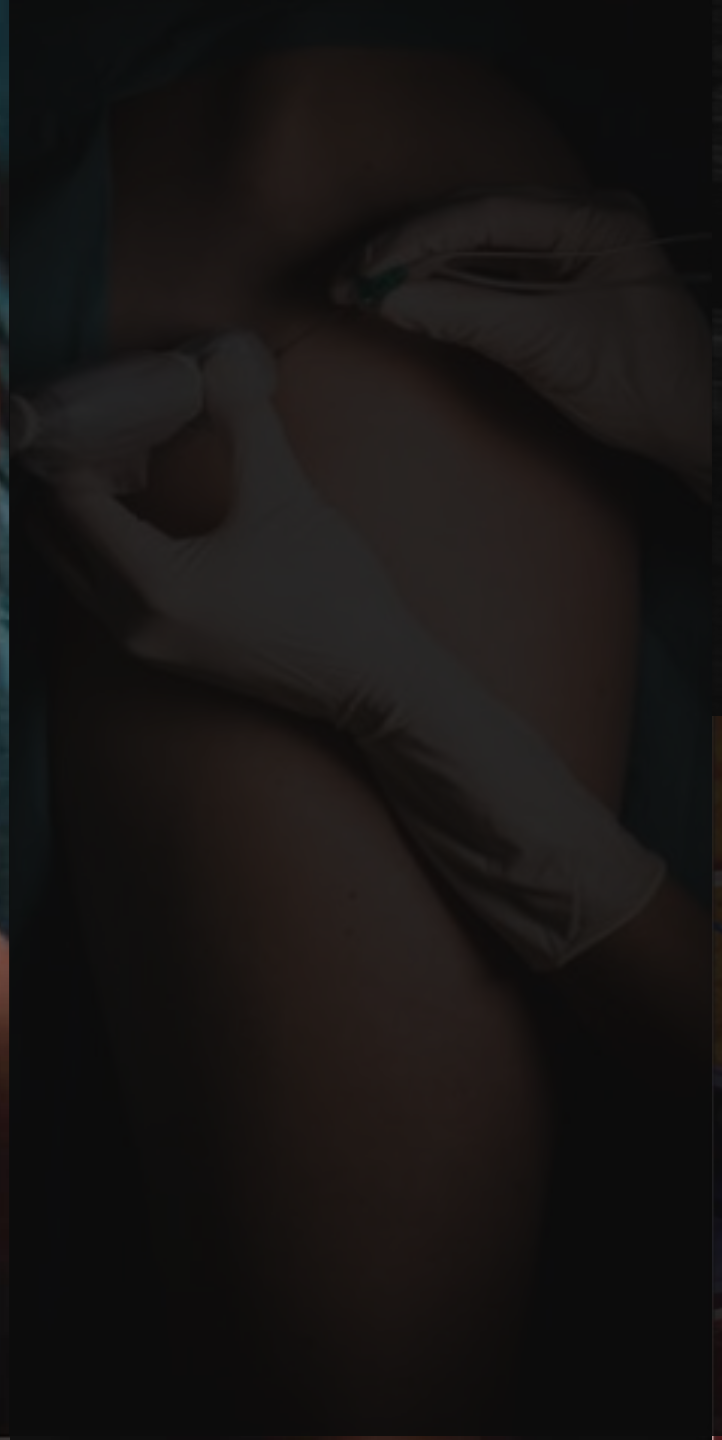

TP-L4
TP-L5
TP-L4
Lumbar plexus
Psoas muscle
NYSORA


Transversus abdominis muscle
Quadratus lumborum muscle
Lumbar plexus
Psoas muscle
Lumbar paravertebral space
Inferior vena cava
Vertebral body
Aorta
ESP
0
5
10
Posterior
JPEG
*** bpm
Medial

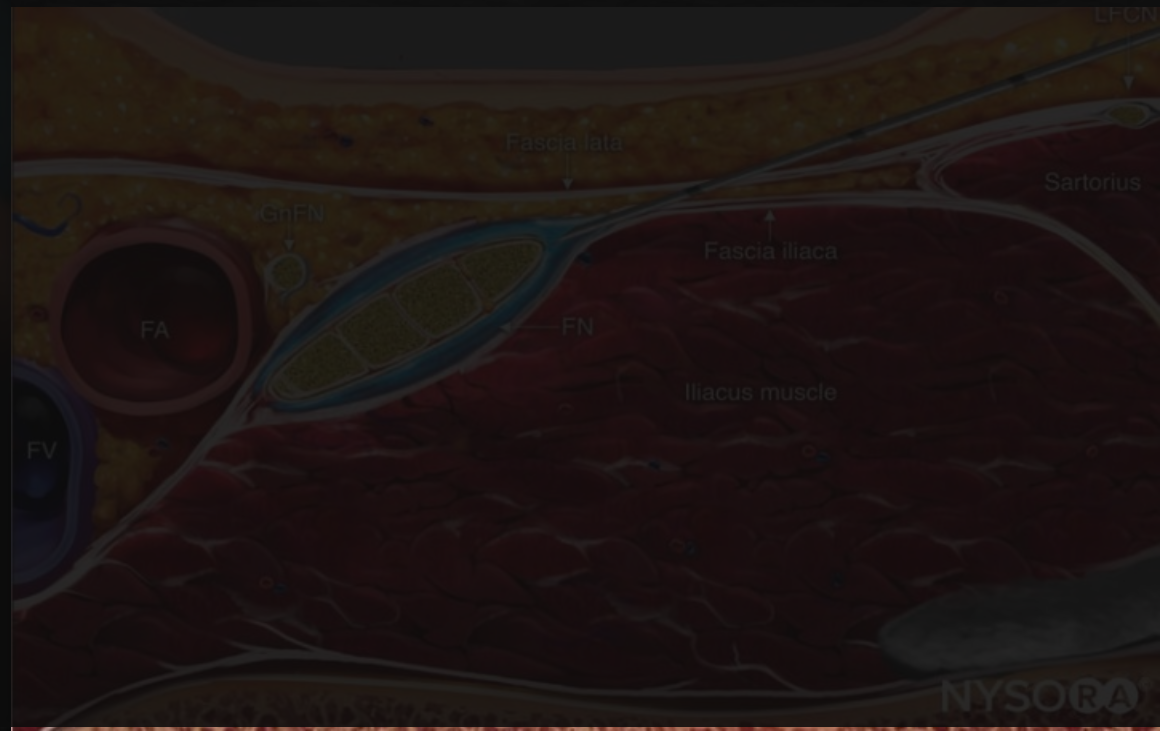

EO
IO
TA
Latissimus dorsi
QL
Kidney
Psoas muscle
ESP
NYSORA

FEMORAL NERVE BLOCKS

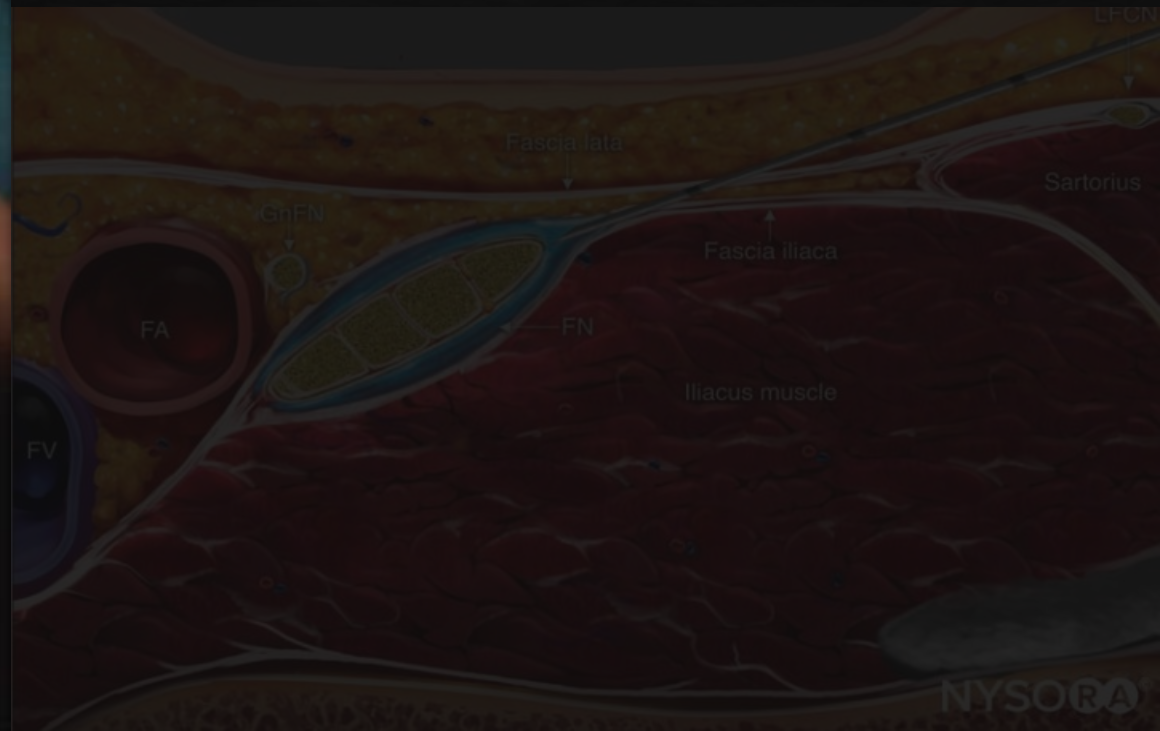
- **Indications:** Anesthesia and analgesia after hip, femur, anterior thigh, knee, and patella procedures
- **Goal:** Local anesthetic spread around the FN
- **Local anesthetic volume:** 10 to 20 mL
- **Probe:** High-frequency linear probe
- The advantages of using ultrasound: a more complete block, LA volume sparing, and fewer side effects such as vascular punctures.

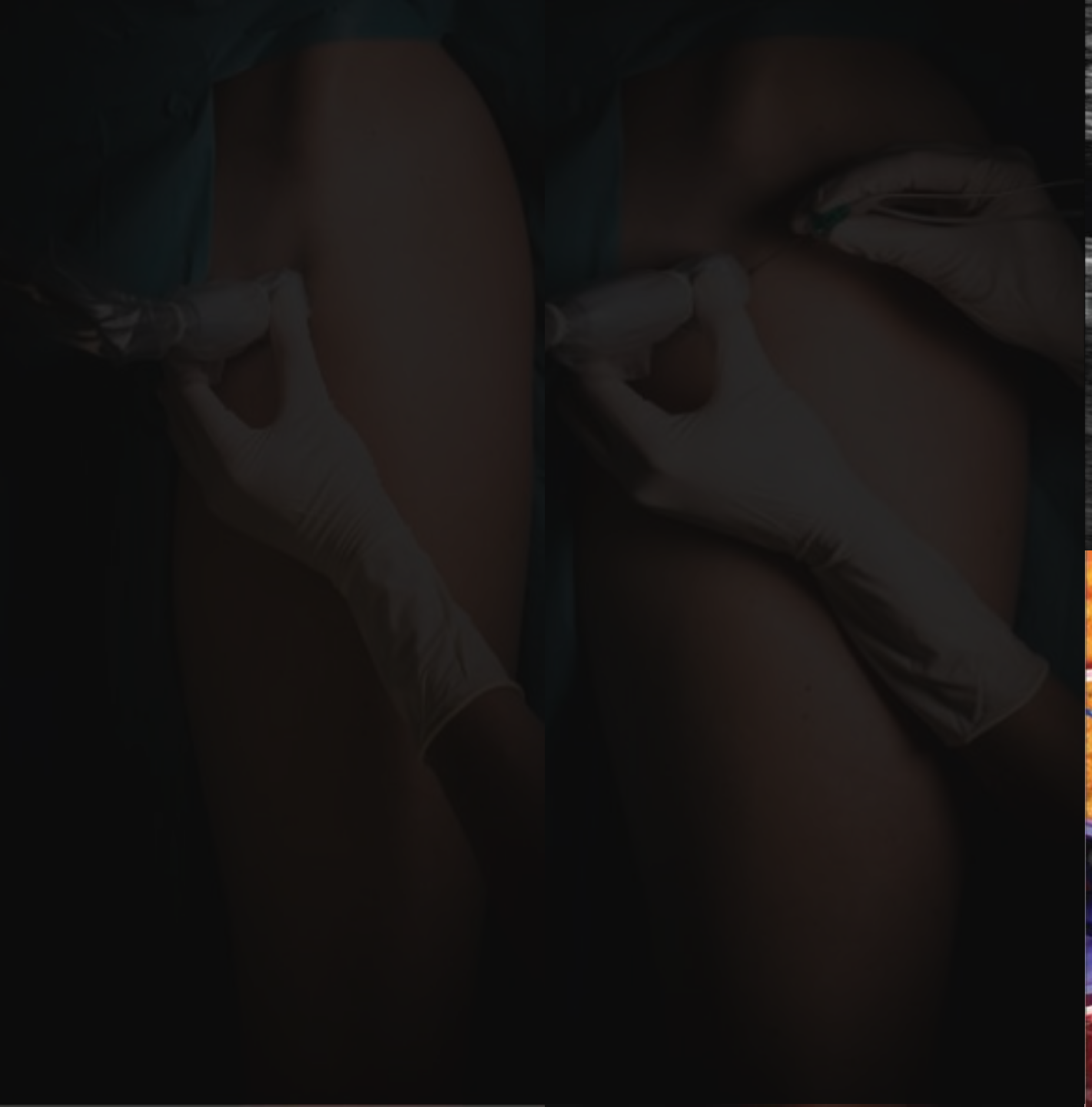



Local anesthetic
FA
Fascia iliaca
FN
Iliopsoas muscle

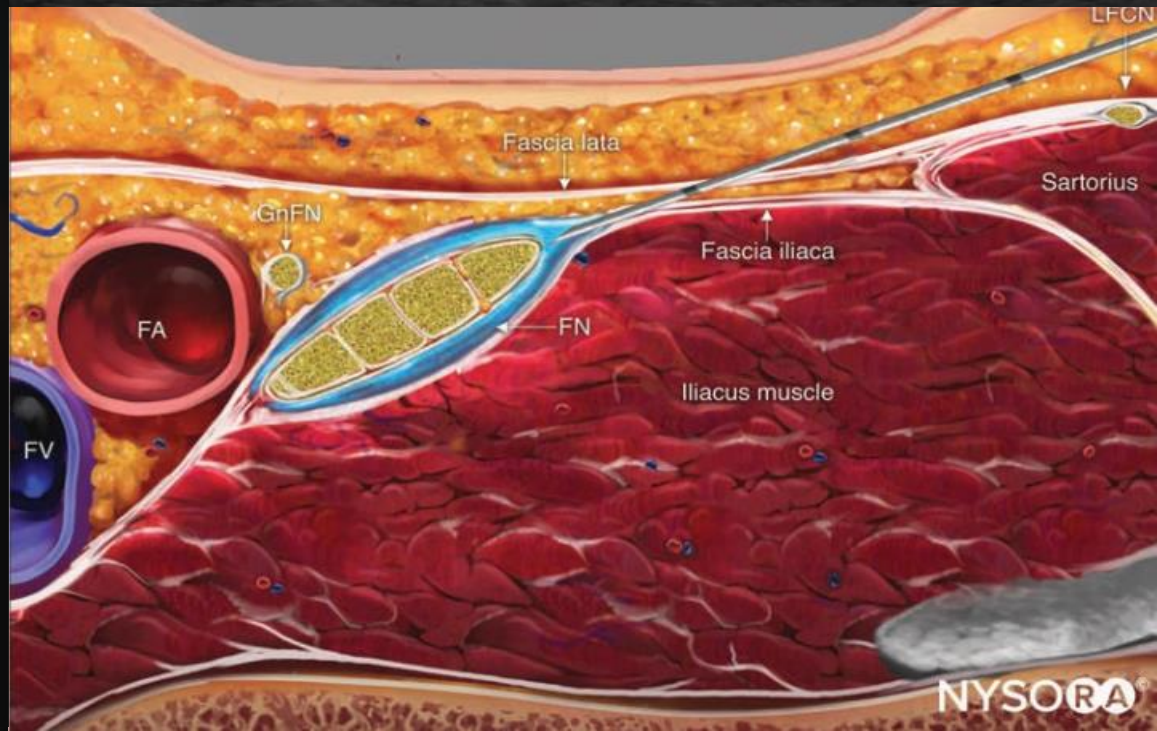

Fascia lata
Sartorius
GnFN
Fascia iliaca
FA
FN
Iliacus muscle
FV
NYSORA


Local anesthetic
FA
Fascia iliaca
FN
Iliopsoas muscle


Fascia lata
Sartorius
GnFN
Fascia iliaca
FA
FN
Iliacus muscle
FV
NYSORA




Local anesthetic
FA
FN
Fascia
Iliaca
Iliopsoas muscle


LFCN
Fascia lata
Sartorius
GnFN
Fascia iliaca
FA
FN
Iliacus muscle
FV
NYSORA

Fascia Iliaca Block (Modified Femoral Nerve Block)

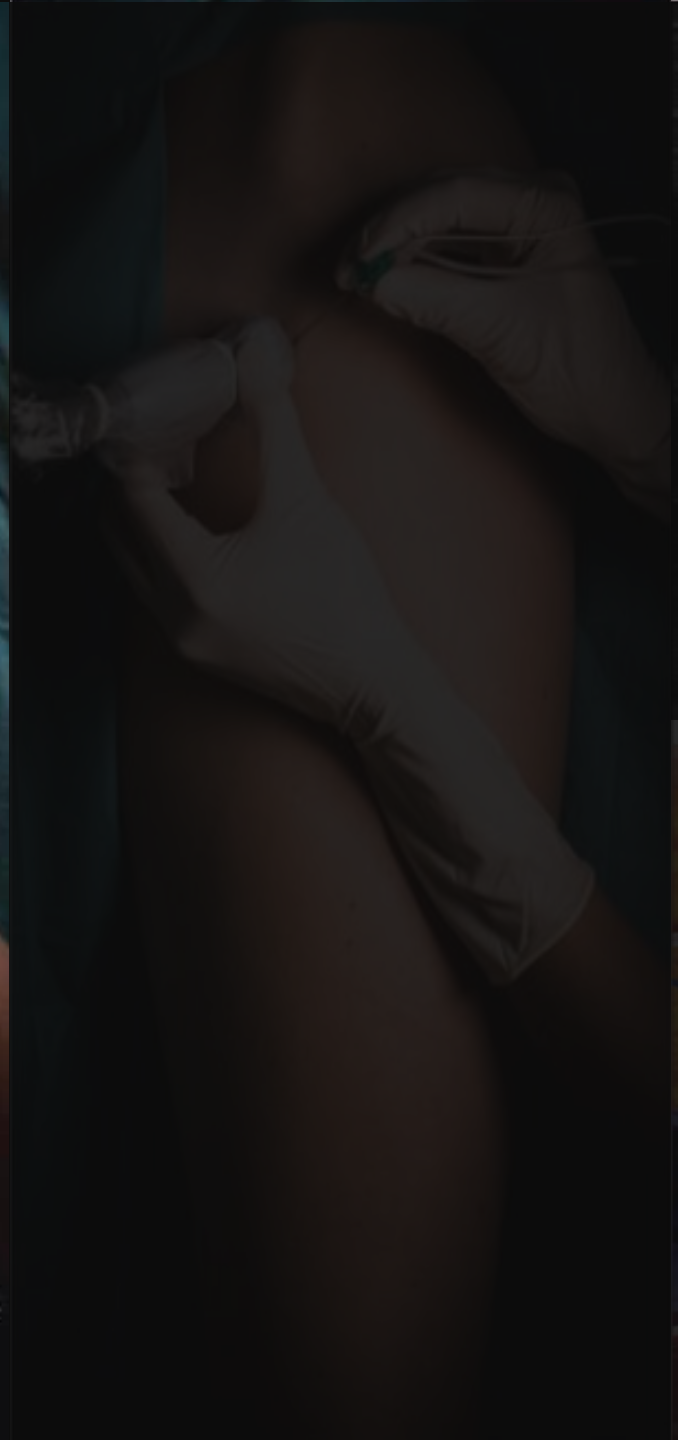
- Block of the nerves of the lumbar plexus under the fascia iliaca at the level of the inguinal ligament (femoral and lateral femoral cutaneous nerves).
- Originally described in children
- Double pop sensation as the needle traverses the fascia lata and fascia iliaca
- Penetration of both layers of fascia is important for block success.
- The use of a short-bevel or bullet-tipped needle has been advocated
- High volumes of dilute long-acting local anesthetic can be injected to block nerves of the lumbar plexus

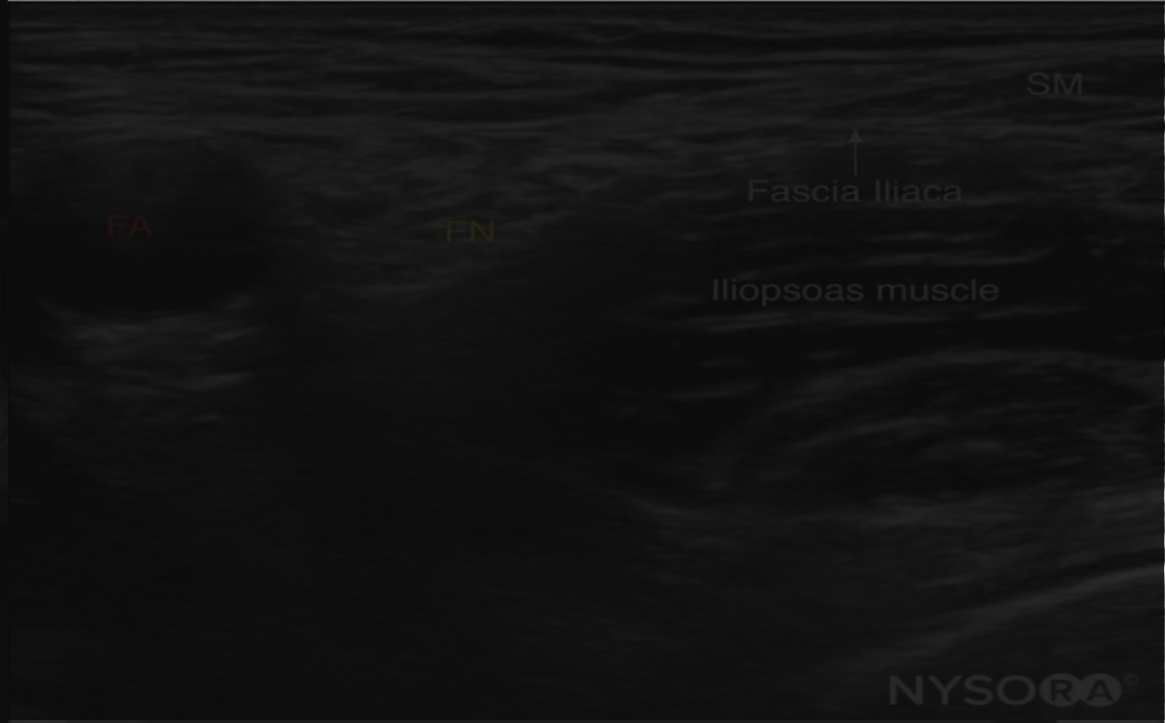
- Ultrasound can also be used to visualize the two fascial layers and monitor the spread of local anesthetic beneath the fascia iliaca

