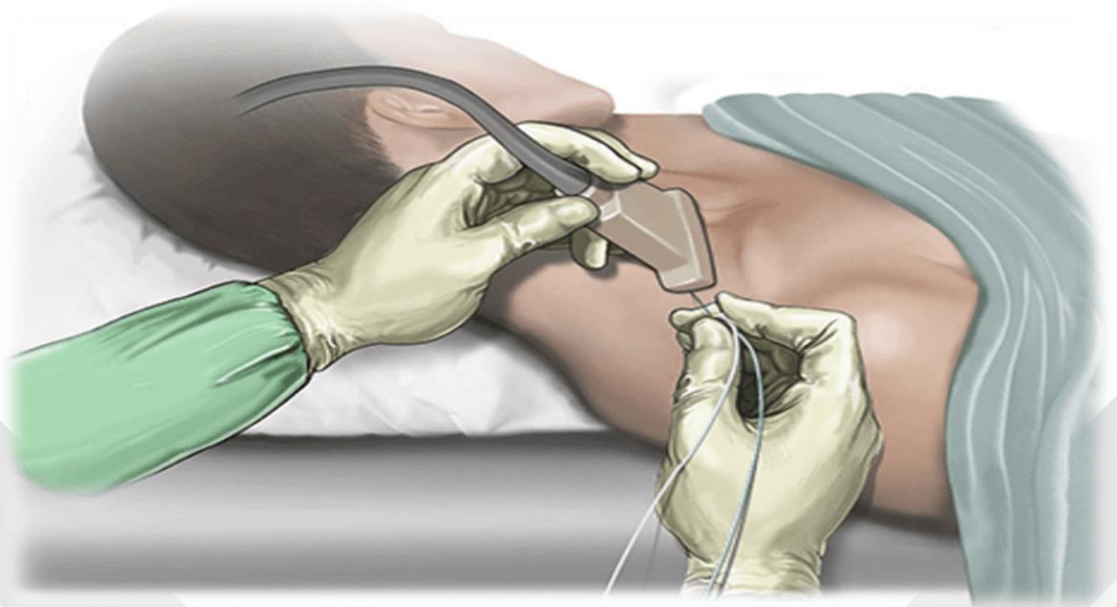
Peripheral nerve block



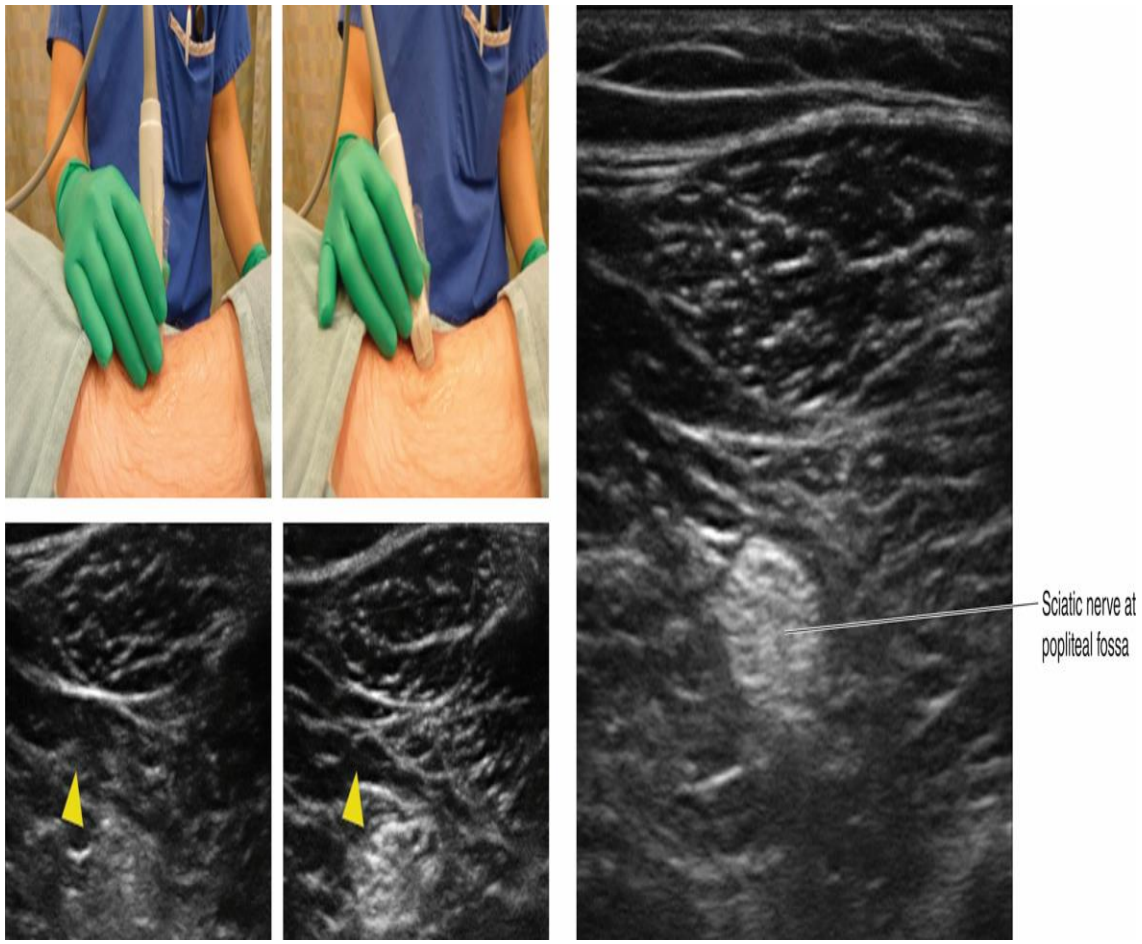
R1 Chanathip Meerod / Maj.Wiriya Homhuan

Outline

- General principle and equipment
- Regional block techniques
- Continuous catheter techniques
- Choice of local anesthetic