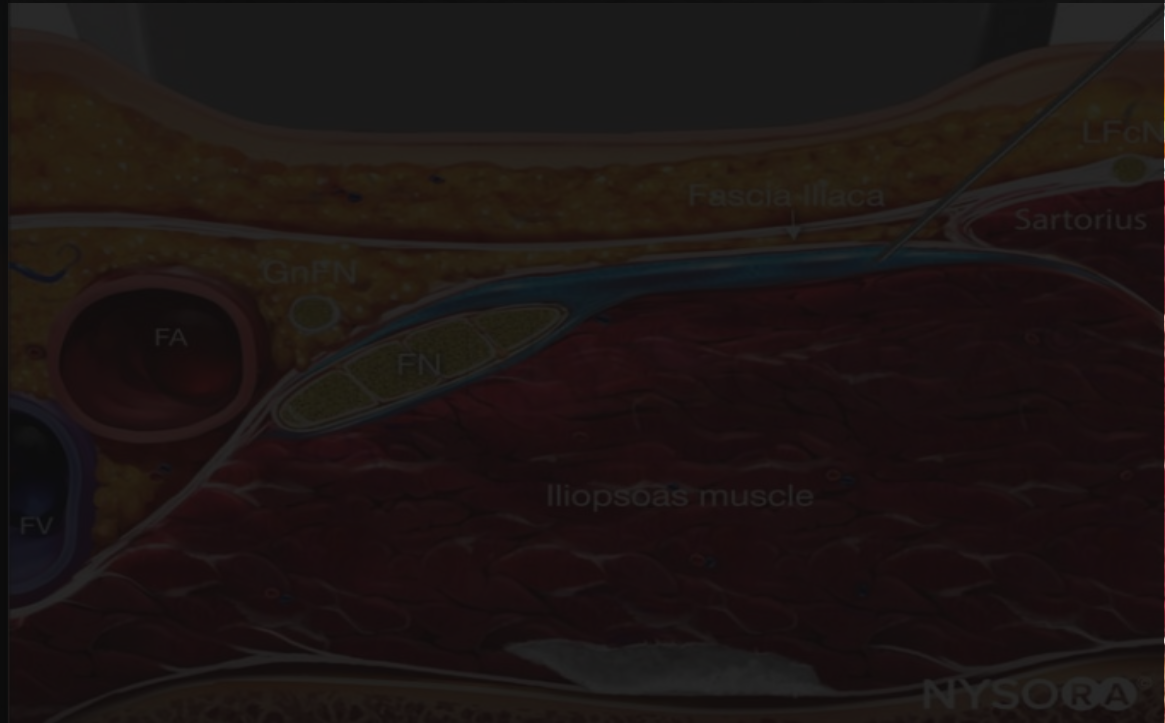
A. Infrainguinal Fascia Iliaca Block

B. Suprainguinal Fascia Iliaca Block

Infrainguinal block

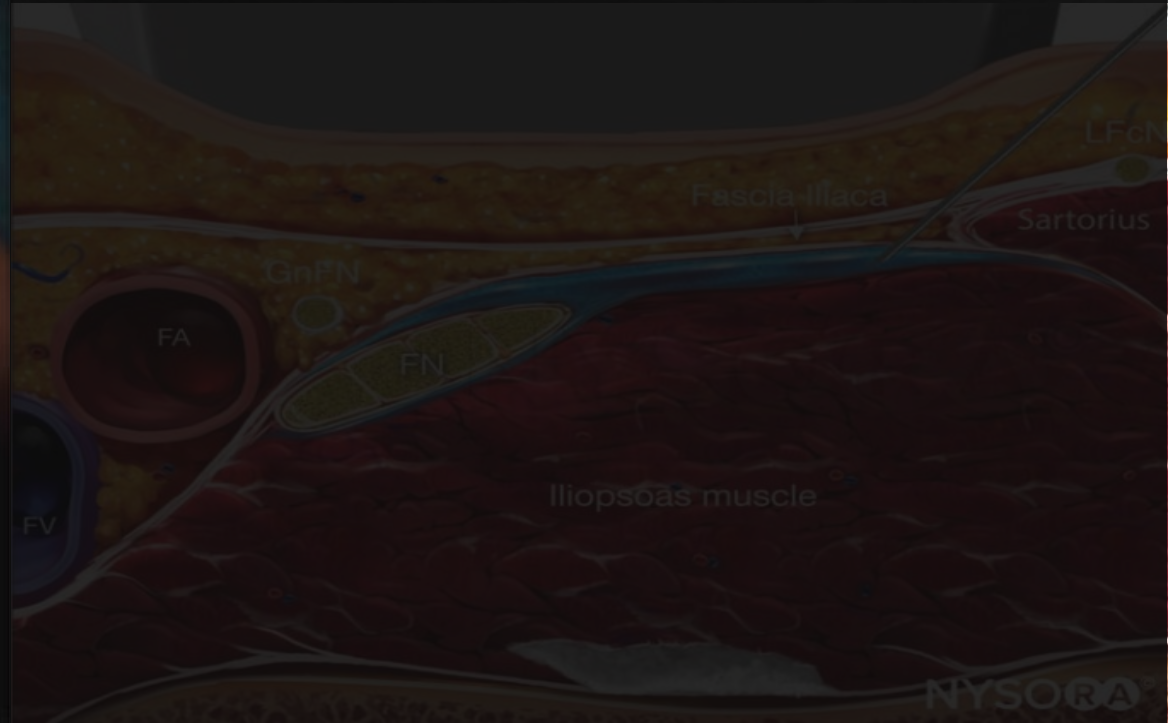







Cr
M
L
Cd


SM
Fascia iliaca
FA
FN
Iliopsoas muscle
NYSORA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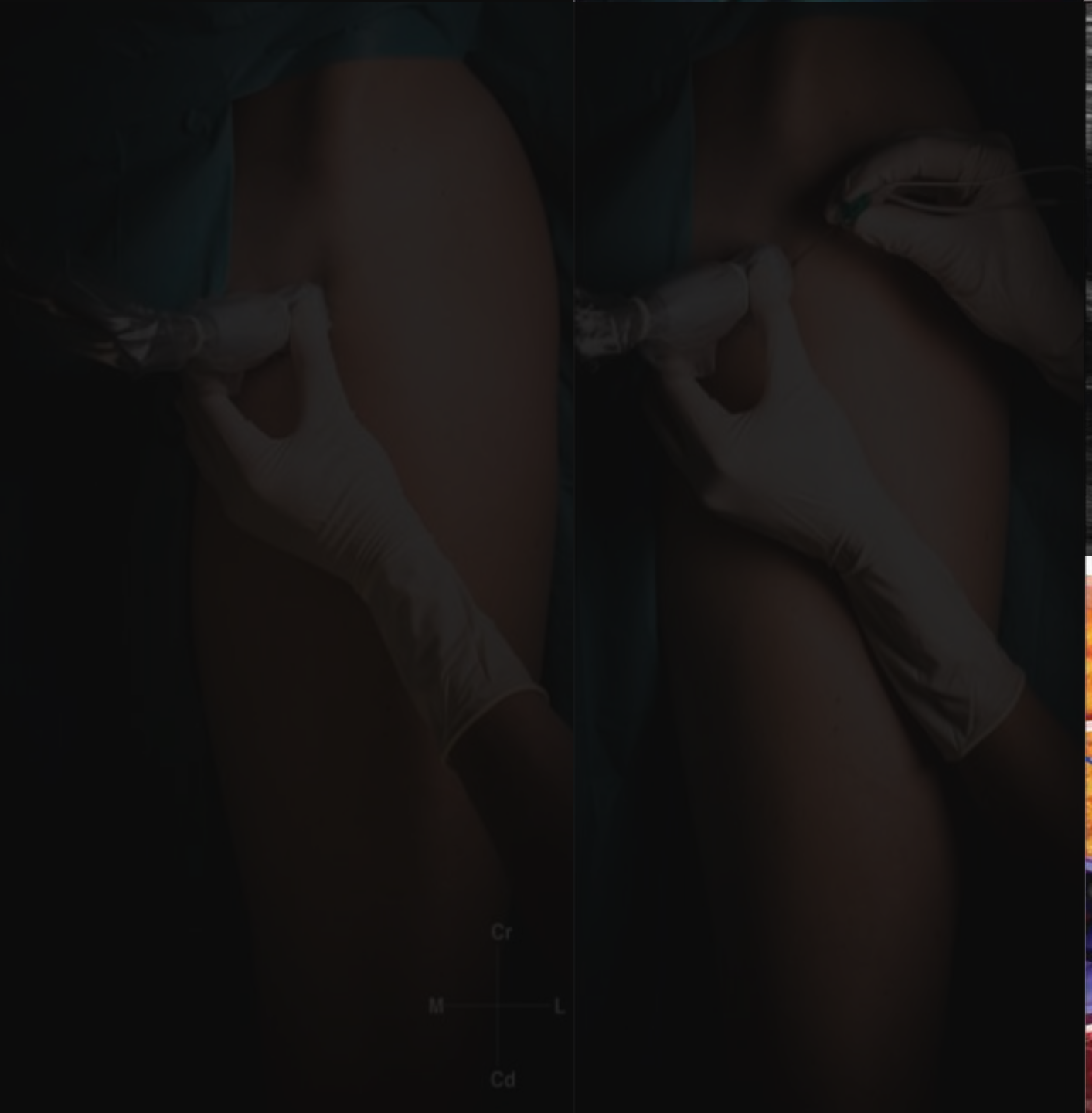
Sartorius
GnFN
FA
FN
FV
Iliopsoas muscle
NYSORA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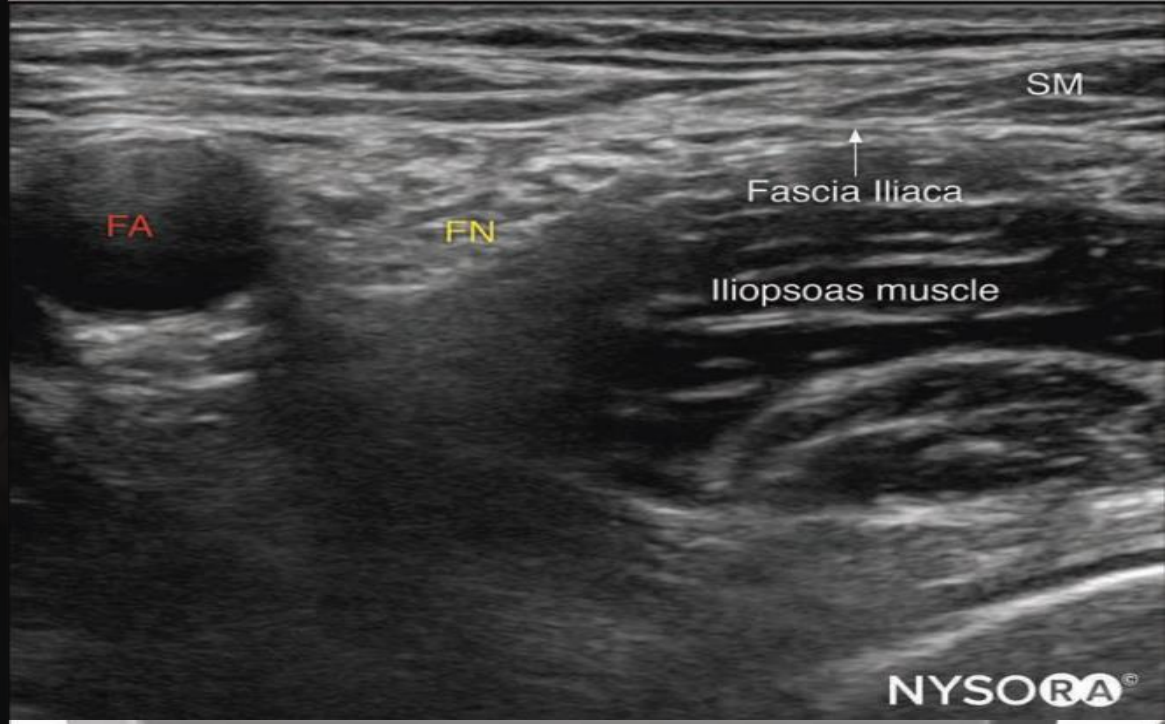
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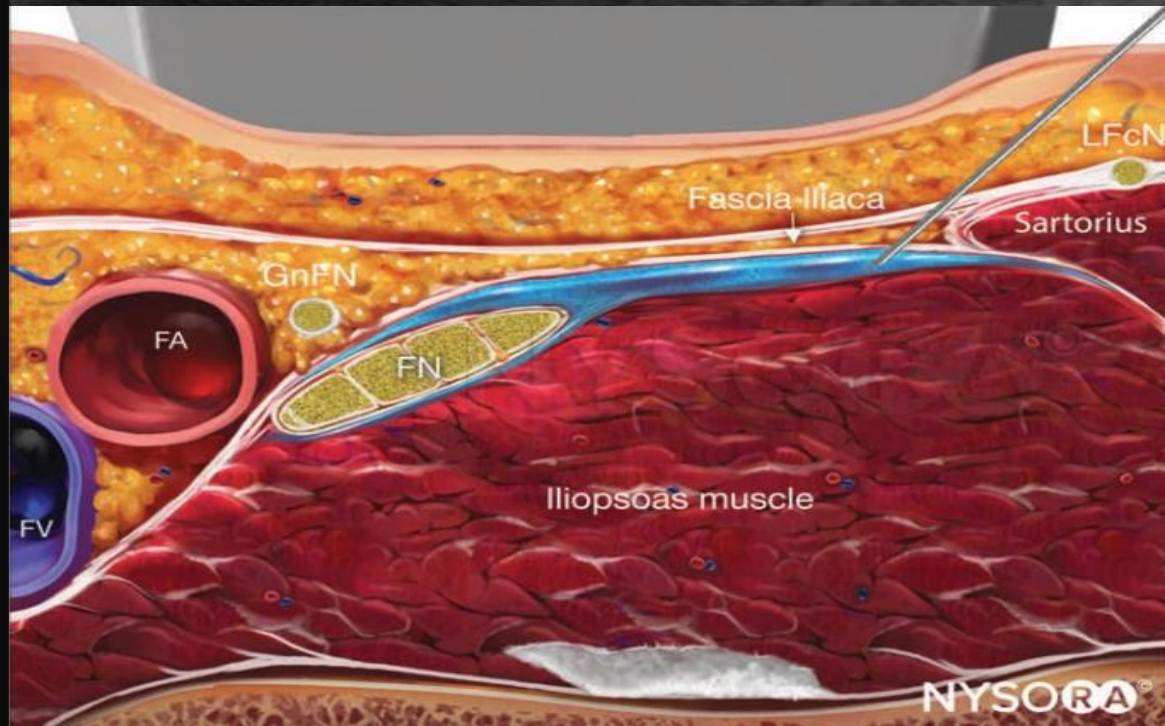
FA
FN
Iliopsoas muscle
NYSORA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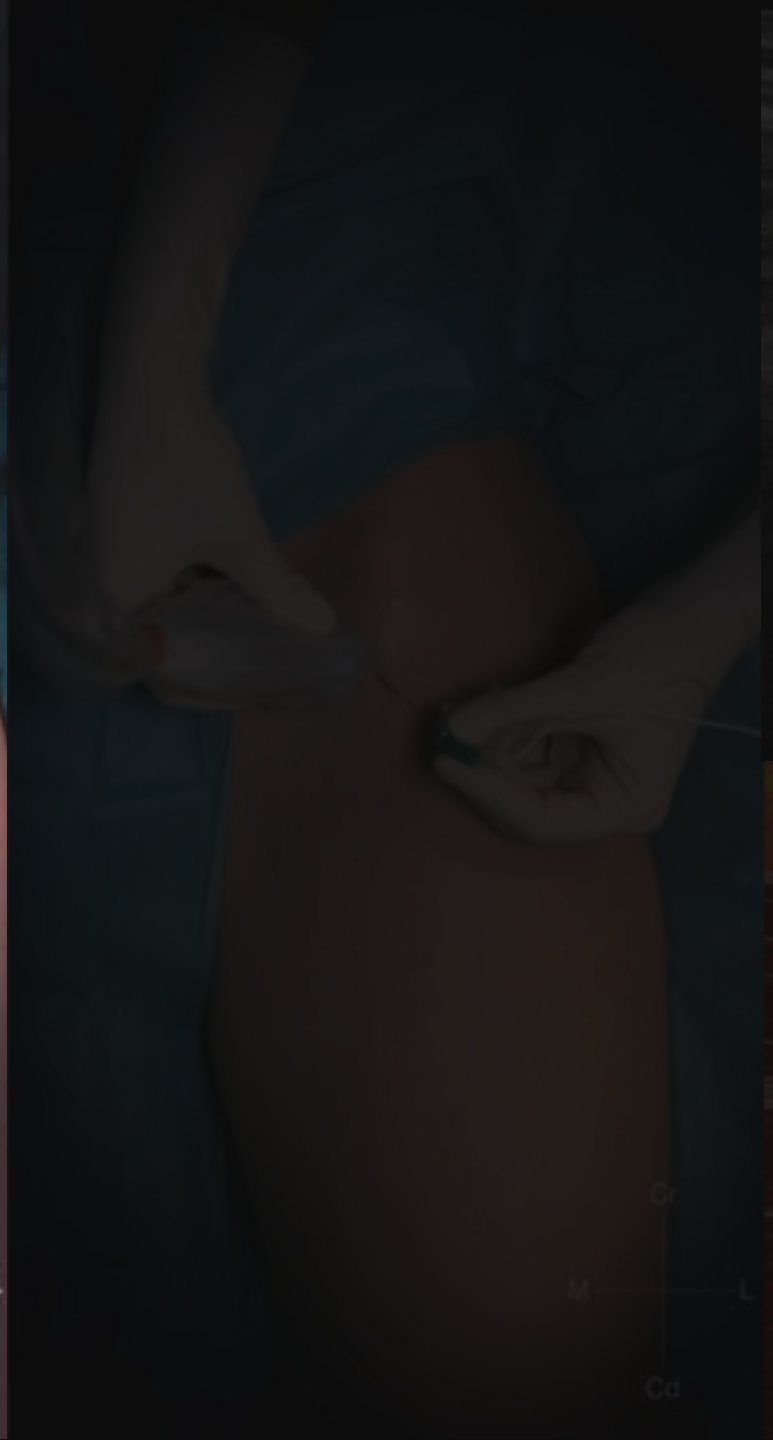
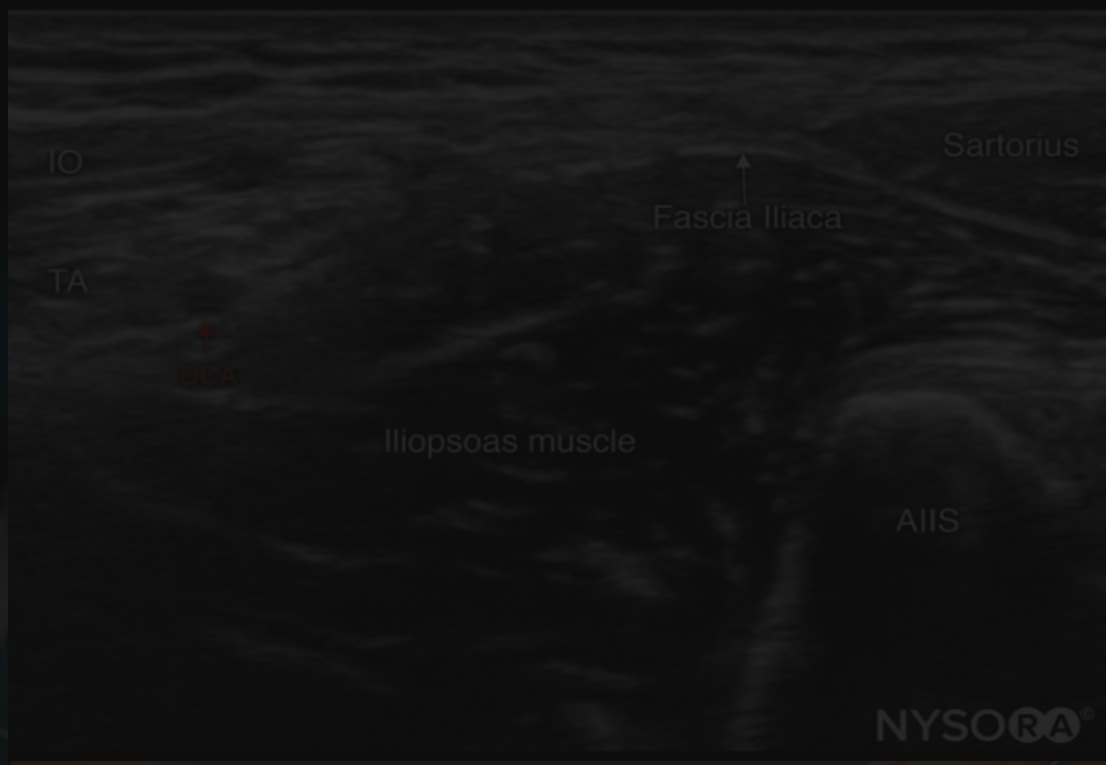
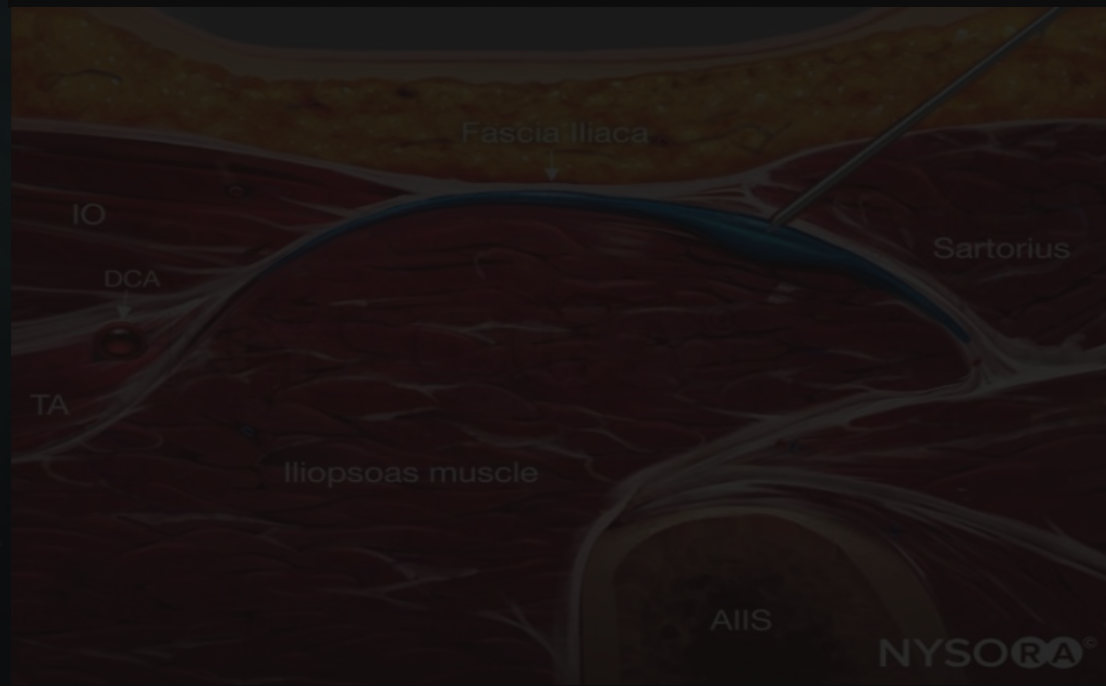
Sartorius
GnFN
FA
FN
FV
Iliopsoas muscle
NYSORA

Suprainguinal block








Cr
M
L
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Cr
M
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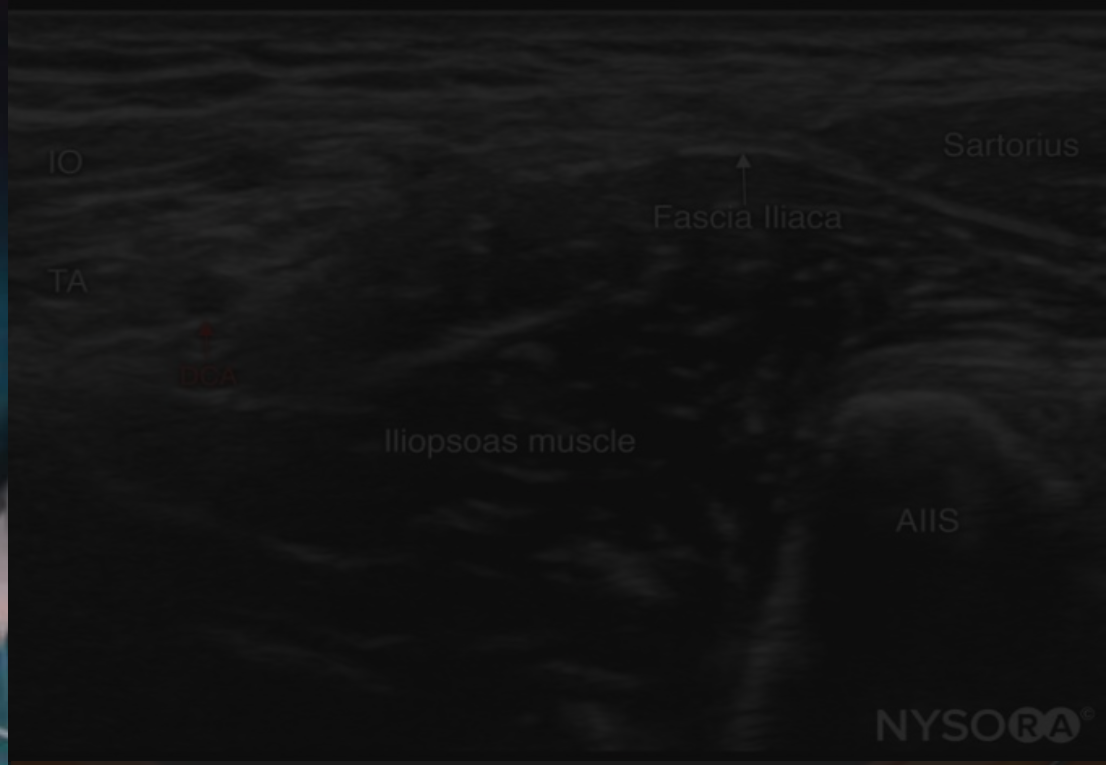
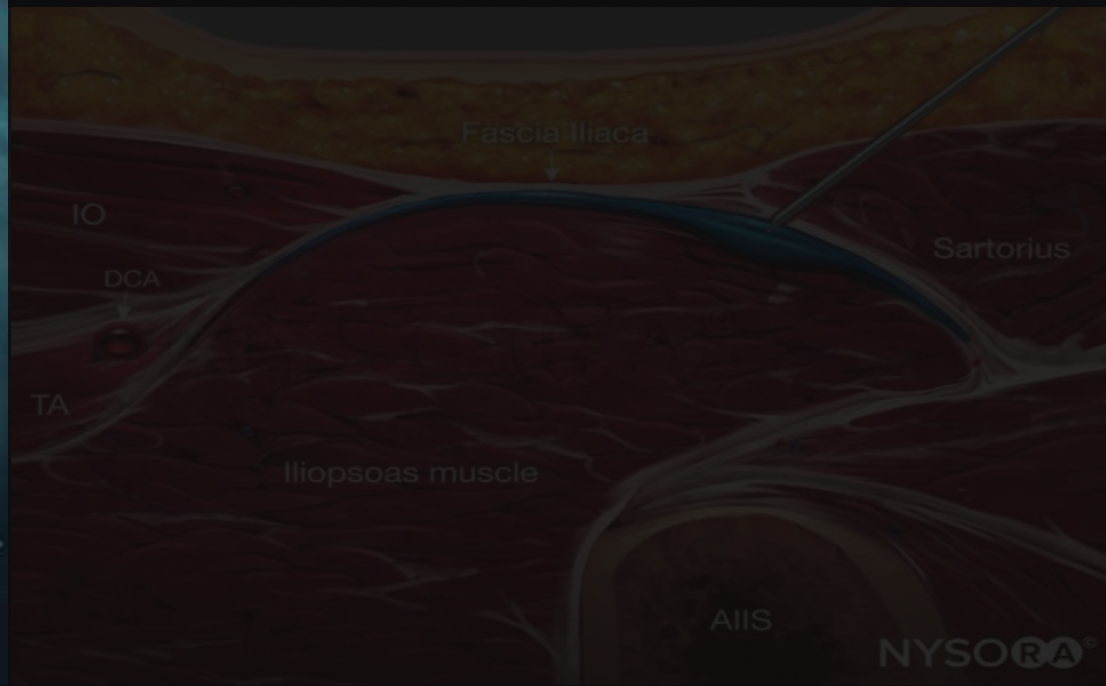

IO
Sartorius
Fascia Iliaca
TA
DCA
Iliopsoas muscle
AIIS
NYSORA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IO
Sartorius
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Iliopsoas muscle
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Cr
M
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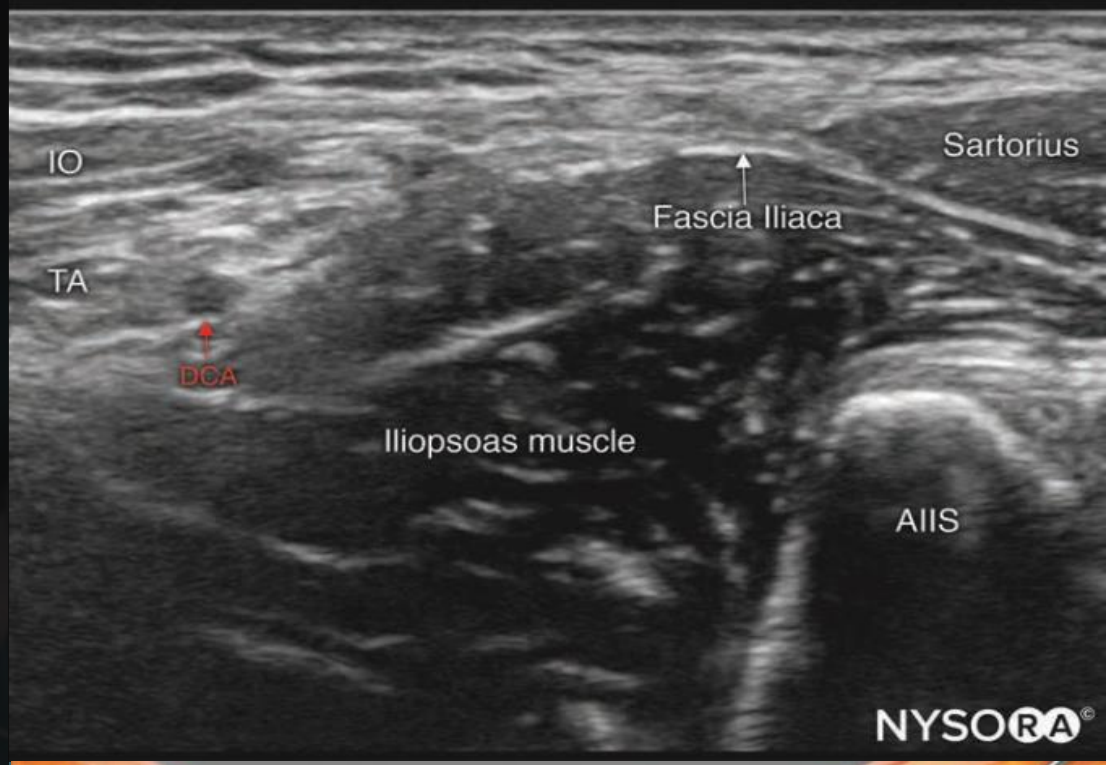
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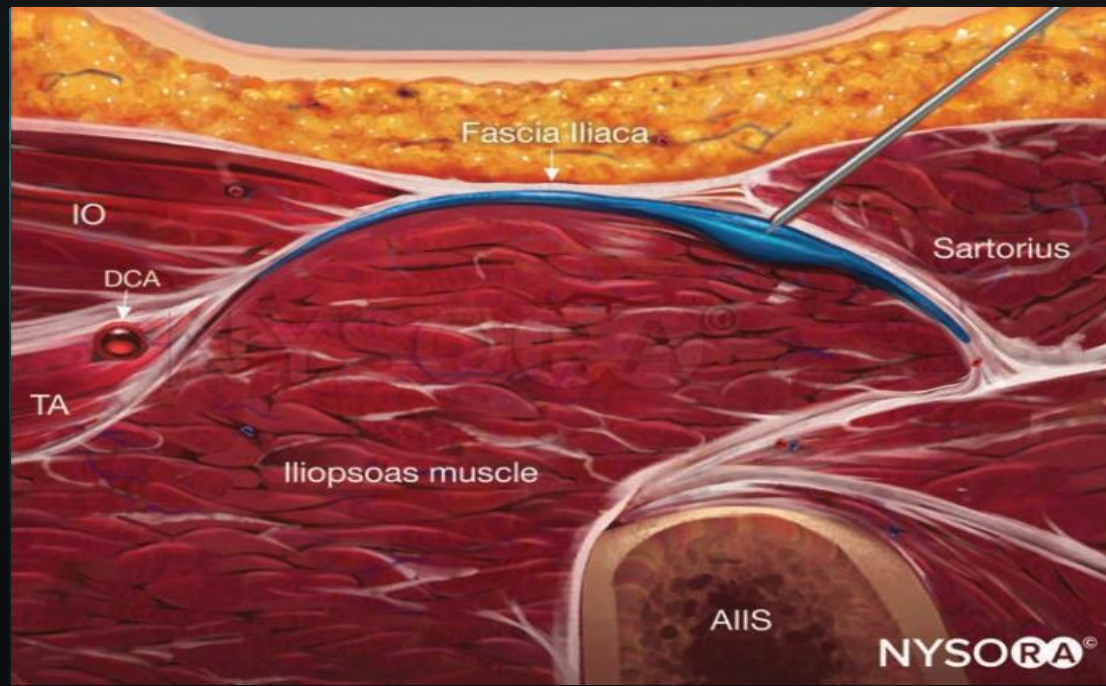
Sartorius
Fascia Iliaca
TA
DCA
Iliopsoas muscle
AIIS
NYSORA©


Fascia Iliaca
IO
Sartorius
DCA
TA
Iliopsoas muscle
AIIS
NYSORA©

ADDUCTOR CANAL BLOCK

- Block of the saphenous nerve under the sartorius muscle at the medial aspect of the mid-third thigh.
- **Indications:** Anesthesia for foot and ankle surgery in combination with a sciatic nerve block, analgesia for knee surgery in combination with multimodal analgesia,
- **Goal:** Spread of LA around the femoral artery in the fascial compartment between the sartorius, vastus medialis, and adductor muscles
- **Probe:** High-frequency linear probe
- **Local anesthetic volume:** 10 to 20 mL


Pr
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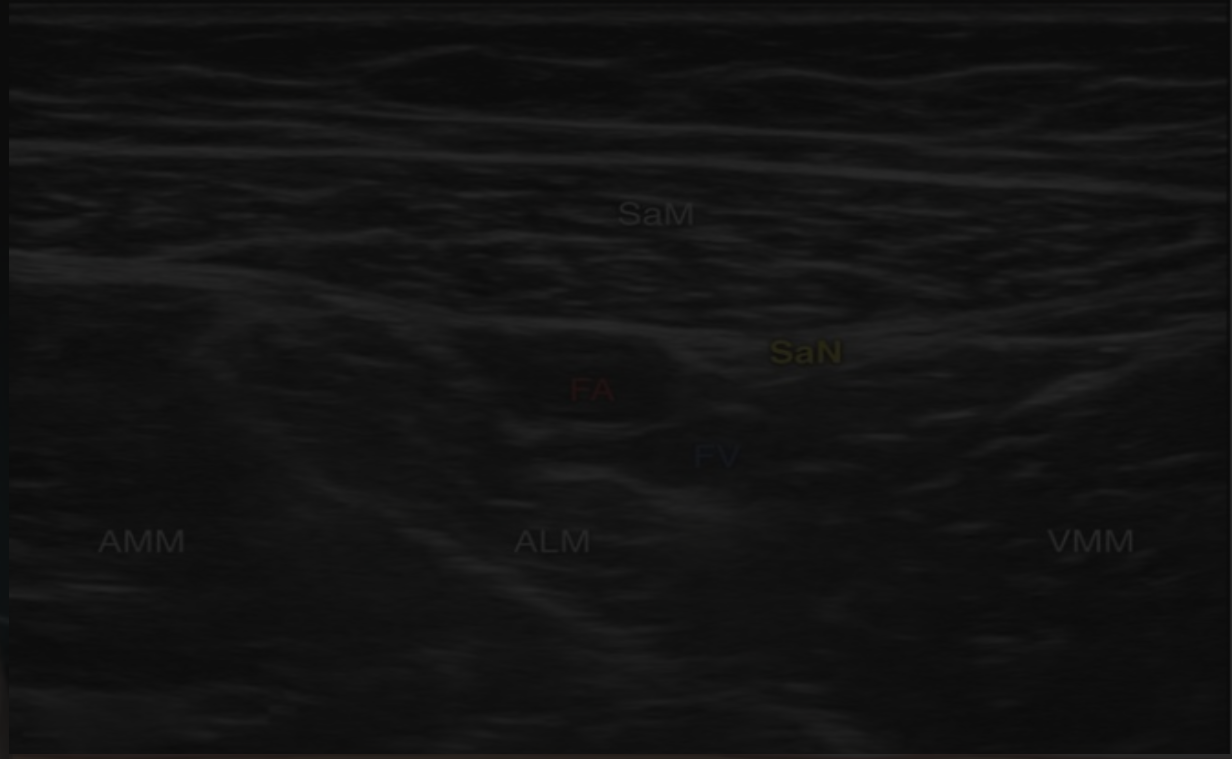
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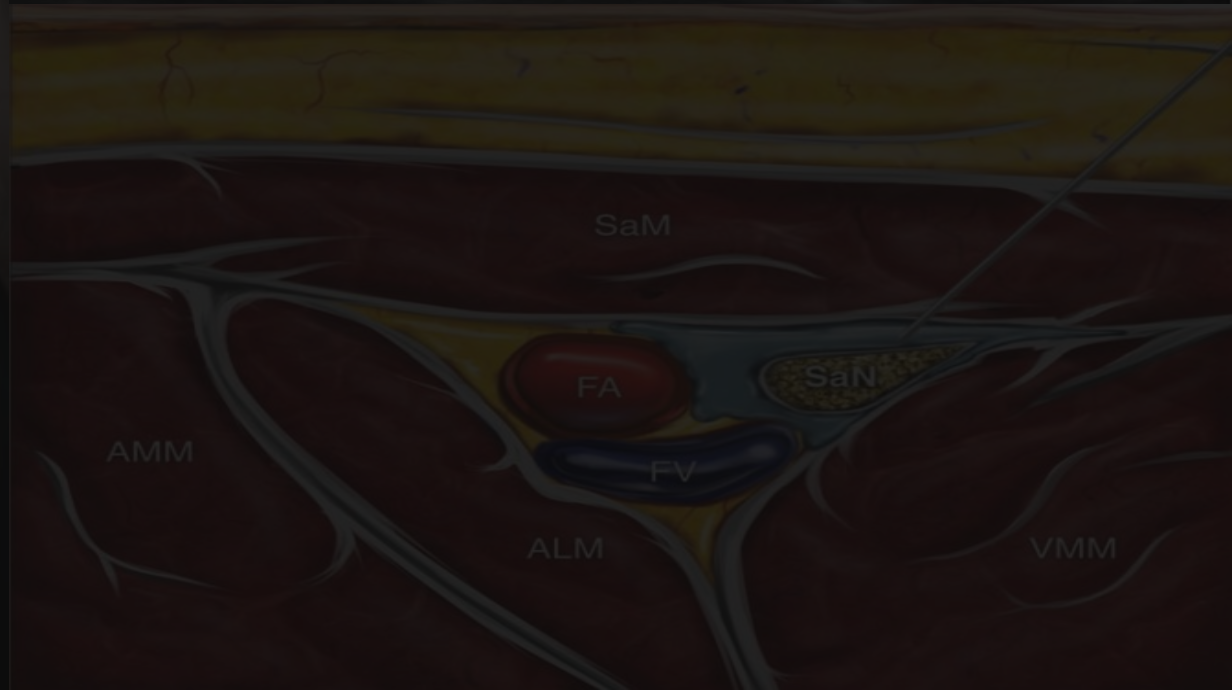
ALM
VMM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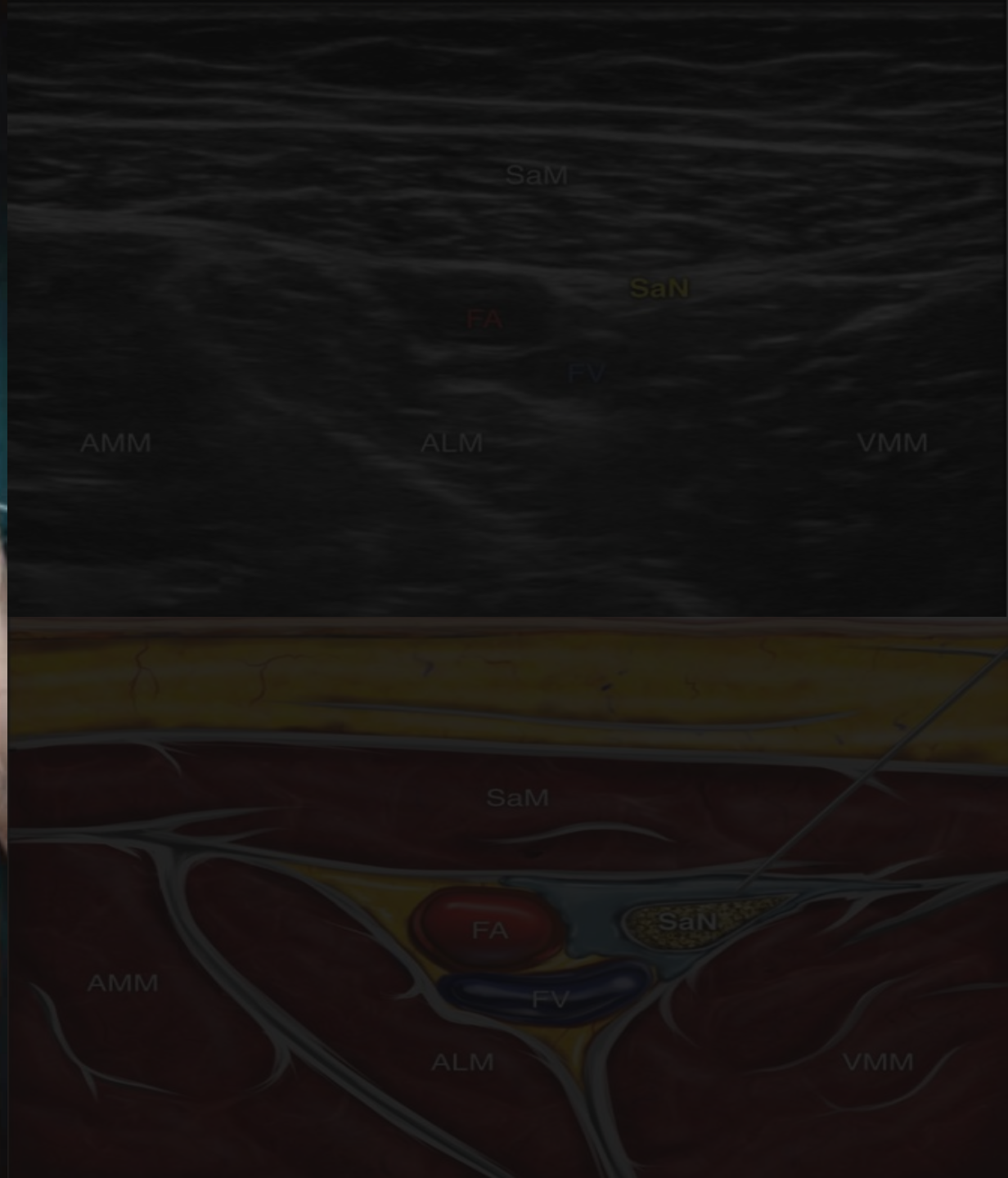
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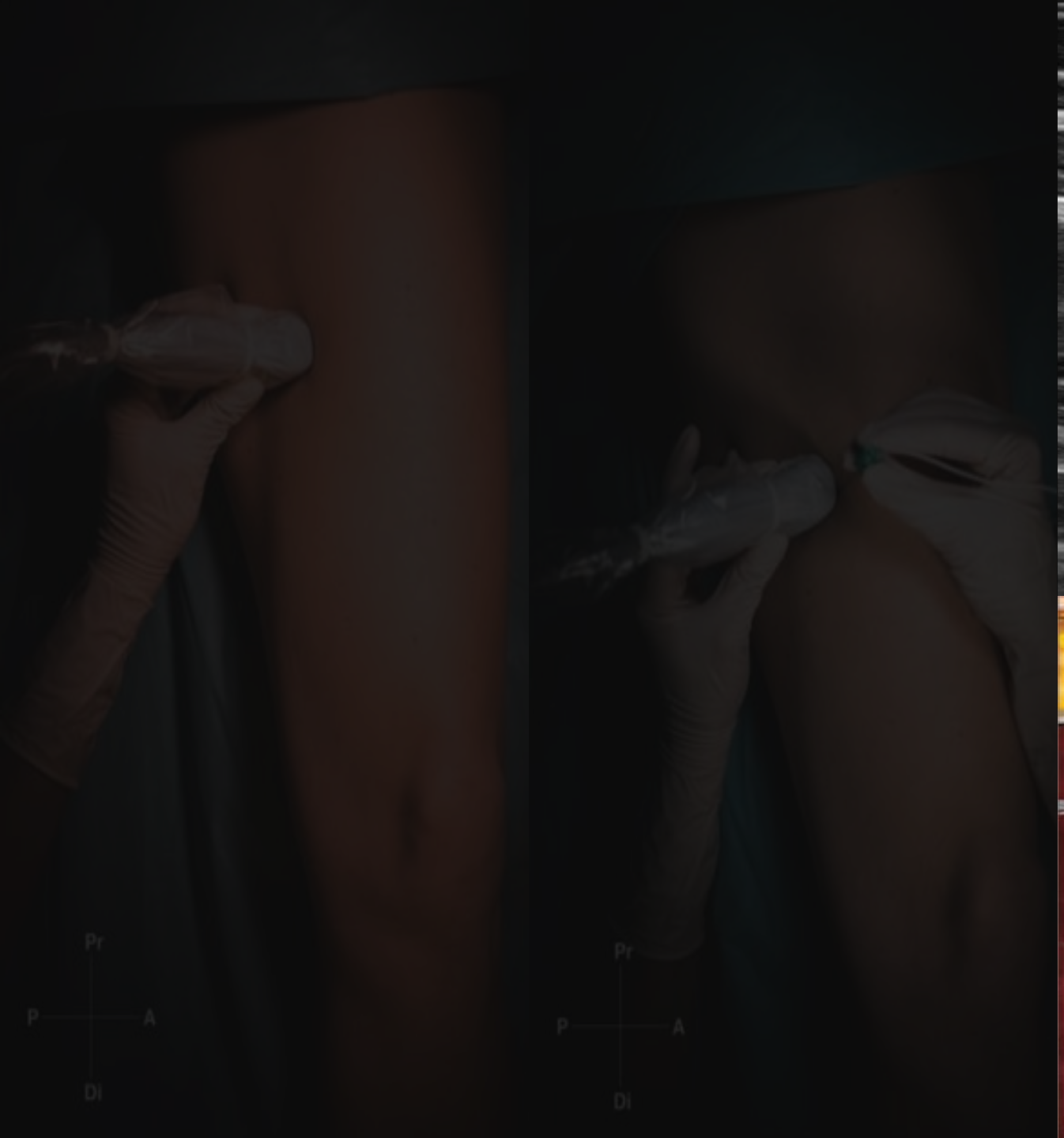
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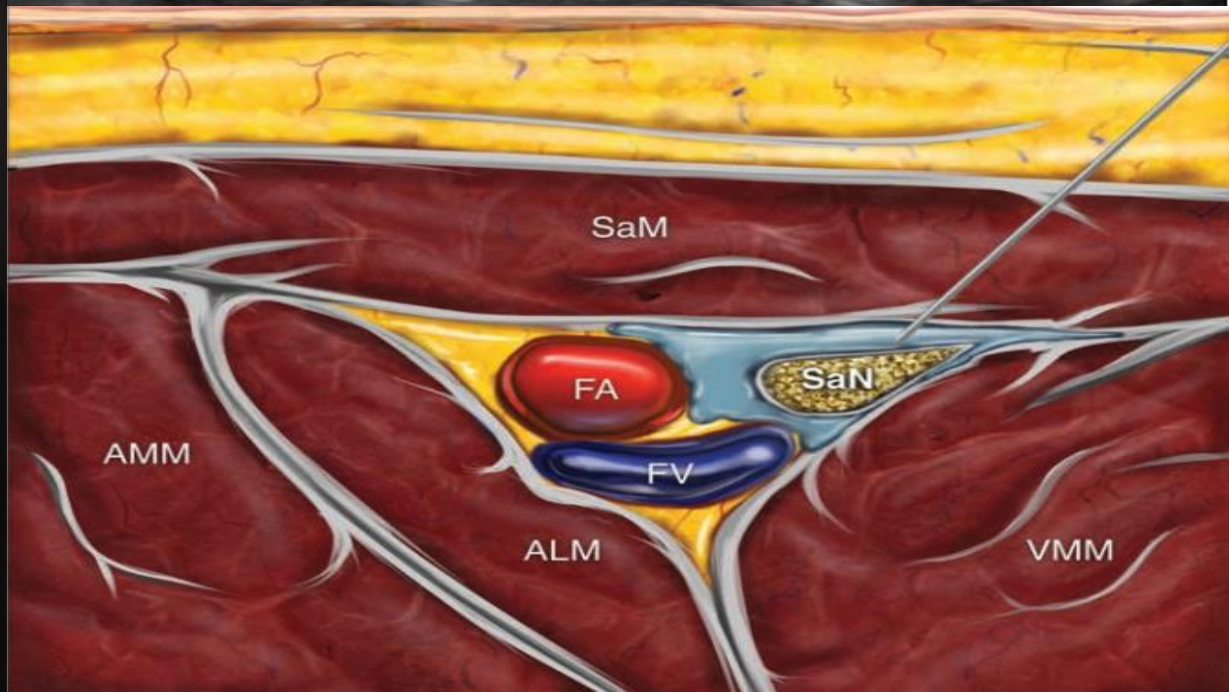
SaM
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ALM
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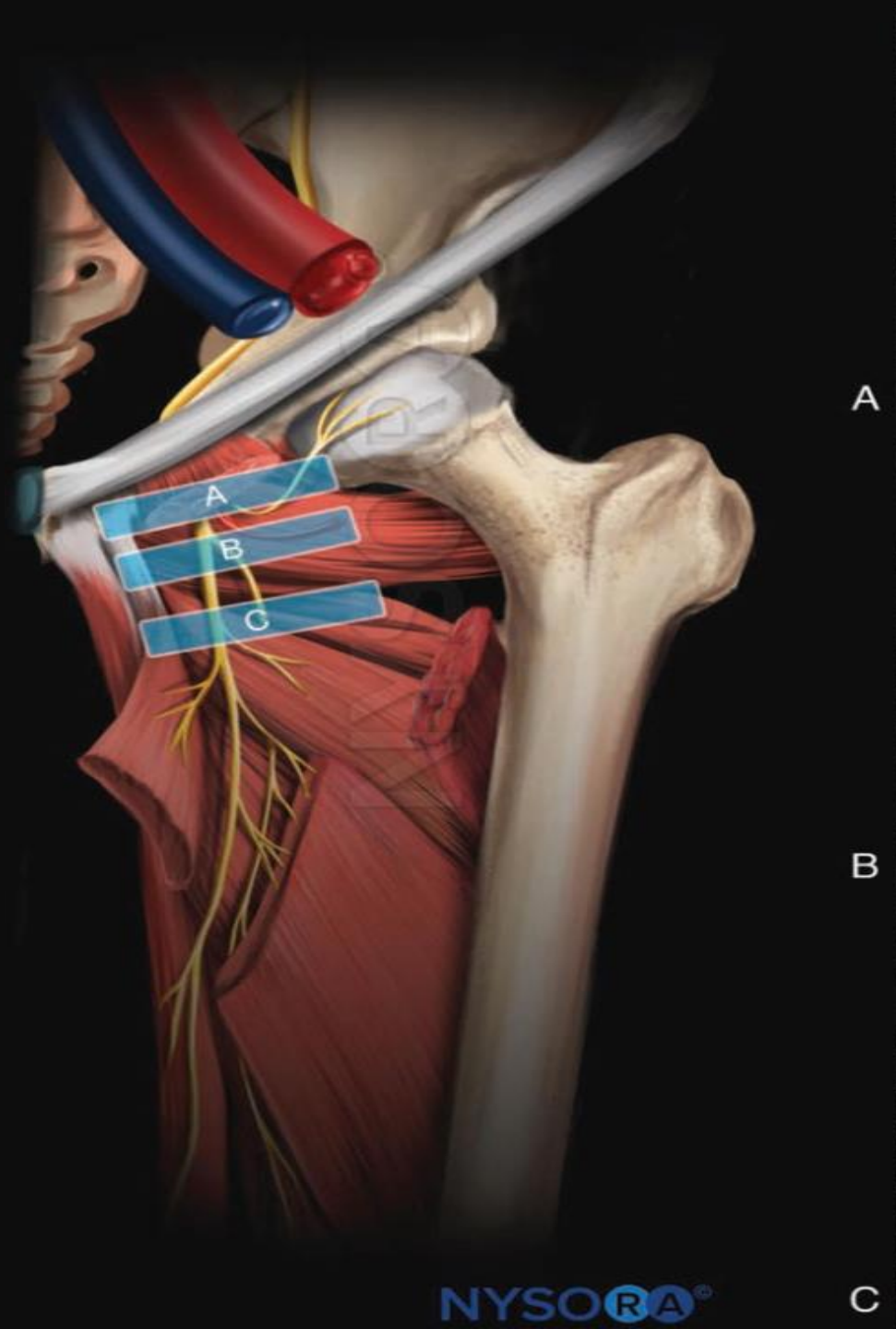
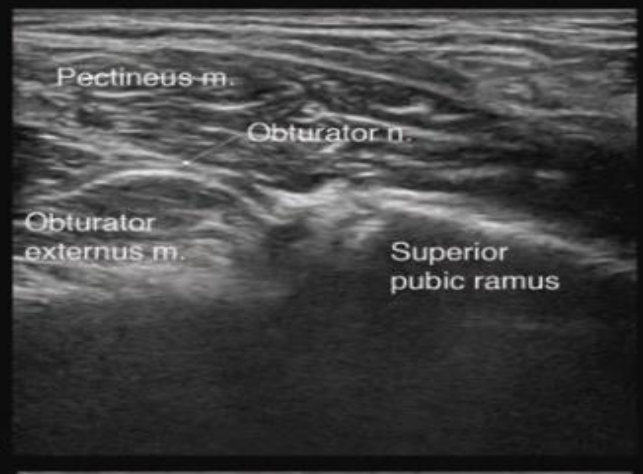
Obturator Nerve Block