- Complications and safety

Techniques for localizing neural structure

- Paresthesia technique
- Peripheral nerve stimulation
- Ultrasound guidance technique



Paresthesia techniques

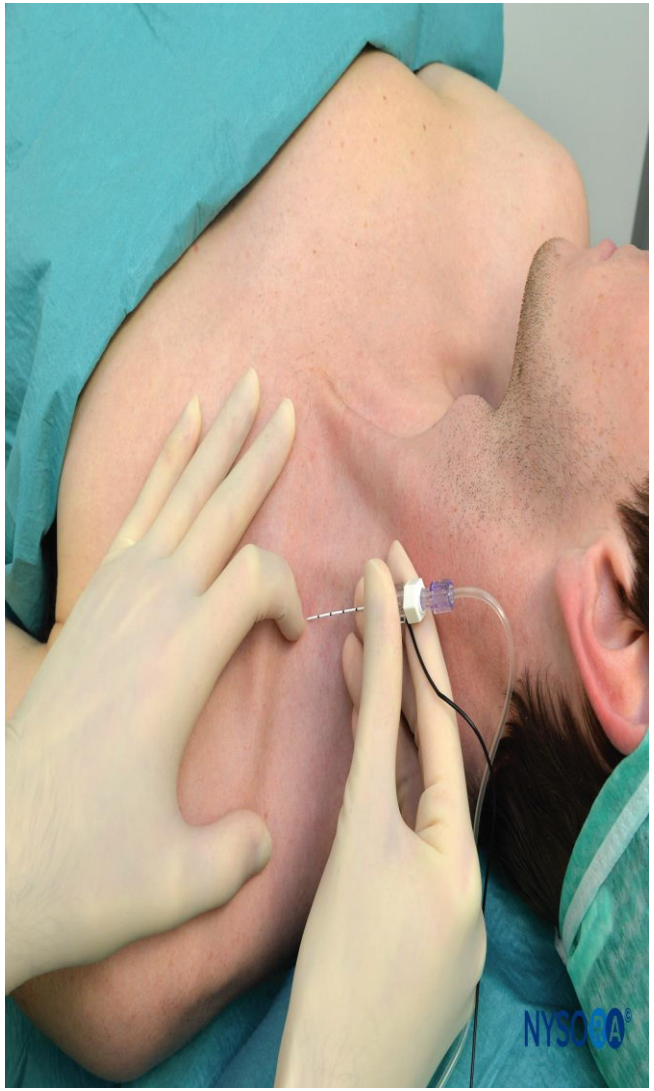
A paresthesia is elicited when needle make direct contact with nerve