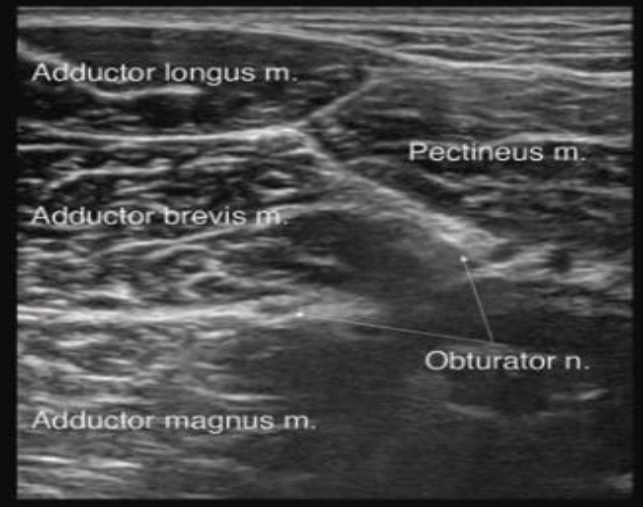
- Block of the obturator nerve at the inguinal crease.
- **Indications:** Supplemental analgesia for hip and knee surgeries (considered as rescue block for knee surgery), prevention of thigh adduction response during transurethral bladder surgery, relief of painful or permanent hip adductor spasticity
- **Goal:** Local anesthetic (LA) spread in the fascial planes containing the branches of the obturator nerve
- **Probe:** High-frequency linear probe
- **Local anesthetic volume:** 5 to 10 mL in each interfascial space or around each branch of the obturator nerve.

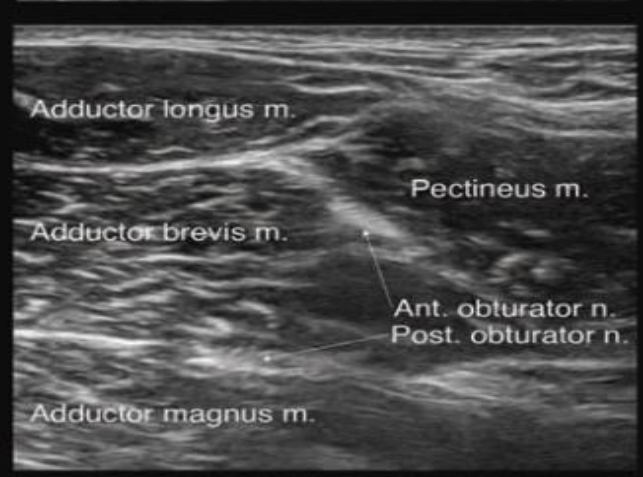
The anterior branch of the obturator nerve travels between the adductor longus and adductor brevis muscles

The posterior branch travels in the fascia between the adductor brevis and adductor magnus muscles










P
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M
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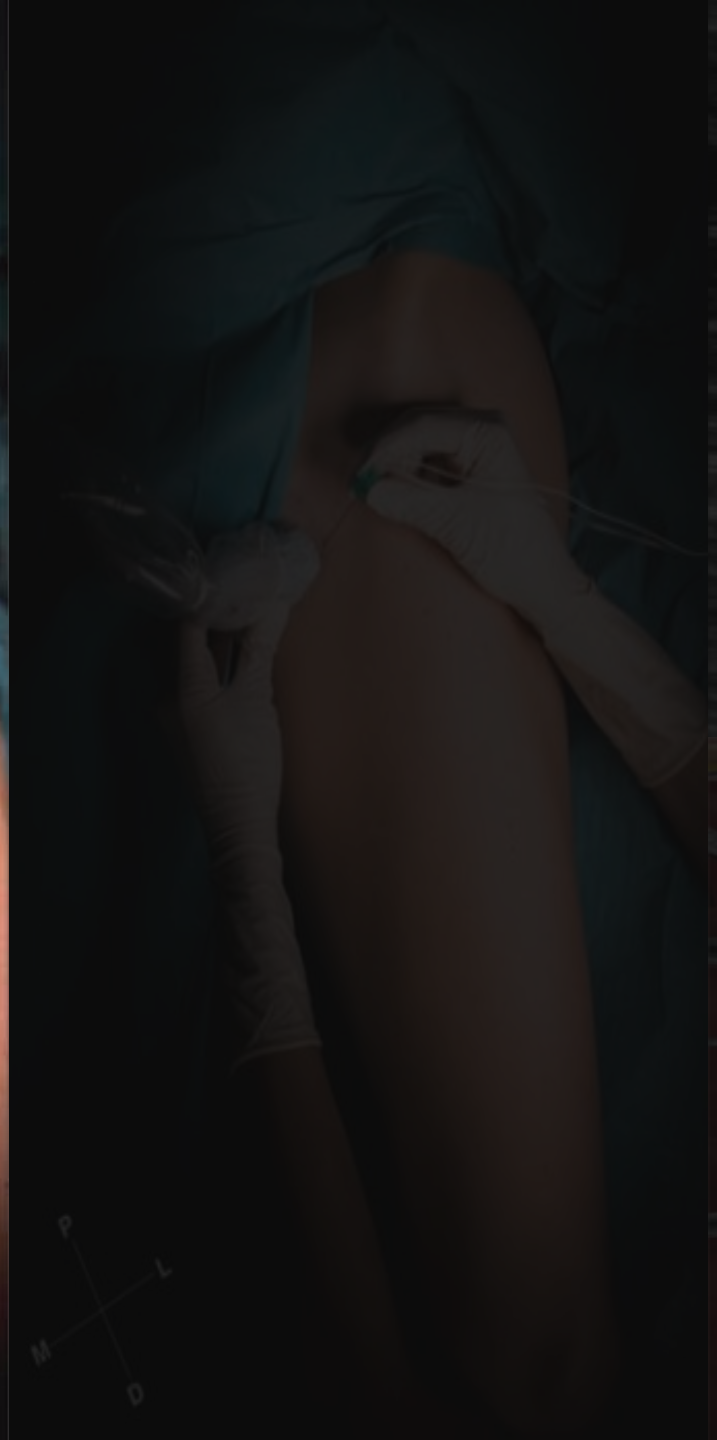
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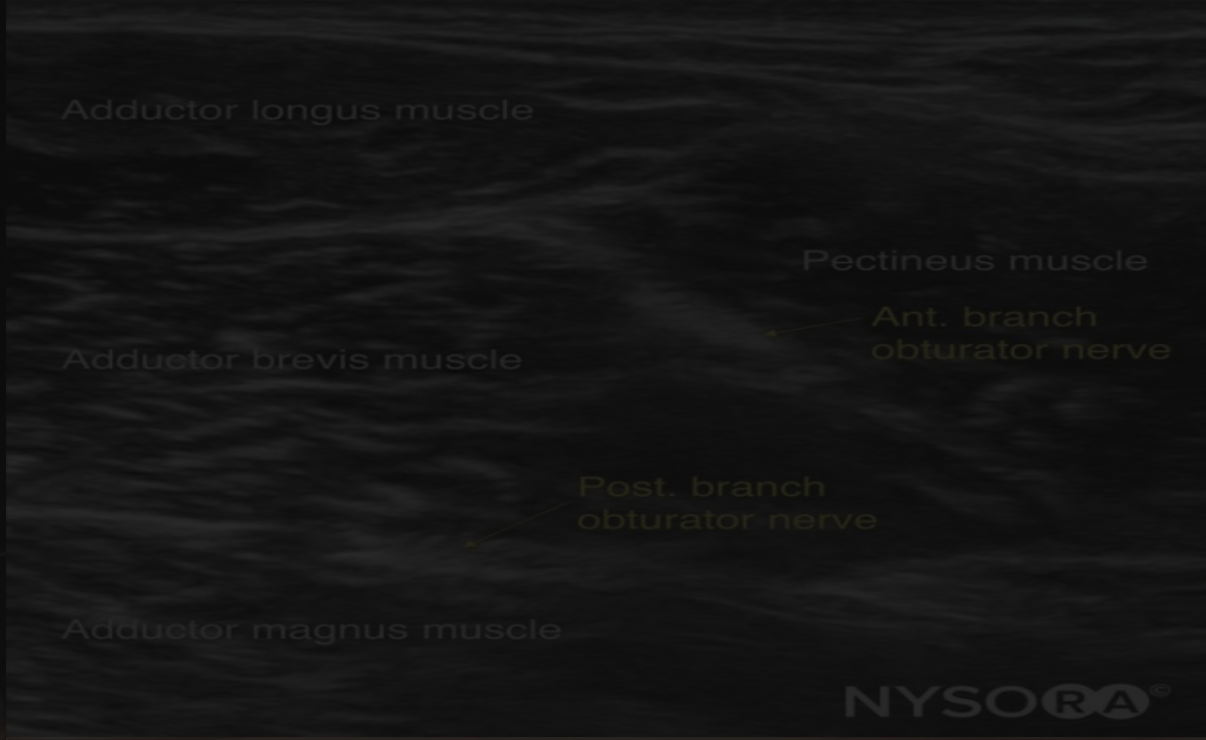
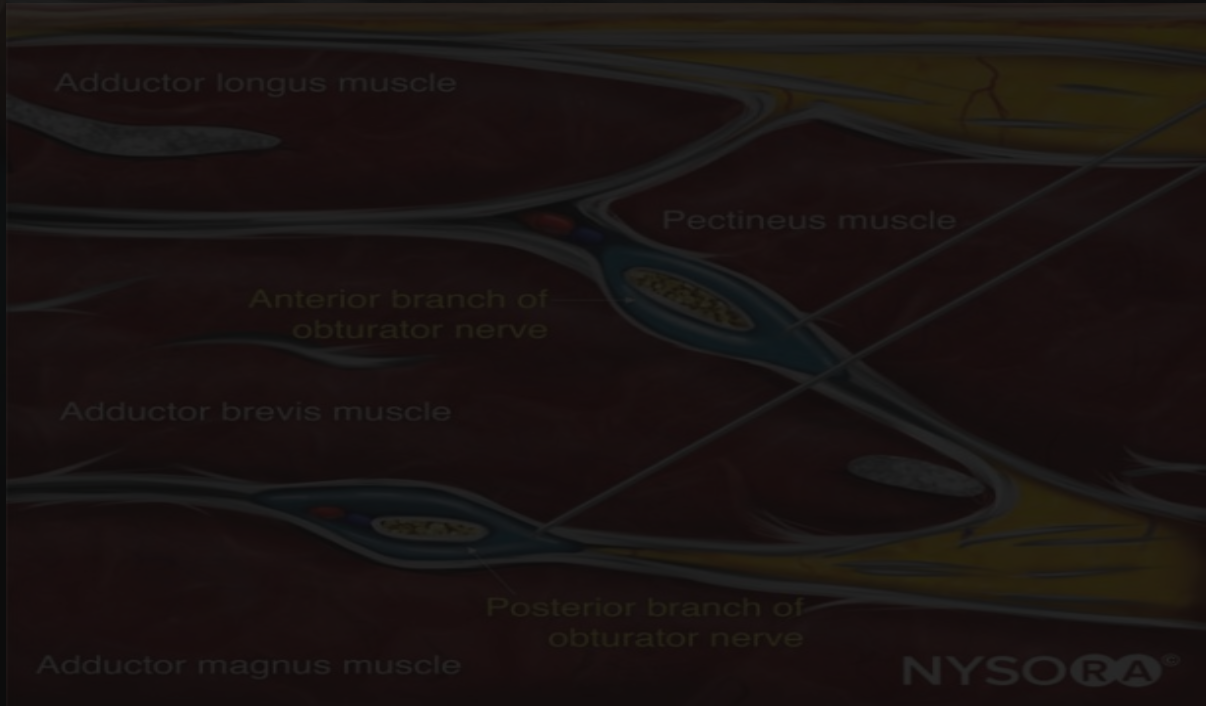

Adductor longus muscle
Pectineus muscle
Ant. branch
obturator nerve
Adductor brevis muscle
Post. branch
obturator nerve
Adductor magnus muscle
NYSORA


Adductor longus muscle
Pectineus muscle
Anterior branch of
obturator nerve
Adductor brevis muscle
Posterior branch of
obturator nerve
Adductor magnus muscle
NYSORA


P
L
M
D


P
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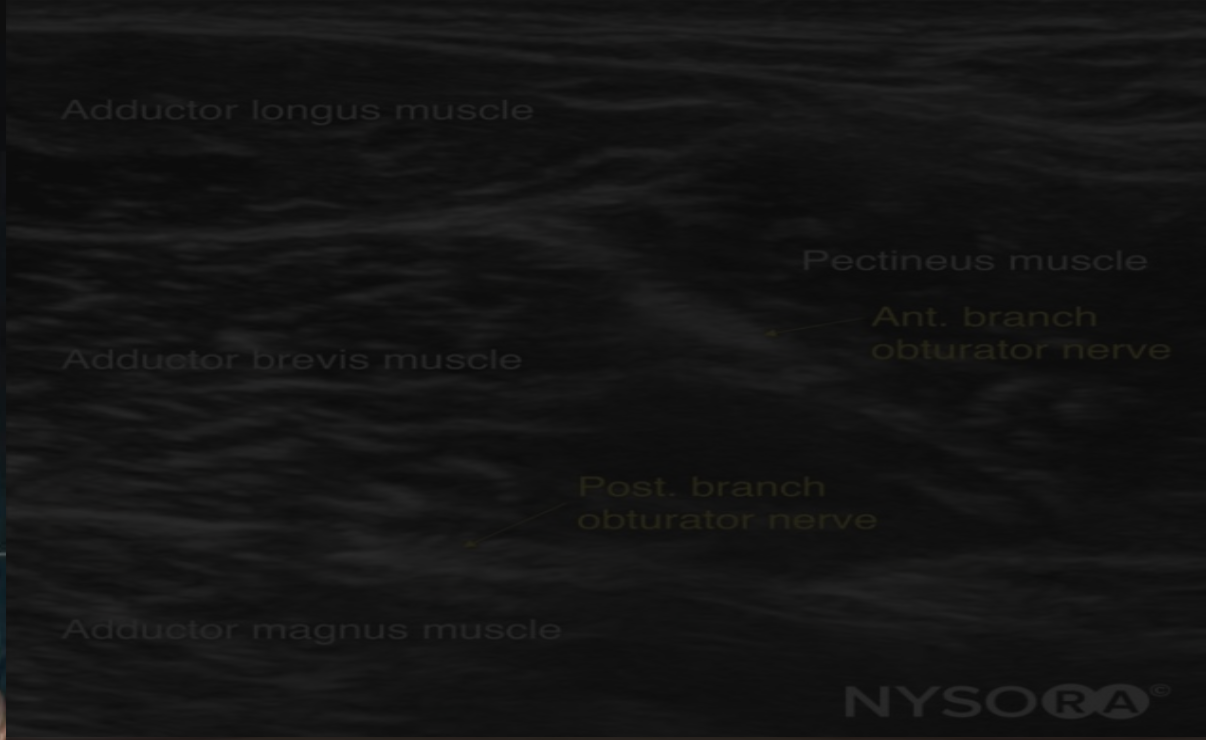
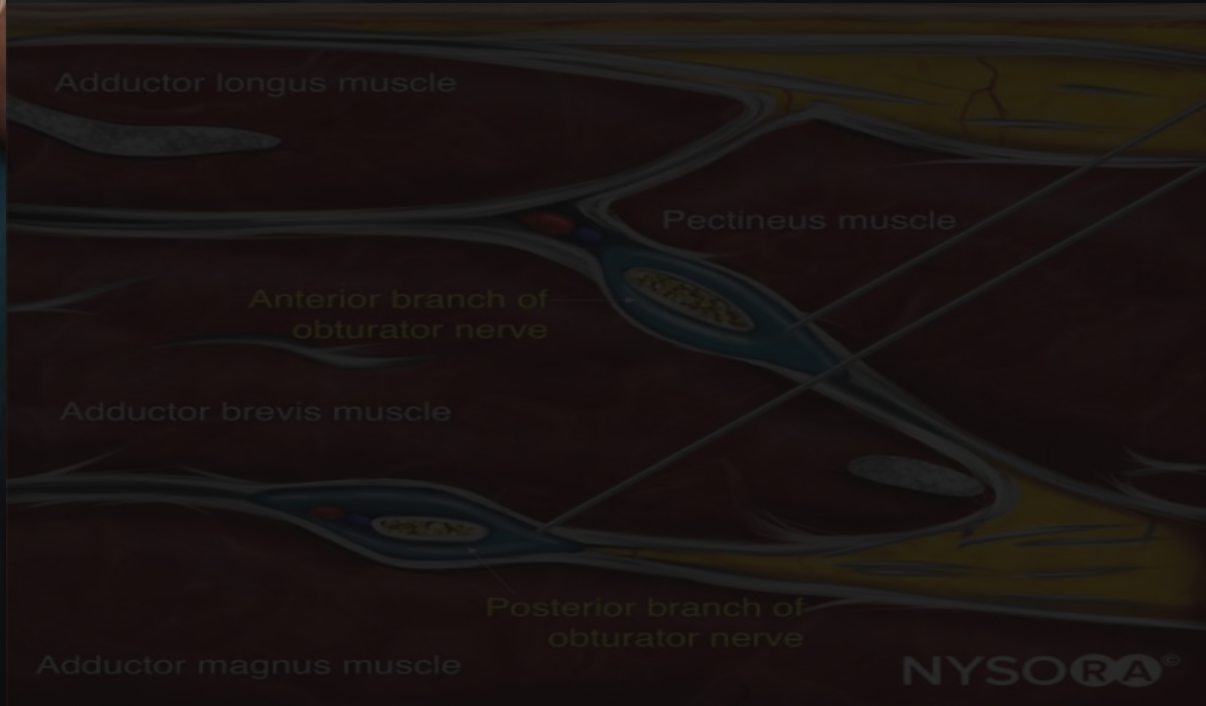
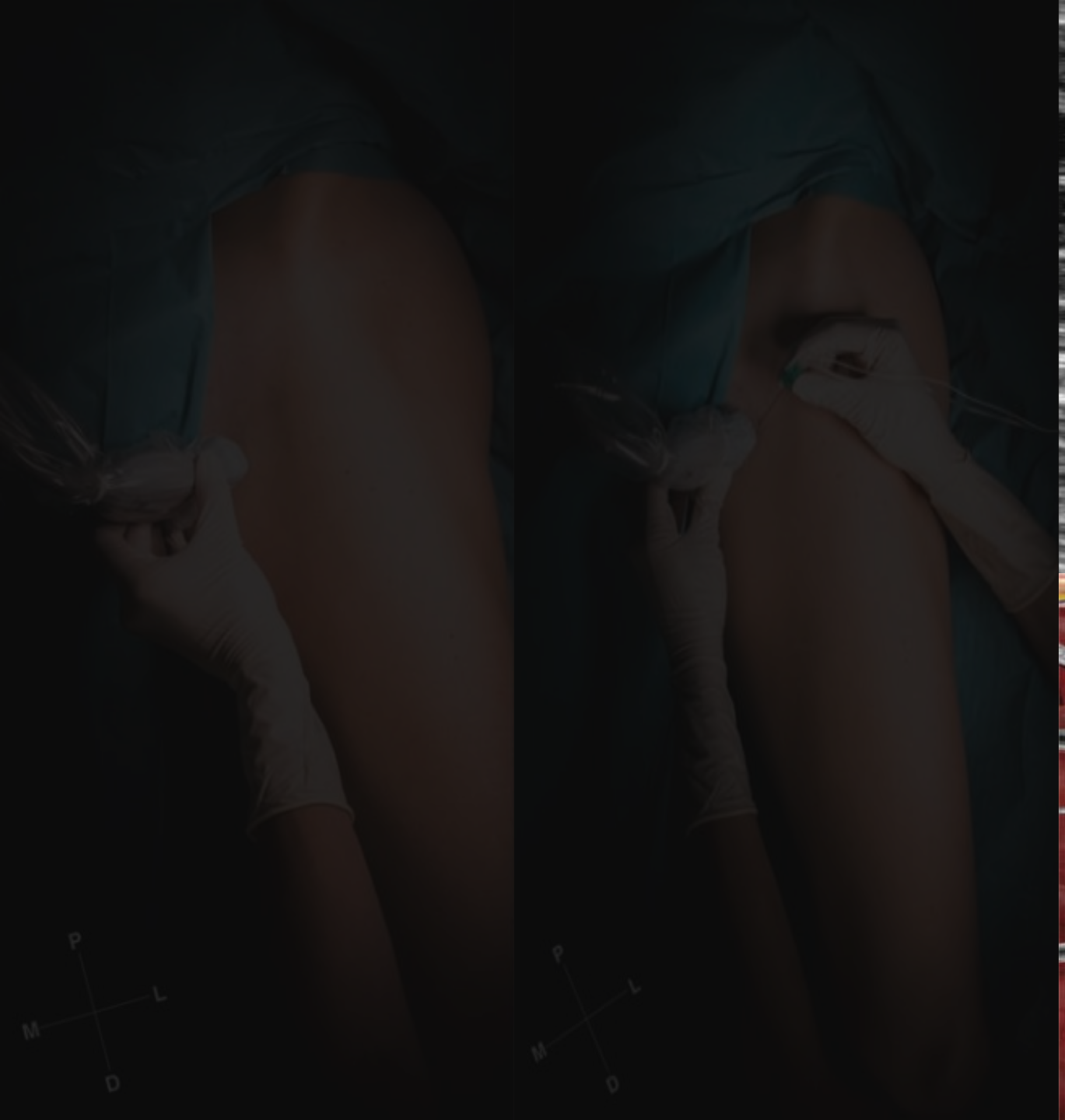

Adductor longus muscle
Pectineus muscle
Ant. branch
obturator nerve
Adductor brevis muscle
Post. branch
obturator nerve
Adductor magnus muscle
NYSORA


Adductor longus muscle
Pectineus muscle
Anterior branch of
obturator nerve
Adductor brevis muscle
Posterior branch of
obturator nerve
Adductor magnus muscle
NYSORA


P
L
M
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P
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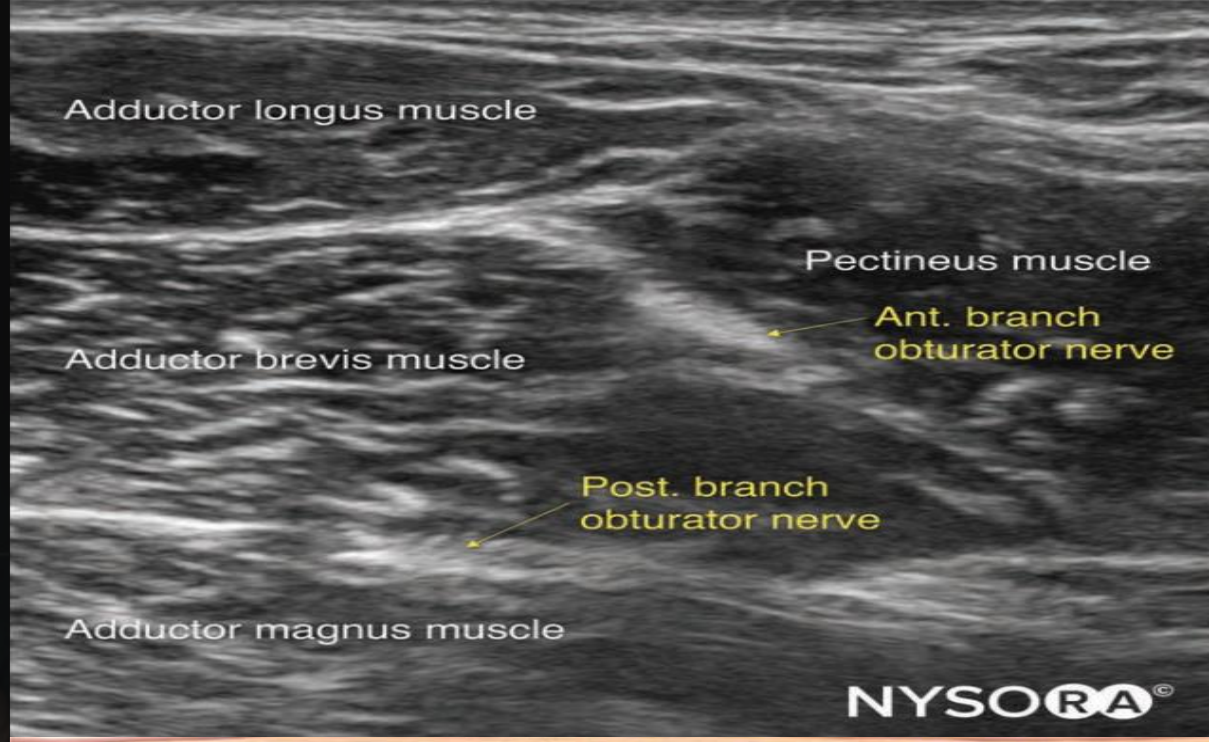
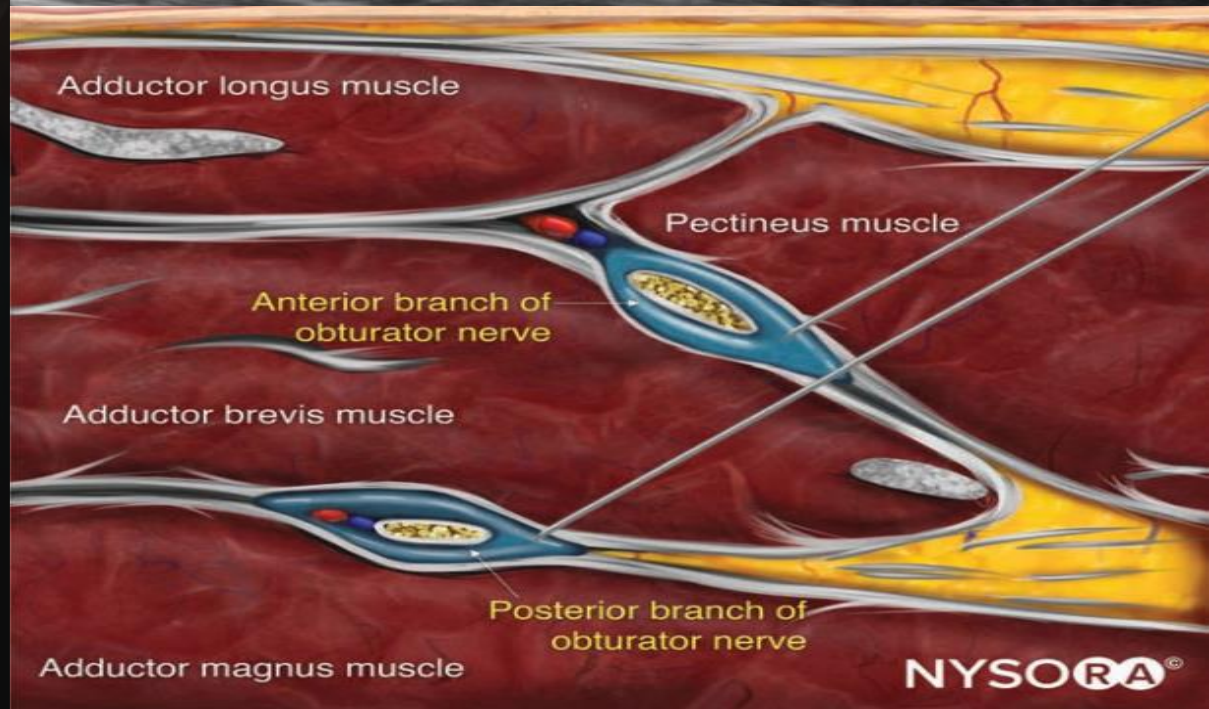
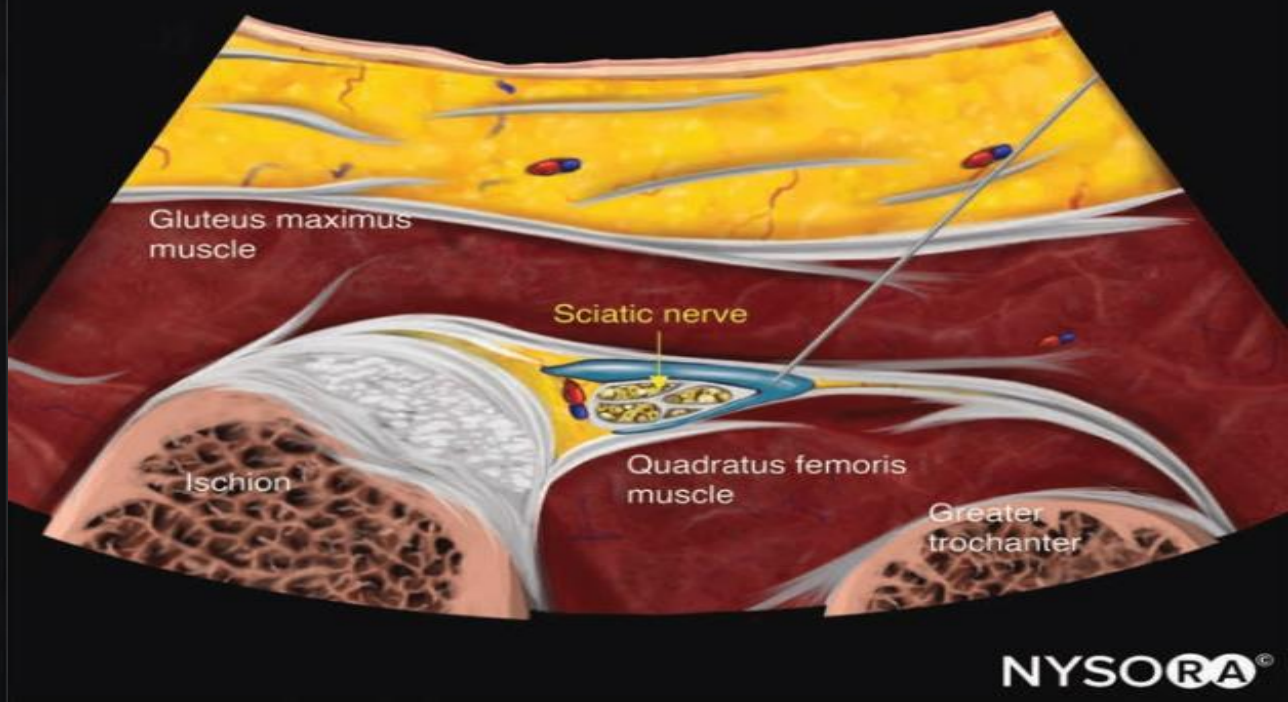

Adductor longus muscle
Pectineus muscle
Ant. branch
obturator nerve
Adductor brevis muscle
Post. branch
obturator nerve
Adductor magnus muscle
NYSORA©


Adductor longus muscle
Pectineus muscle
Anterior branch of
obturator nerve
Adductor brevis muscle
Posterior branch of
obturator nerve
Adductor magnus muscle
NYSORA©

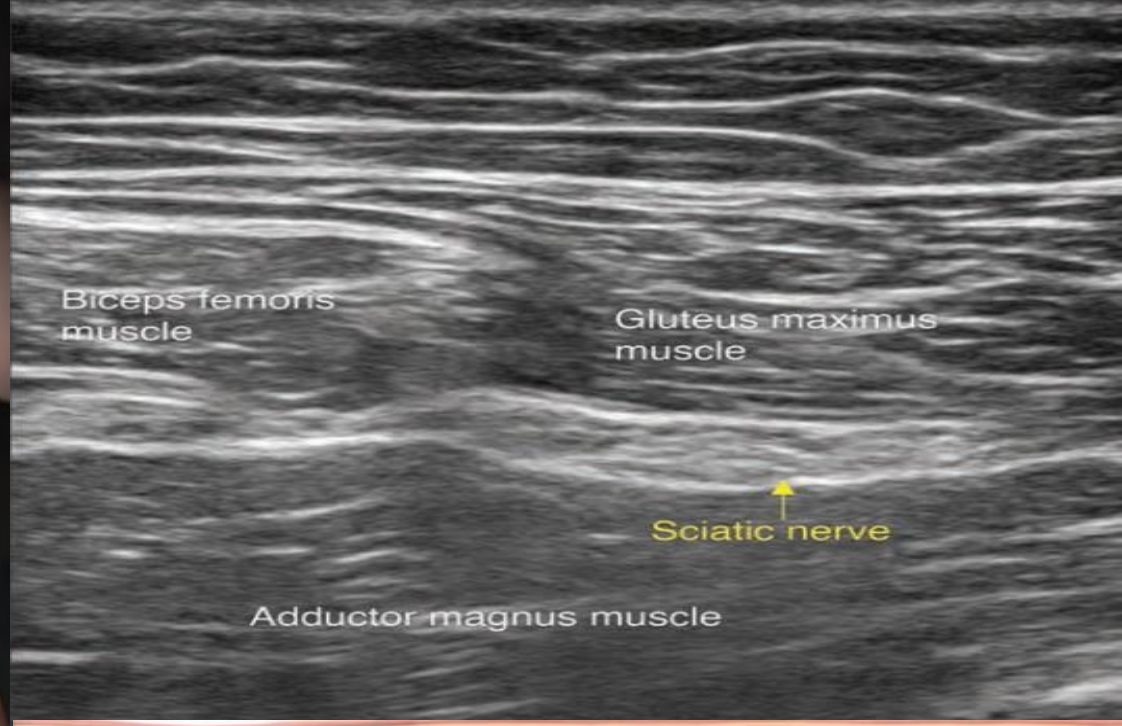
Proximal Sciatic Nerve Block

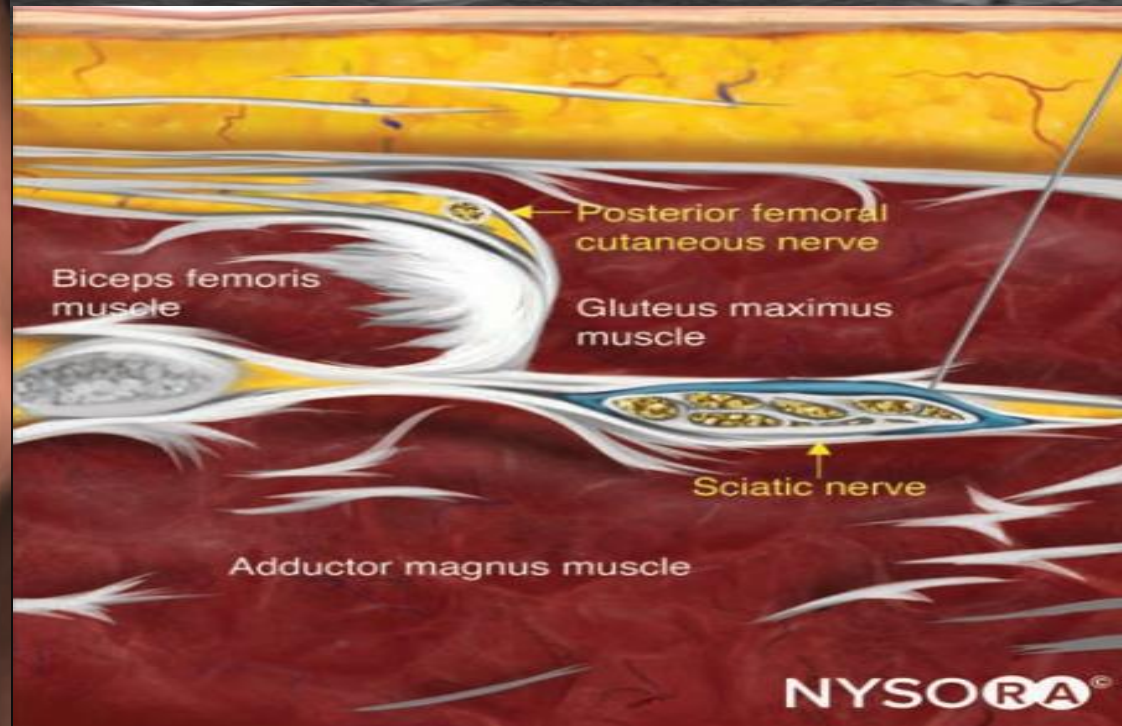
- Block of the sciatic nerve at the gluteal, subgluteal, or proximal thigh level.
- **Indications:** Anesthesia and analgesia for foot and ankle surgery, procedures involving the posterior aspect of the thigh and knee, and for above-knee amputation
- **Goal:** Local anesthetic spread within the sheath containing the sciatic nerve
- **Probe:** Low-frequency curvilinear probe
- **Local anesthetic volume:** 10 to 20 mL



Sciatic nerve at the gluteal level

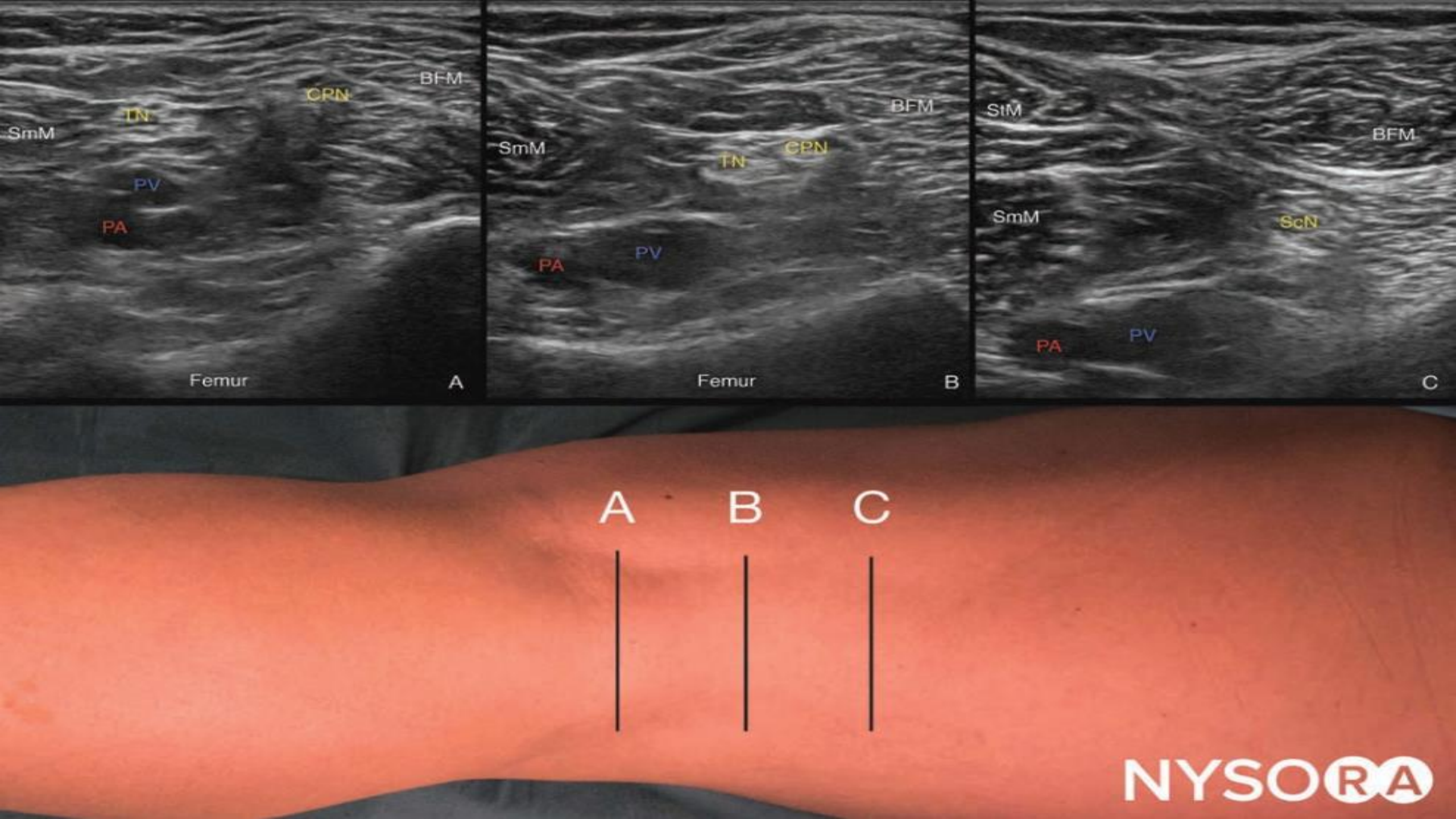
Sciatic nerve at the subgluteal level





Popliteal Sciatic Block

- Block of the sciatic nerve at the popliteal fossa
- **Indications:** Foot and ankle surgery; analgesia after major knee surgery
- **Goal:** Local anesthetic (LA) spread within the sciatic nerve sheath (Vloka's sheath) between tibial and common peroneal nerves
- **Probe:** High-frequency linear probe
- **Local anesthetic volume:** 15 to 20 mL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CPN
TN
SmM
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PA
Femur
A
BFM
SmM
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ScN
PA
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C
A
B
C
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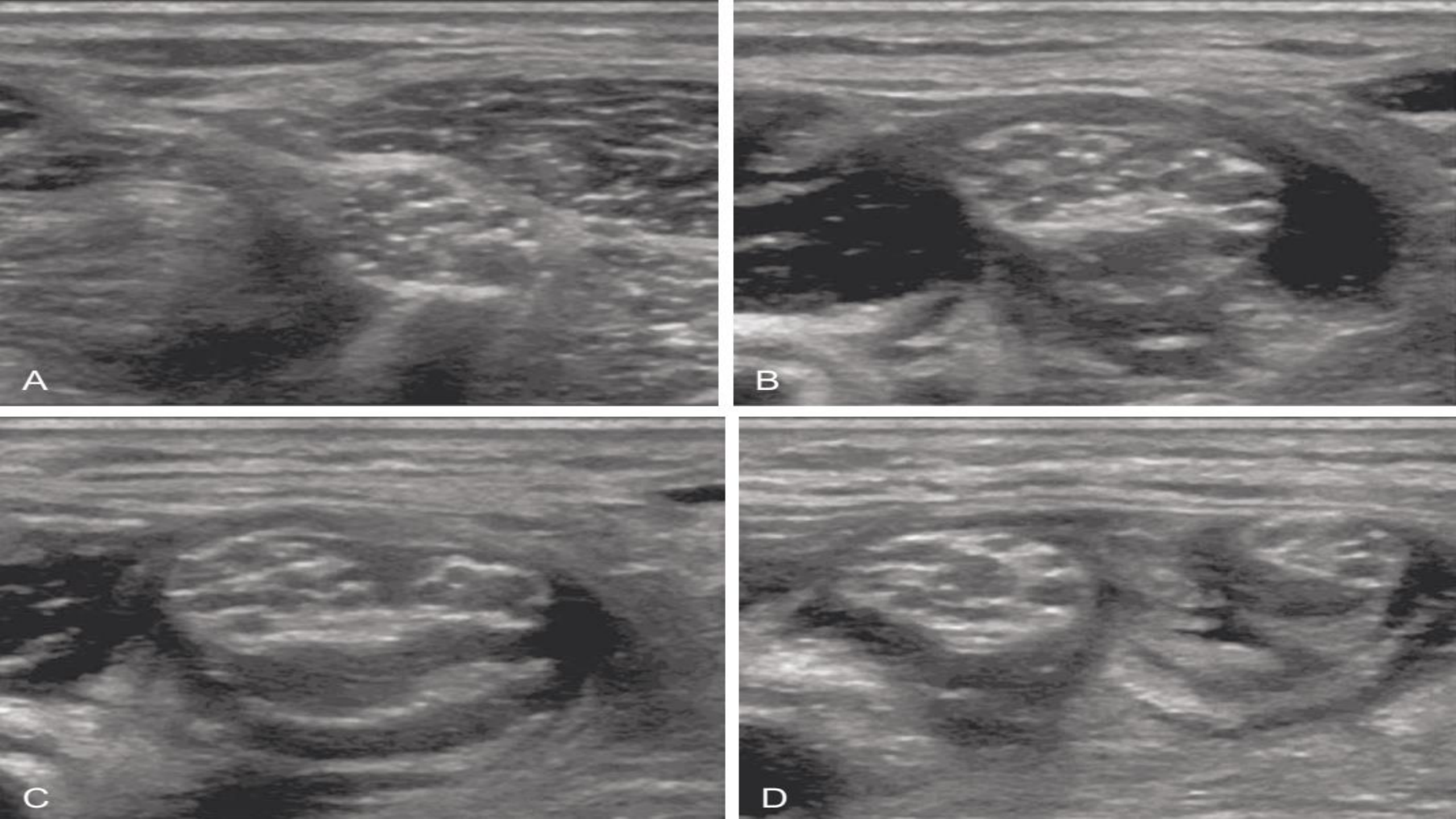
A
B
C
D

Patient positions for popliteal block


P
M
L
D

P
M
L
D


BFM
SmM
TN
CPN
Vloka's sheath
PV
PA
Femur
NYSORA


SmM
BFM
TN
CPN
Vloka's sheath
PV
PA
NYSORA


P
M
L
D


P
M
L
D


BFM
SmM
CPN
TN
Vloka's sheath
PV
PA
Femur
NYSORA


SmM
BFM
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Vloka's sheath
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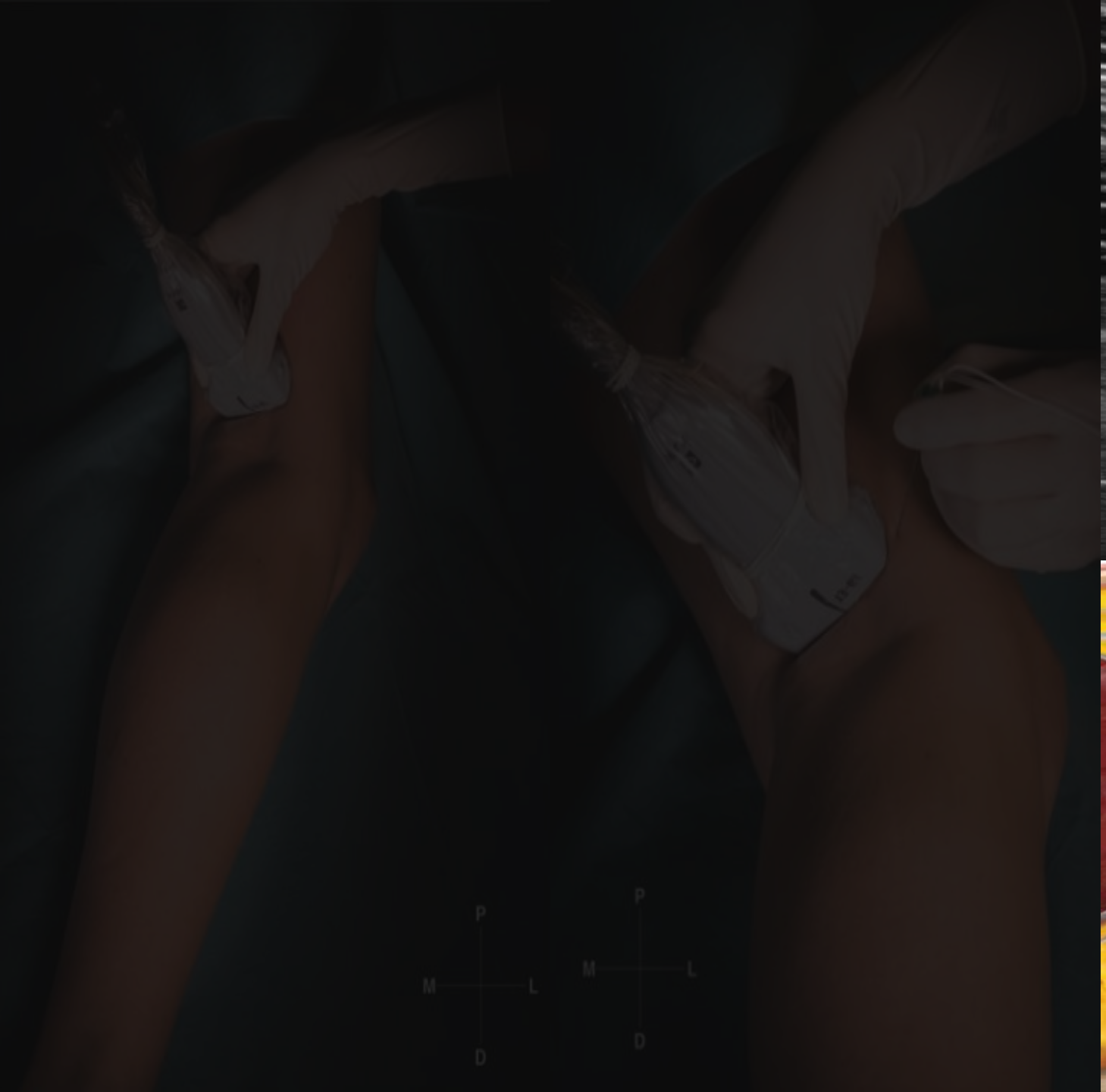
NYSORA


P
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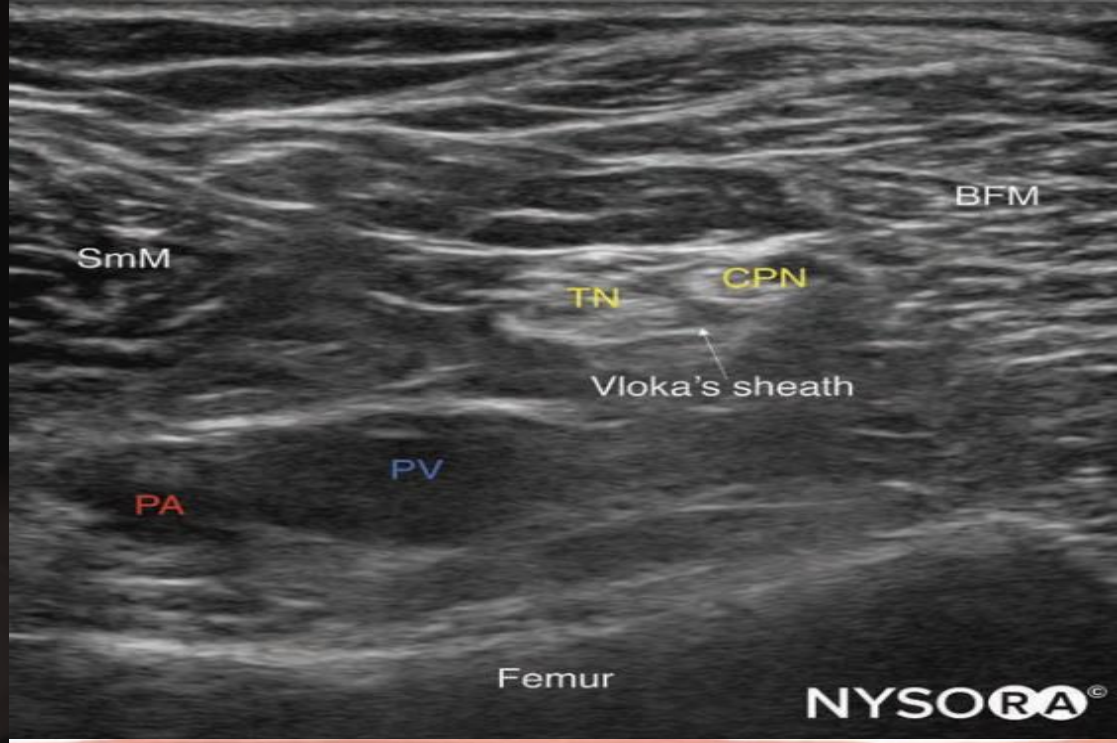
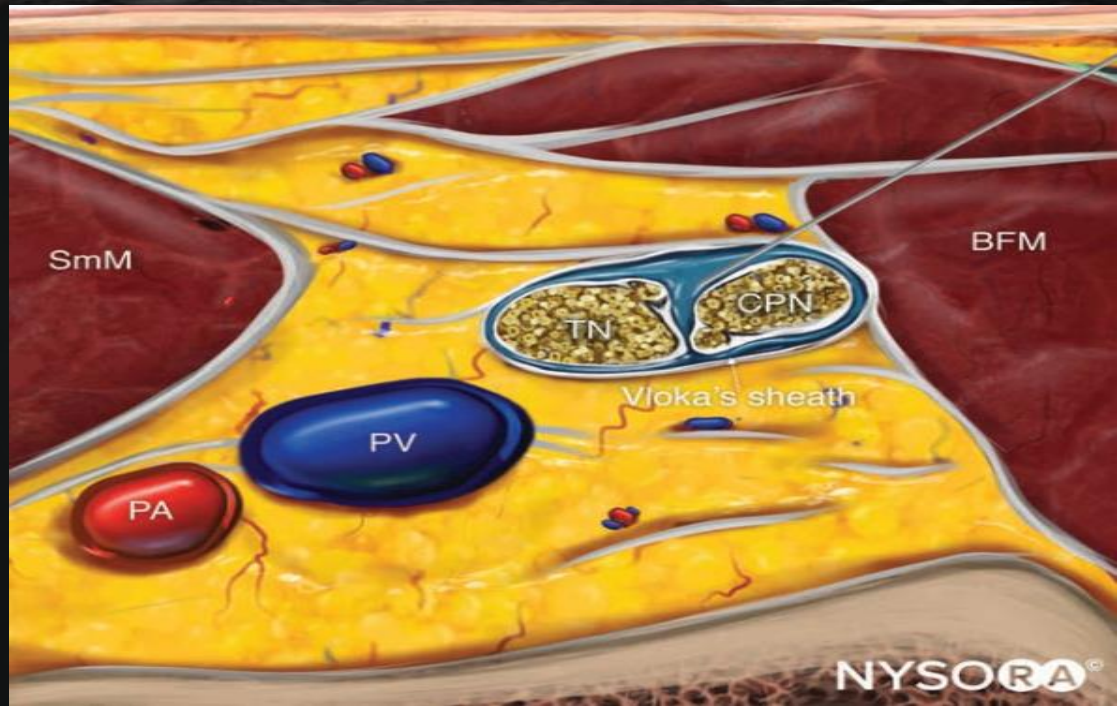
D


BFM
SmM
TN
CPN
Vloka's sheath
PV
PA
Femur
NYSORA©


SmM
BFM
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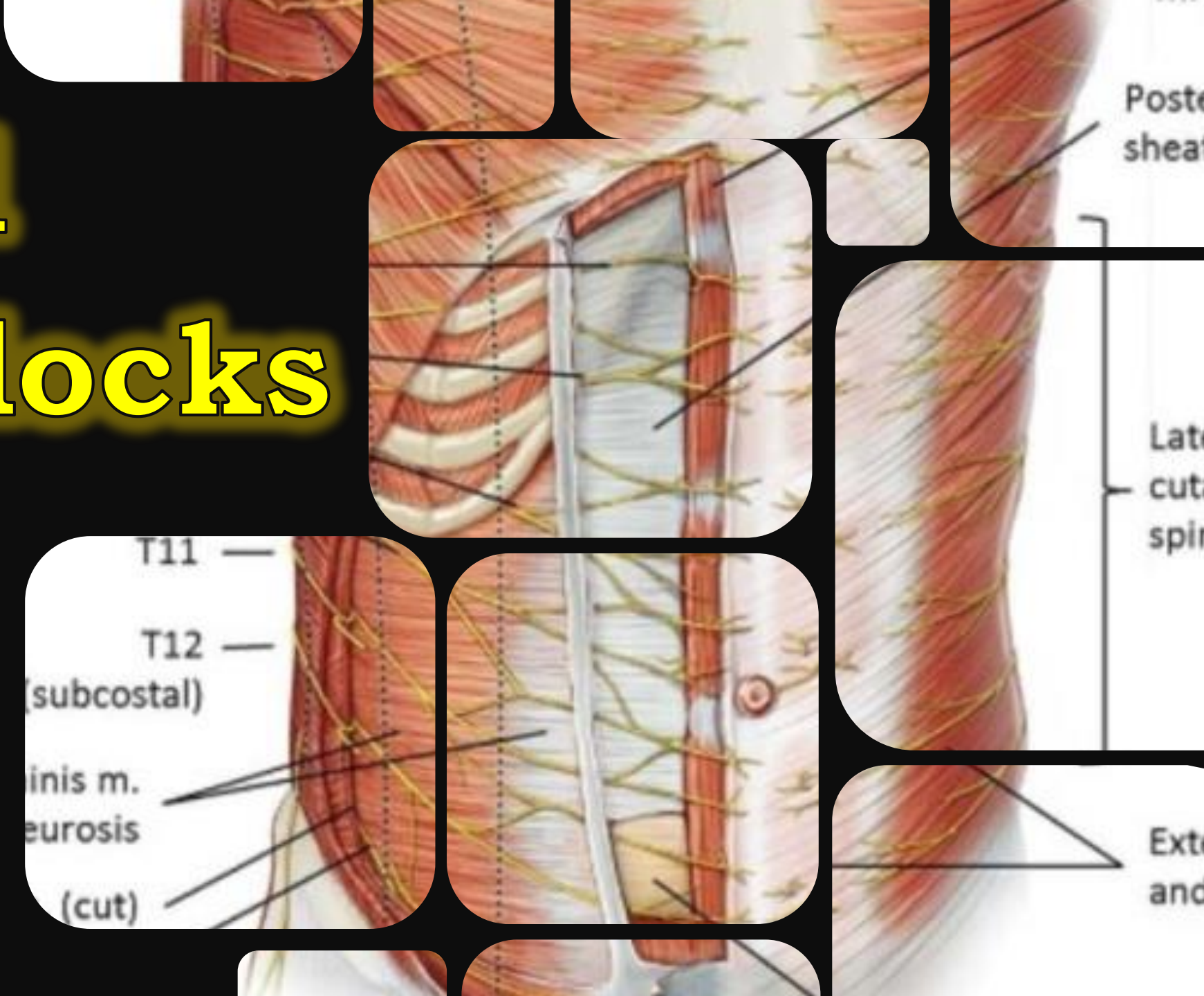
CPN
Vloka's sheath
PV
PA
NYSORA©

Truncal Blocks



Erector Spinae

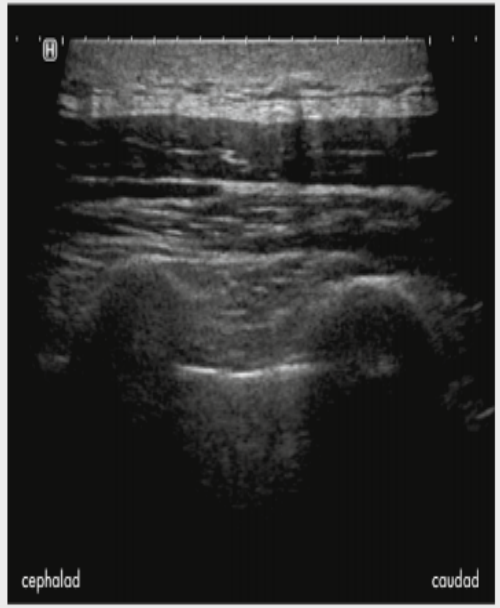
Erector Spinae Plane – thoracic and upper abdominal surgery, posterior rib fractures

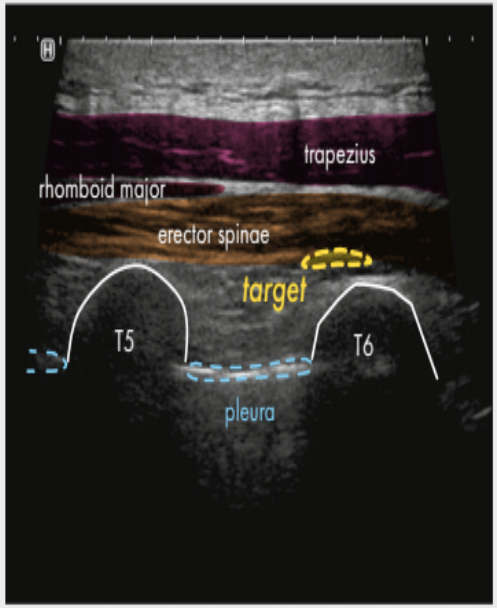
Identify: Count the spinous processes to identify the correct spinal level. In the paramedian plane identify the corresponding transverse process, overlying muscle layers and underlying pleura.

Target: Using an in-plane approach from the cephalic end of the probe, the target is the fascial plane deep to the erector spinae muscle.

Tips: Choose a site where the needle track would hit the transverse process if it was inserted too far - this acts as a safety net. Look for free spread of local anaesthetic in the fascial plane and use ultrasound to assess the segmental spread up and down the spine. This is a suitable site for catheter techniques for chest wall injuries.

Avoid: Lateral injection - be sure to identify transverse processes not ribs. Calculate the maximum local anaesthetic dose and dilute as necessary to achieve a suitable volume, especially with bilateral injections.





Serratus Anterior

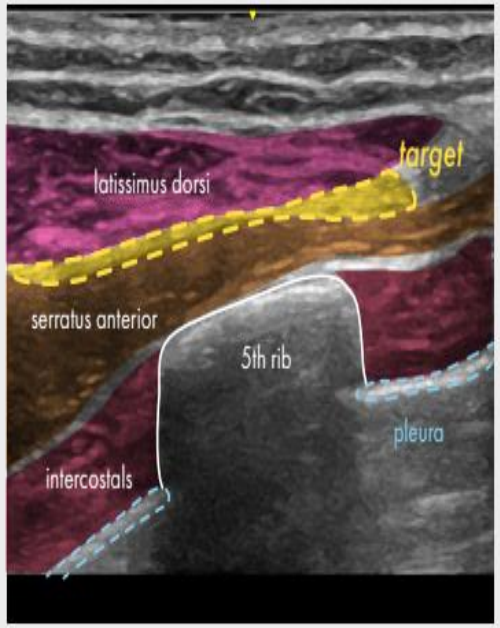
Serratus Anterior Plane – rib fractures, breast surgery, axillary surgery

Identify: Starting with the probe in a transverse plane in the mid-axillary line, scan posteriorly until the latissimus dorsi muscle appears. There is usually an artery in the serratus anterior plane (a branch of the thoracodorsal artery).

Target: The aim is to inject in the fascial plane between latissimus dorsi and serratus anterior.

Tips: This approach is also very suitable for insertion of a nerve catheter. This block relies on adequate volume for spread eg 30ml of local anaesthetic.

Avoid: Vascular puncture, intravascular injection, pneumothorax.



TAP

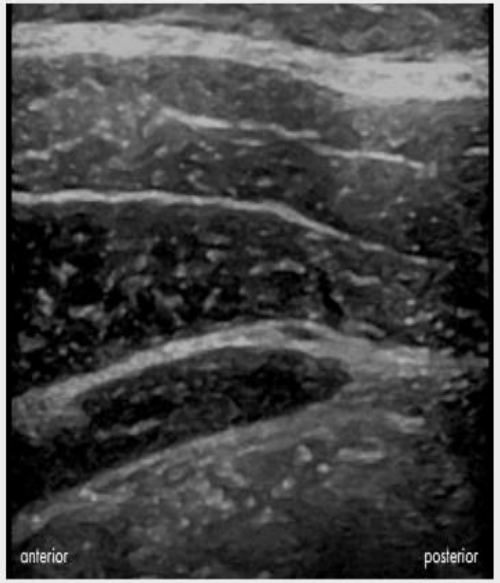
Transversus Abdominis Plane – abdominal surgery

Identify: The 3 muscle layers of the abdominal wall (external oblique, internal oblique; transversus abdominus) and trace them back posteriorly to the termination of transversus abdominus.

Target: Beneath the fascial layer between the internal oblique and tranversus abdominus muscles near the posterior limit of the transversus muscle.

Tips: The posterior target site is generally the most effective and because of the tangential approach through the abdominal wall a 100mm needle is appropriate. The block can be performed unilaterally or bilaterally, depending on surgical site, and adequate volume is required for spread eg 20-30ml each side. Visceral pain will not be blocked by a TAP block. For surgery above the umbilicus use the quadratus lumborum block.

Avoid: Intravascular injection - check for small vessels with doppler prior to injection; avoid intraperitoneal injection; be aware of total local anaesthetic dose.



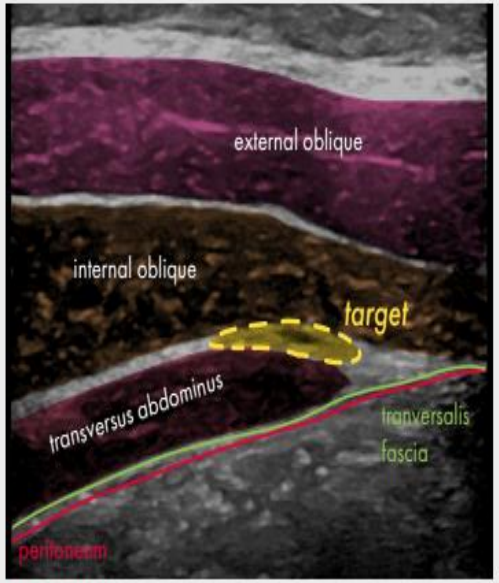


Table 5
Blocks of the trunk

Type	Nerves Blocked	Indication	Risks
Superficial cervical plexus	C1–4	• Cutaneous analgesia to the neck, anterior shoulder, and clavicle	
Intercostal	Individual injection at the vertebral level required	• Analgesia after thoracic and upper abdominal surgery • Rib fracture • Herpes zoster • Cancer	• Highest complication risk of any block • Results in highest blood levels of local anesthetic per volume injected of any block • Pneumothorax
Paravertebral	Individual injection at the vertebral level required	• Procedures of the thoracic and abdominal wall • Mastectomy • Inguinal or abdominal hernia • Nephrectomy	• Sympathectomy • Pneumothorax

Intercostal Block

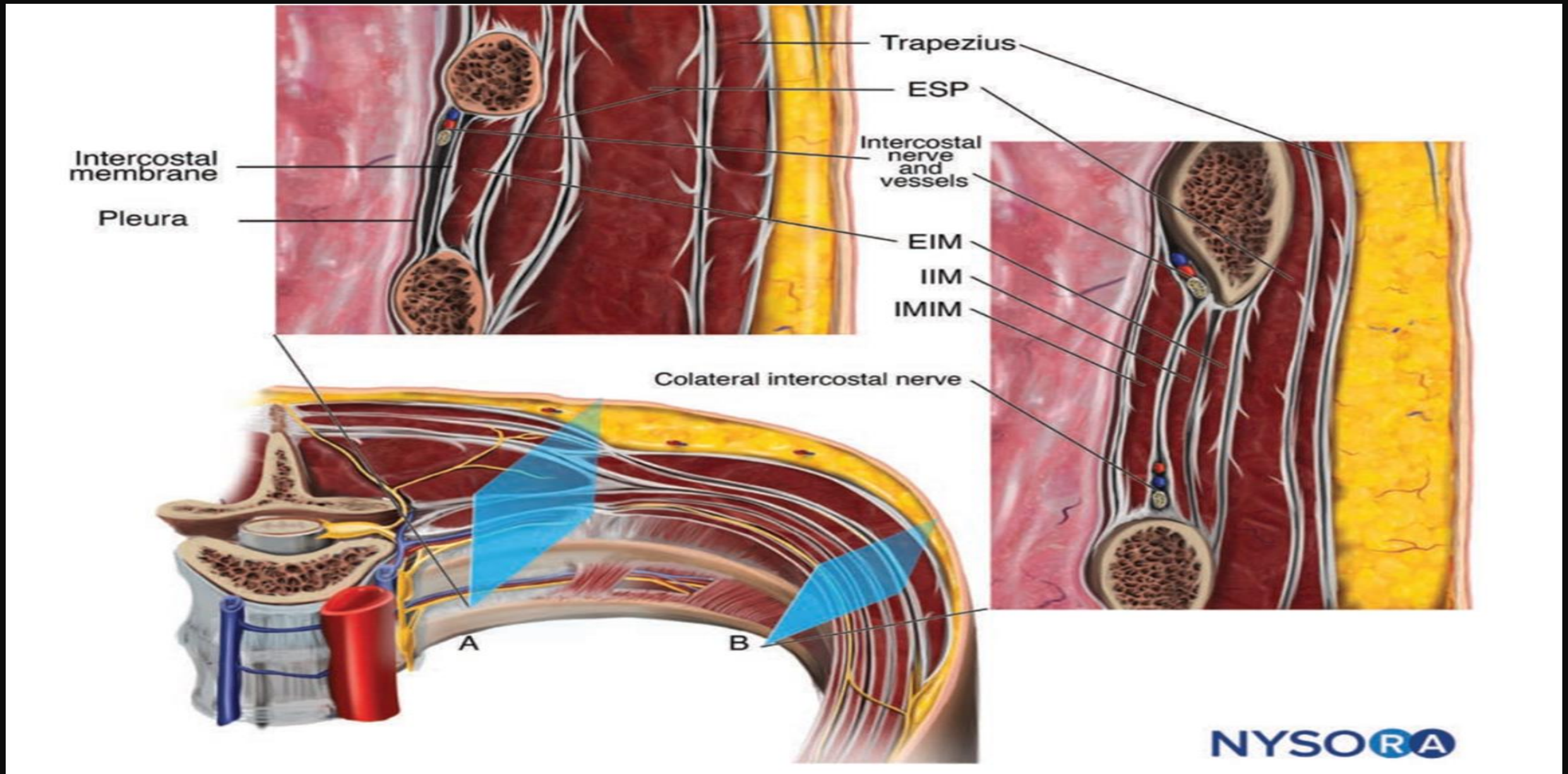
- The spinal nerves T2-T12 innervate the thoracic wall and upper abdomen
- Thoracic nerve roots divide into dorsal and ventral rami.
  The dorsal rami provide innervation to the skin and muscles of the paravertebral region. The ventral rami continue laterally as the intercostal nerves
- Initially, the nerves travel between the parietal pleura and the intercostal membrane.
  Just lateral to the angle of the rib, they enter the space between the innermost and internal intercostal muscles
- At the midaxillary line, the intercostal nerve gives rise to the lateral cutaneous branch. The continuation of the intercostal nerve terminates as the anterior cutaneous branch

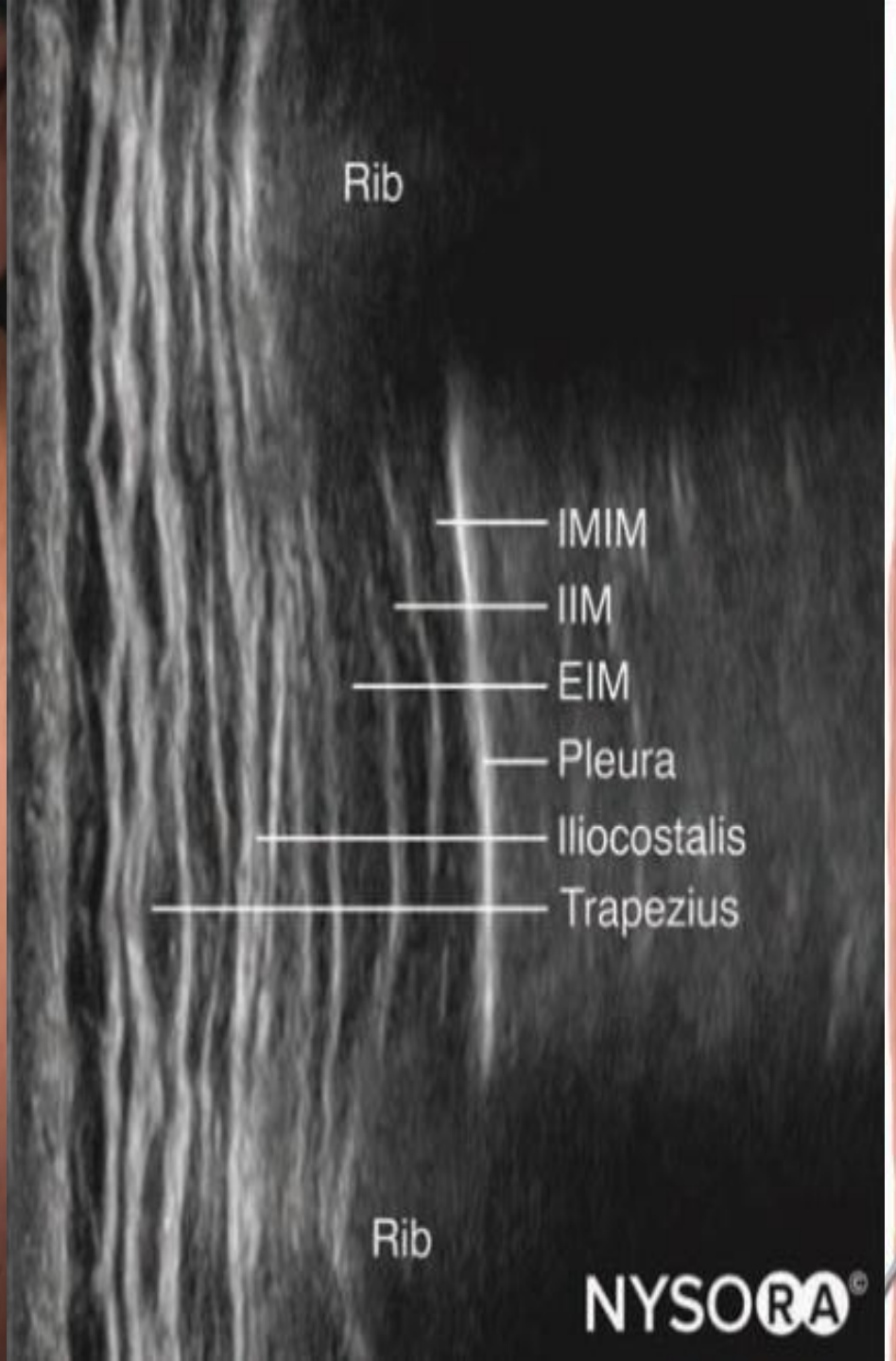
- The optimal target needle endpoint is just below the internal intercostal muscle (assure that the needle tip remains superficial to the parietal pleura)

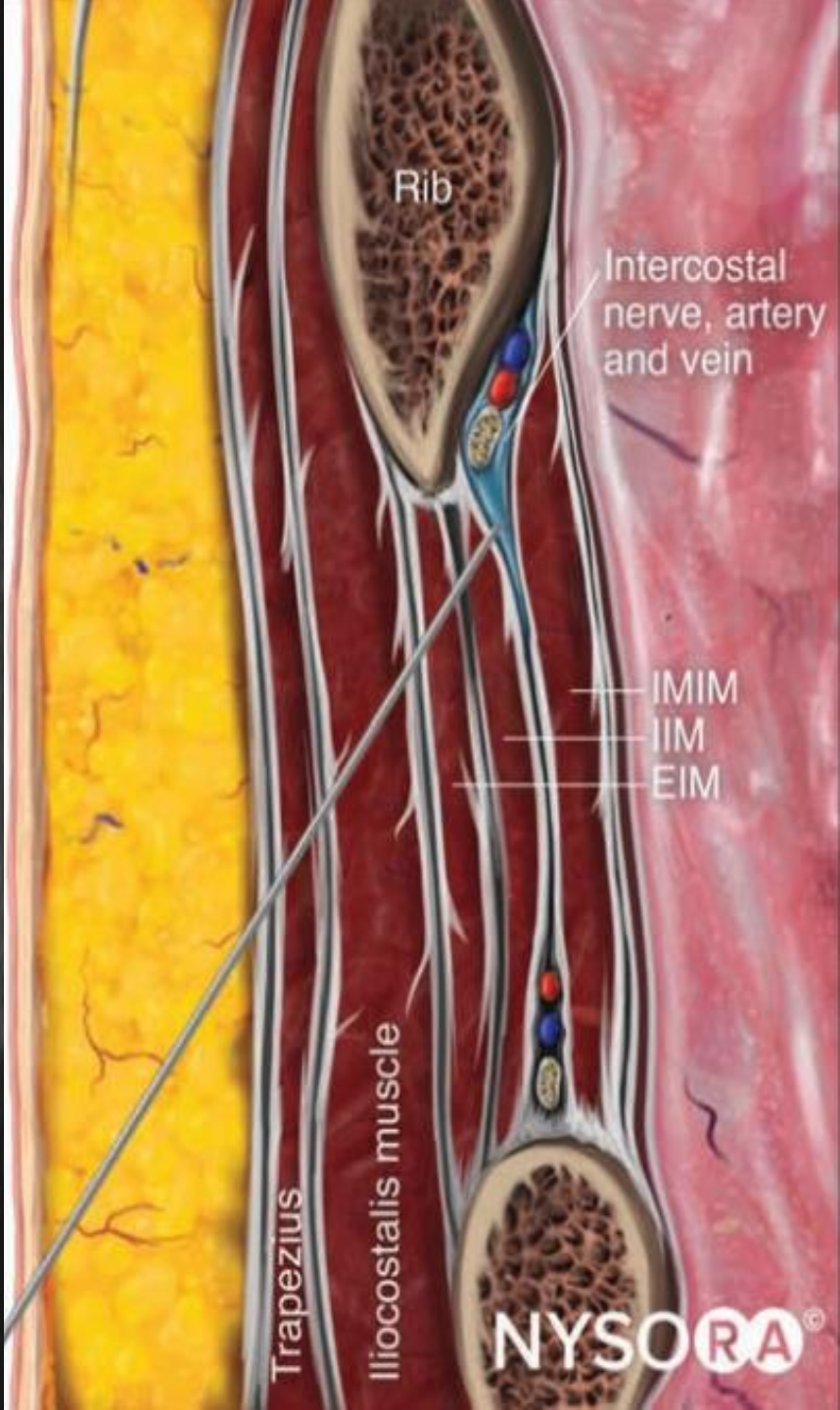
- **Lateral approach:** scan the intercostal space lateral to the costal angle advance needle tip in the space between the innermost and internal intercostal muscles

- **Medial approach:** the transducer is placed in a sagittal orientation 4 to 5 cm lateral to the spinous process and the needle is advanced below the external intercostal muscle (between the parietal pleura and the intercostal membrane)

Anatomy of the intercostal nerve medial (A) and lateral (B) to the costal angle

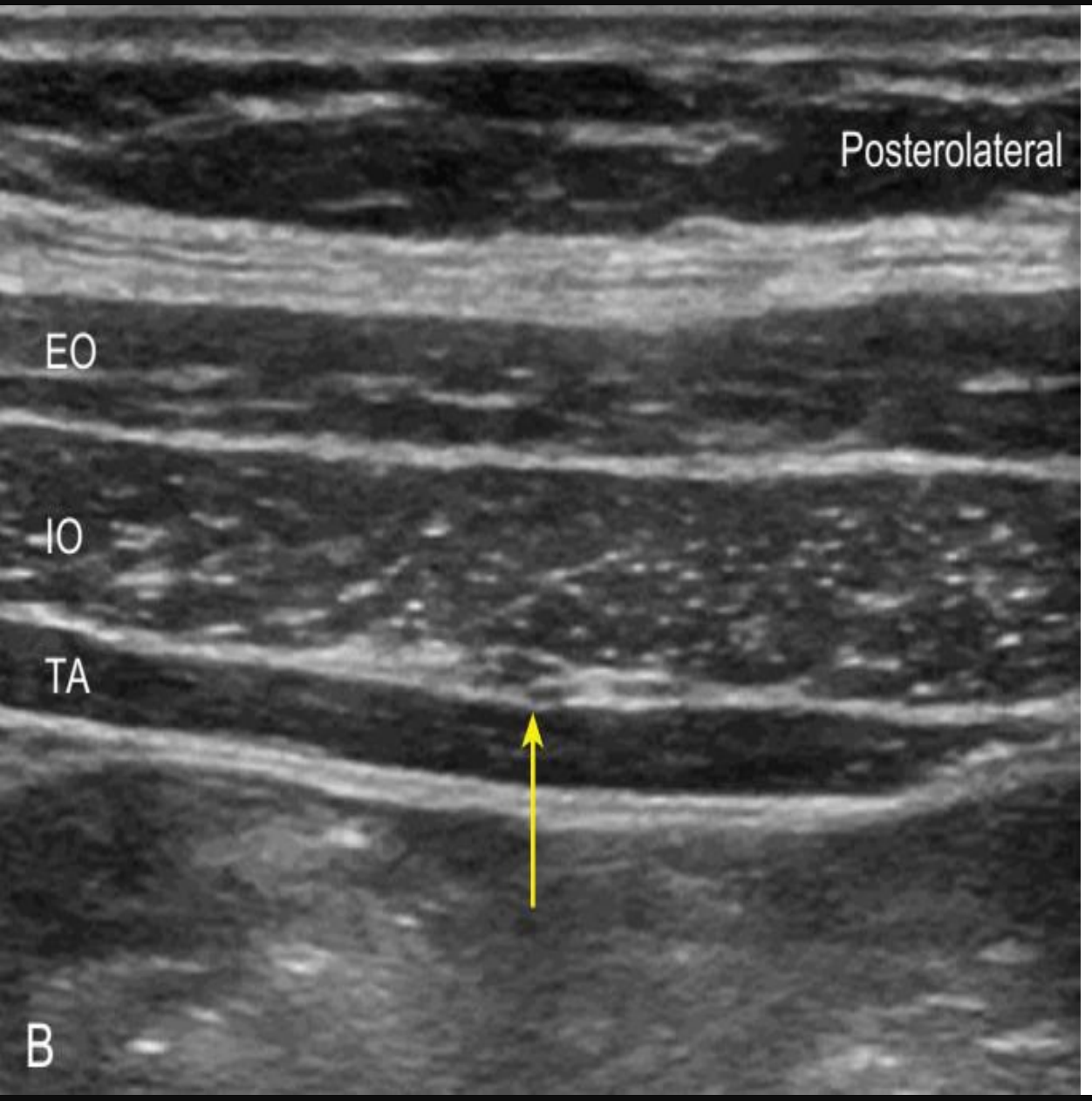


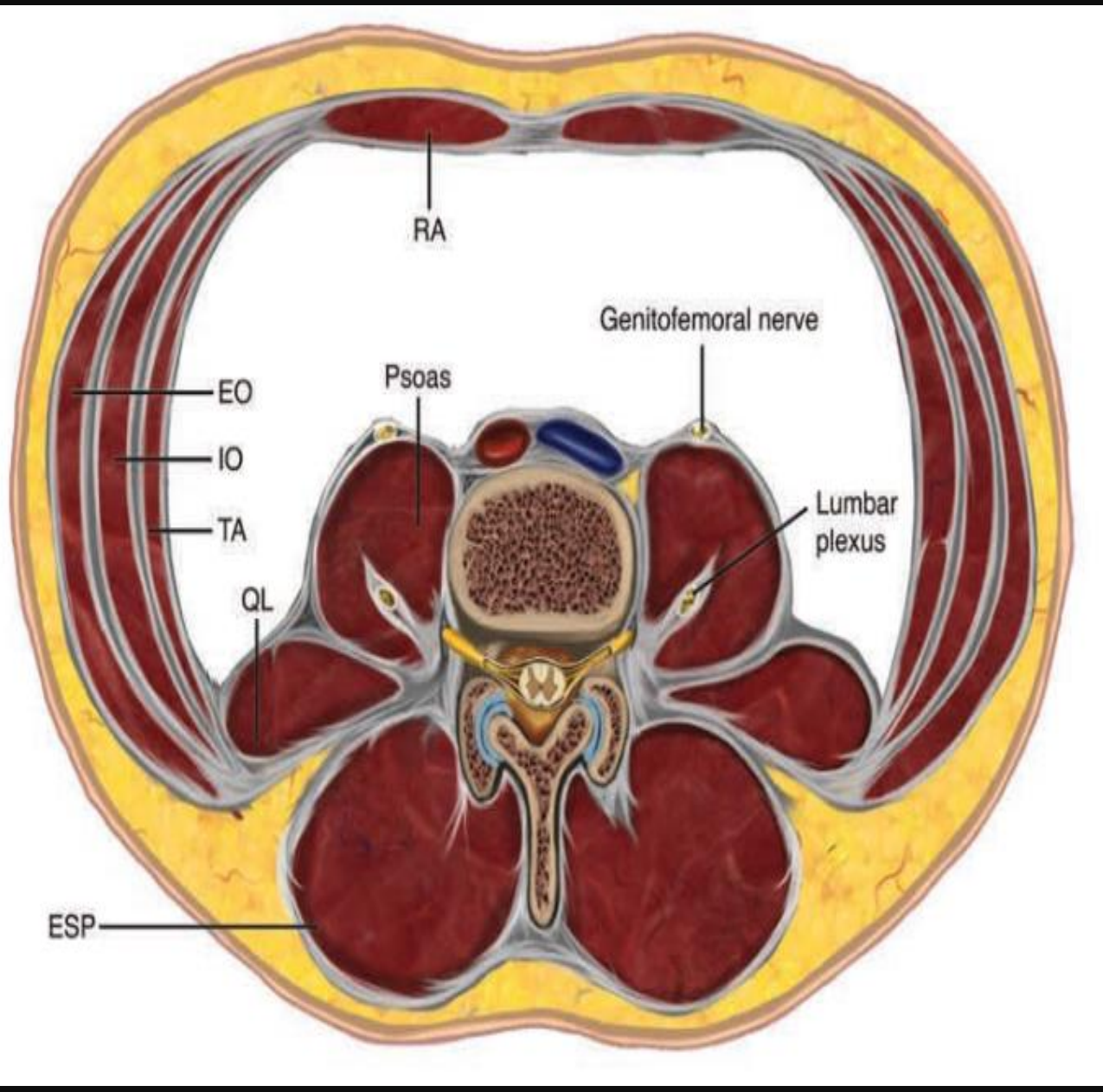

Rib
IMIM
IIM
EIM
Pleura
Iliocostalis
Trapezius
Rib
NYSORA


Rib
Intercostal nerve, artery and vein
IMIM
IIM
EIM
Trapezius
Iliocostalis muscle
NYSORA

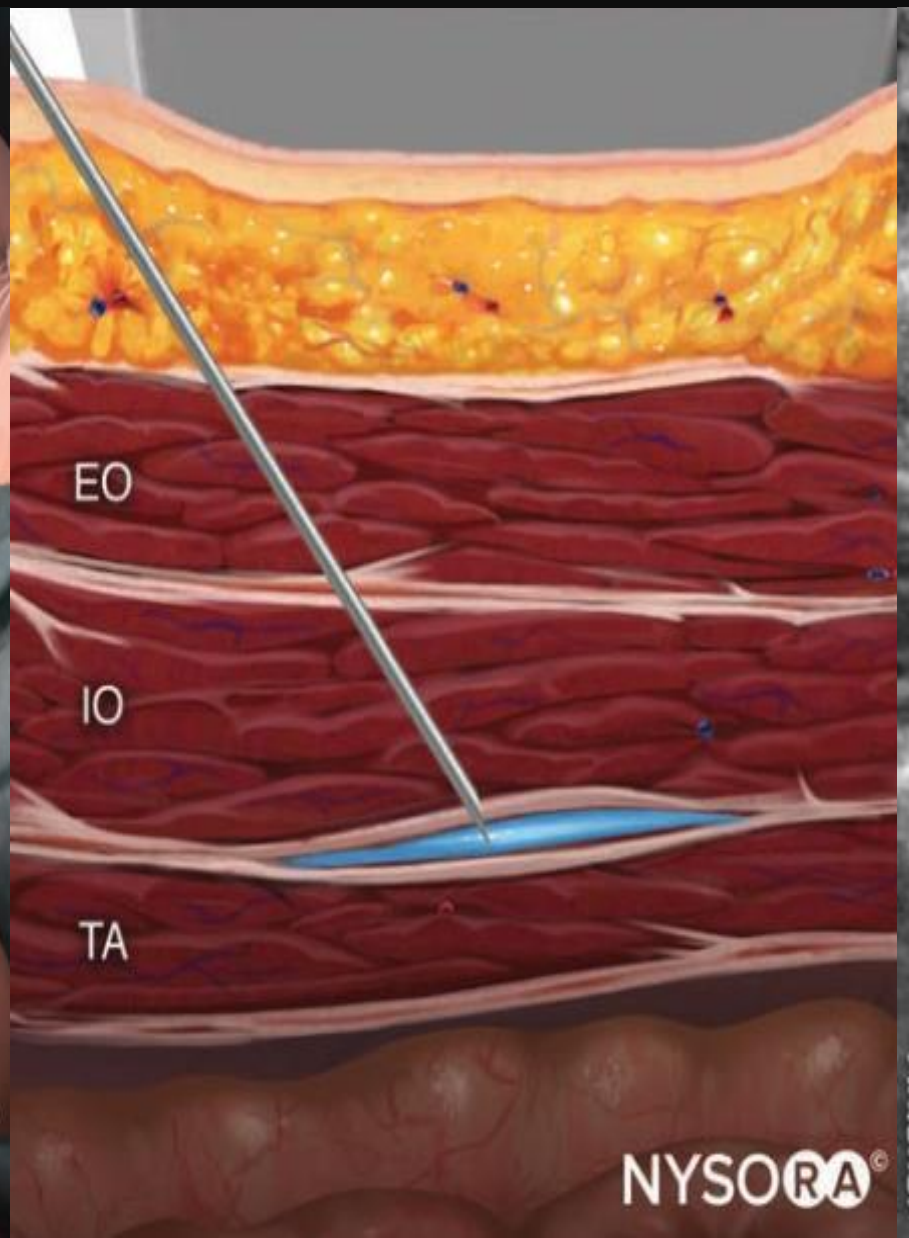
TRANSVERSUS ABDOMINIS PLANE BLOCKS

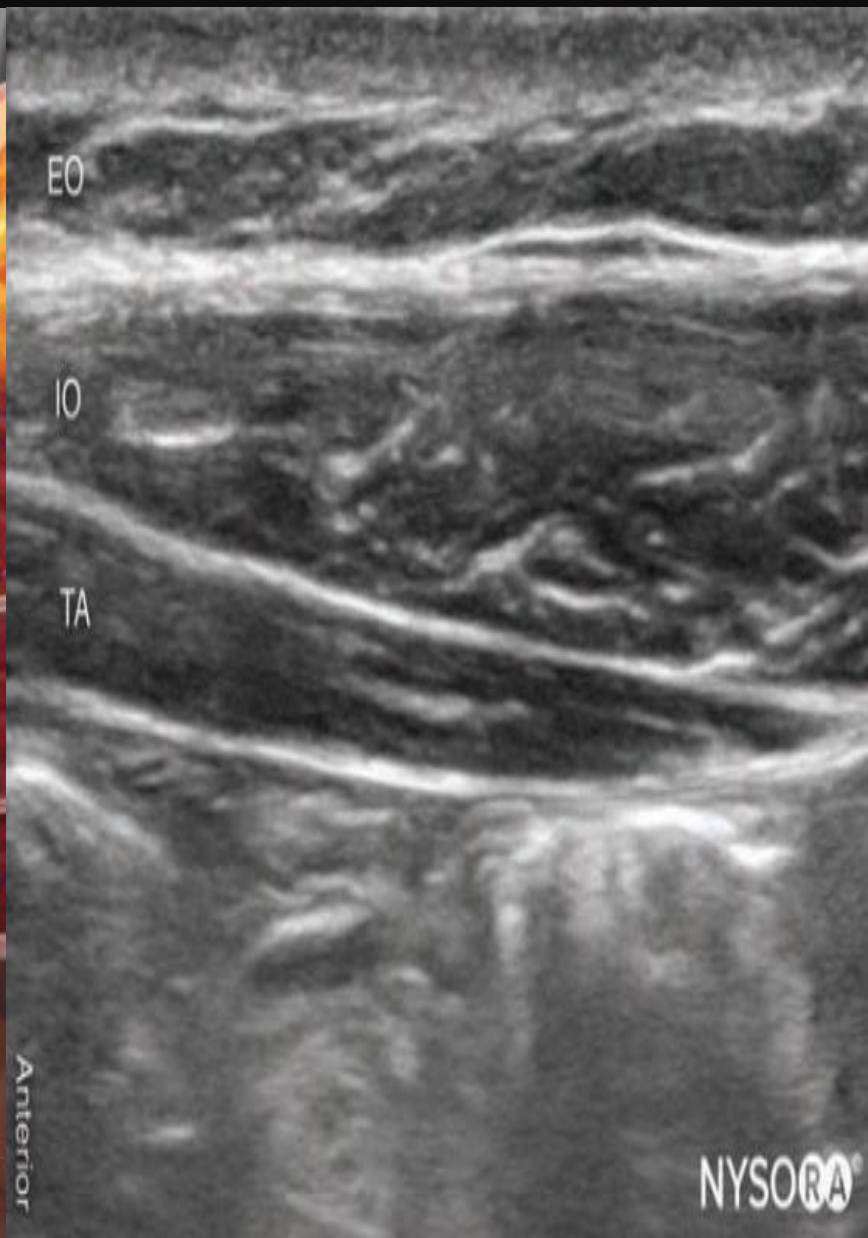
- Four peripheral nerves, the subcostal, ilioinguinal, iliohypogastric, and genitofemoral, primarily innervate the lower abdominal wall.
- The course of the first three nerves through the abdominal wall within the layer between the transversus abdominis and the internal oblique
- For US-Guided TAP block, the patient is usually in the supine position and The transducer is placed between the iliac crest and costal margin in the midaxillary line.
- In this location, the muscle layers of the lateral abdominal wall (external oblique, internal oblique, and transversus abdominis) are well defined.


Posterolateral
EO
IO
TA
B

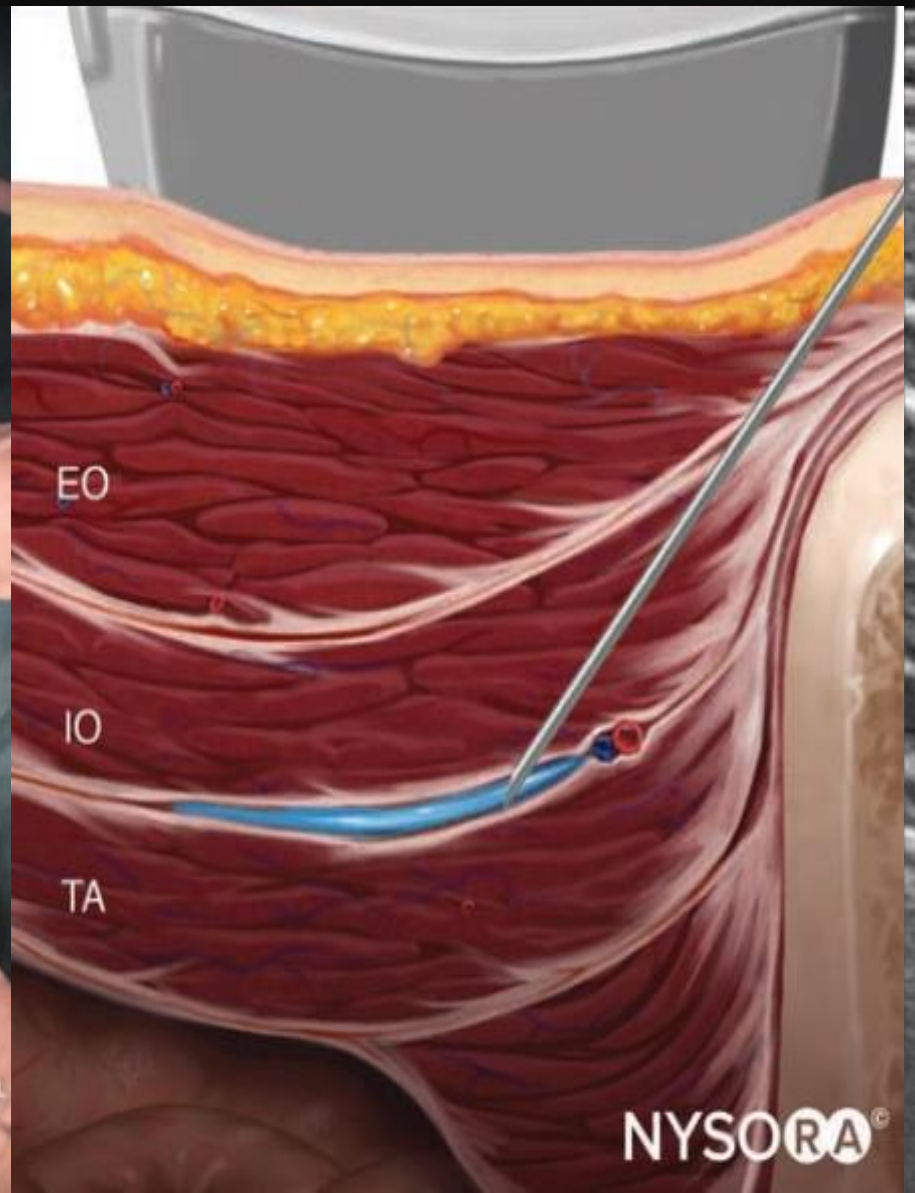

RA
Genitofemoral nerve
Psoas
EO
IO
TA
Lumbar plexus
QL
ESP

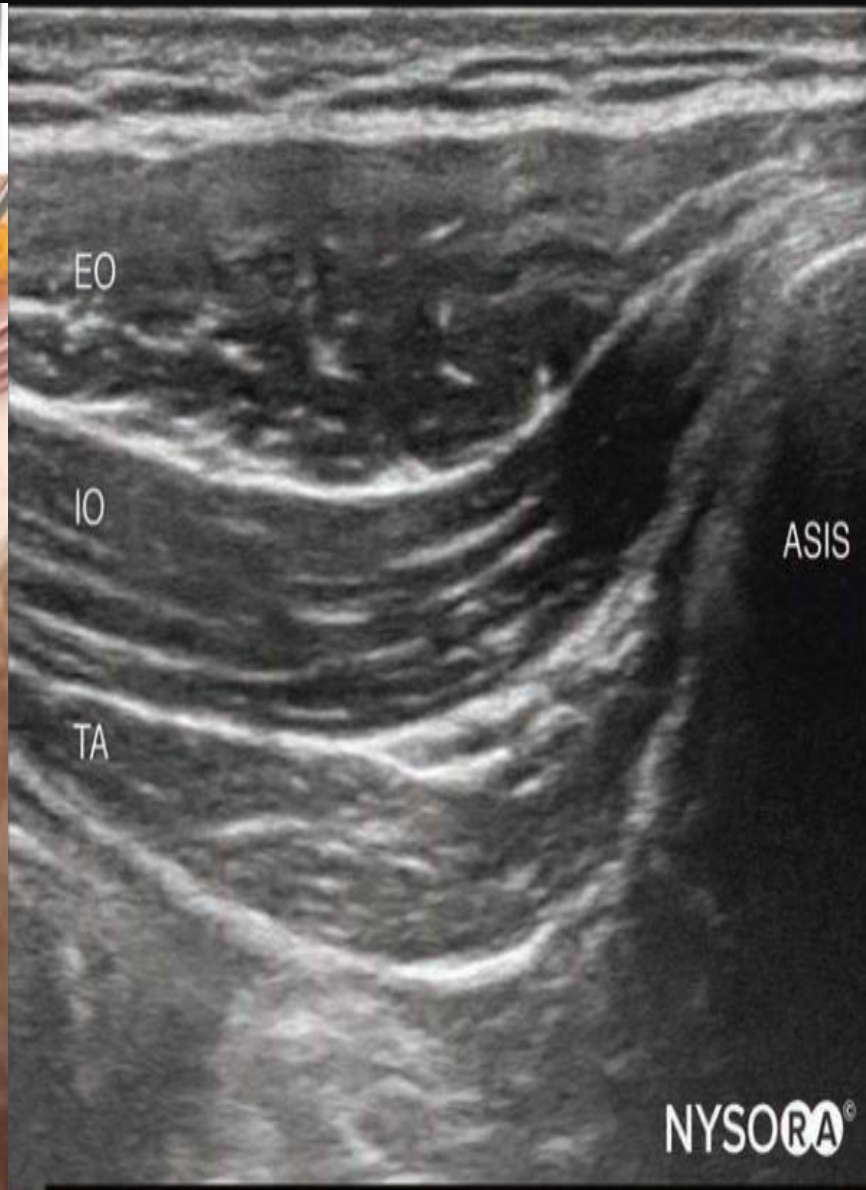
Lateral TAP block



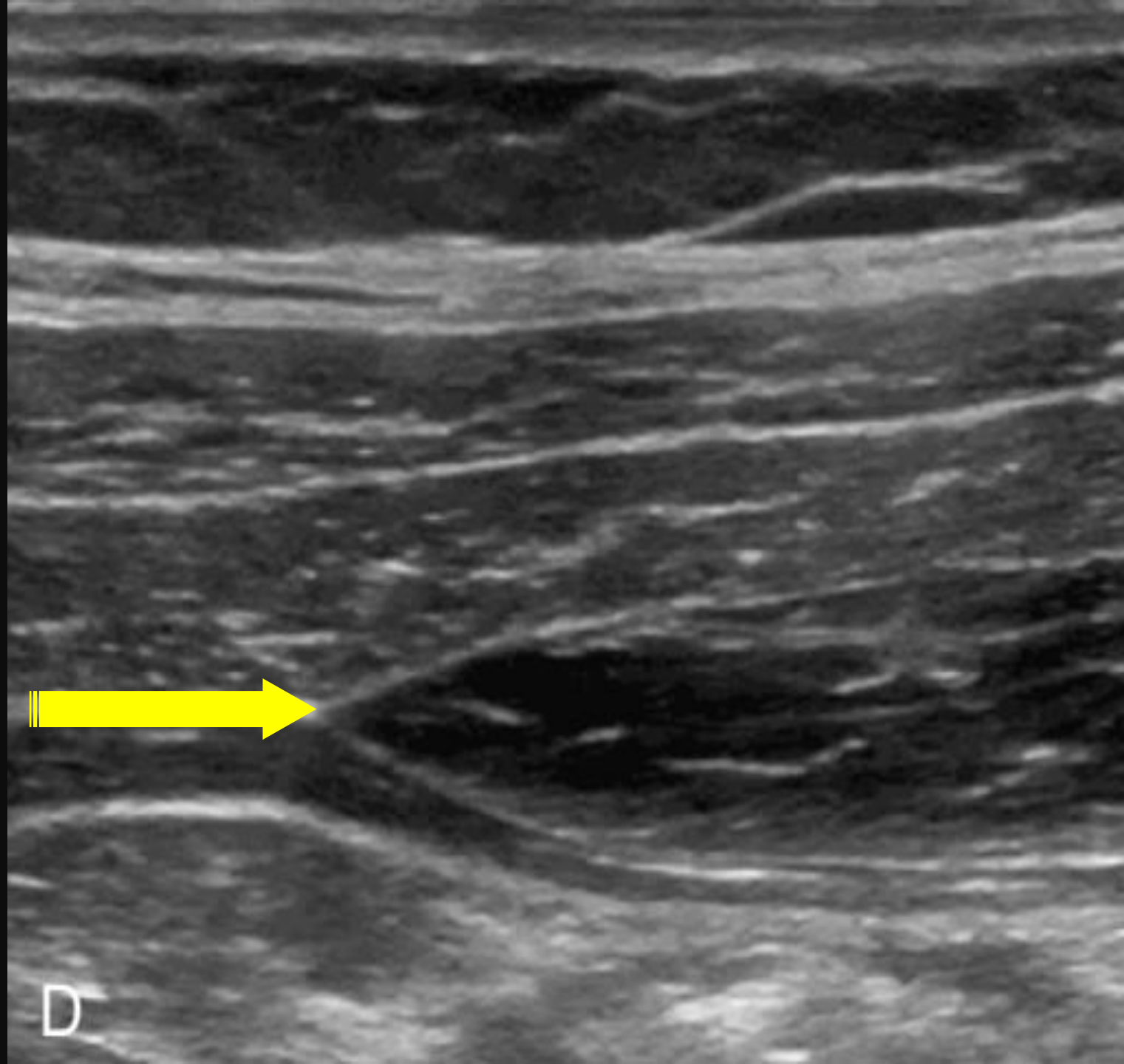


Anterior TAP Block





The KAYAK sign:
successful TAP injection



Thank You For Your Attention