Disadvantages :

- Reliant on patient cooperation & participation to guide LA injection accurately
- Highly dependent on skill of practitioner and understanding of anatomy
- More chances of damage to nerve & surrounding structure
- Take longer time of action

Advantages :

- doesn't need any special equipment



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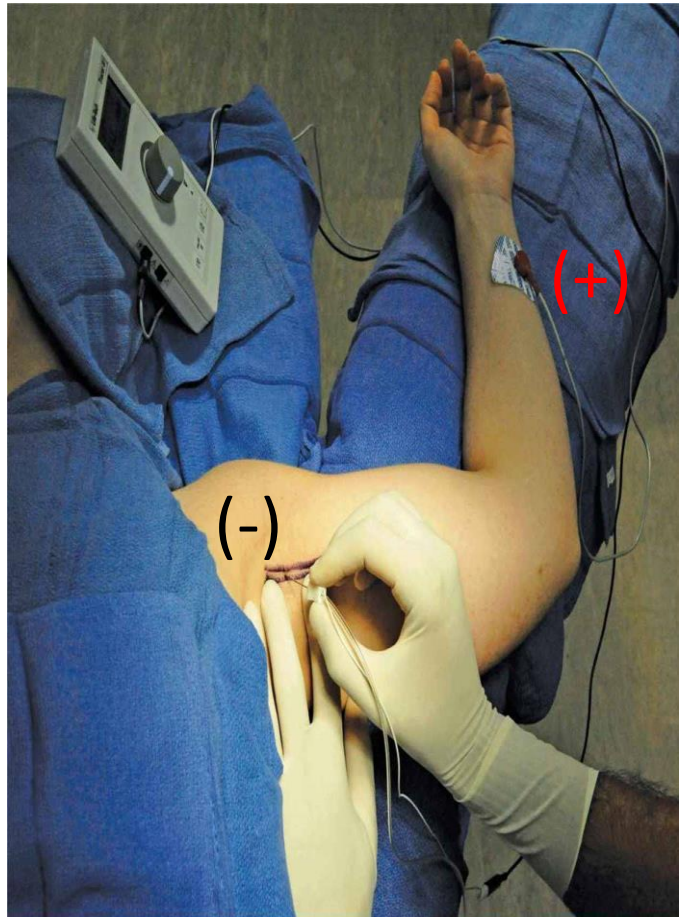
Peripheral nerve stimulation

- **Delivering small electrical pulses to the end of a block needle** to *cause depolarization and muscle contraction when needle tip close proximity to neural structure*
- Cathodal stimulation is more efficient than anode
- **Higher output (>1.5mA**) => *painful and vigorous muscle contraction*
- 0.5 mA appropriate used to facilitate the location for LA injection or catheter placement
- Short duration impulse (0.1ms) : motor fibers
- Longer duration impulse (0.3ms) : sensory fibers
- **Recommend injection : 0.3-0.5 mA**



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Ultrasound guidance

Choose appropriate transducer/frequency

Understand anatomic relationship

Apply varying degree of pressure with transducer

Align transducer with underlying nerve target

Rotate transducer to fine-tune image

Tilt the transducer to optimize image

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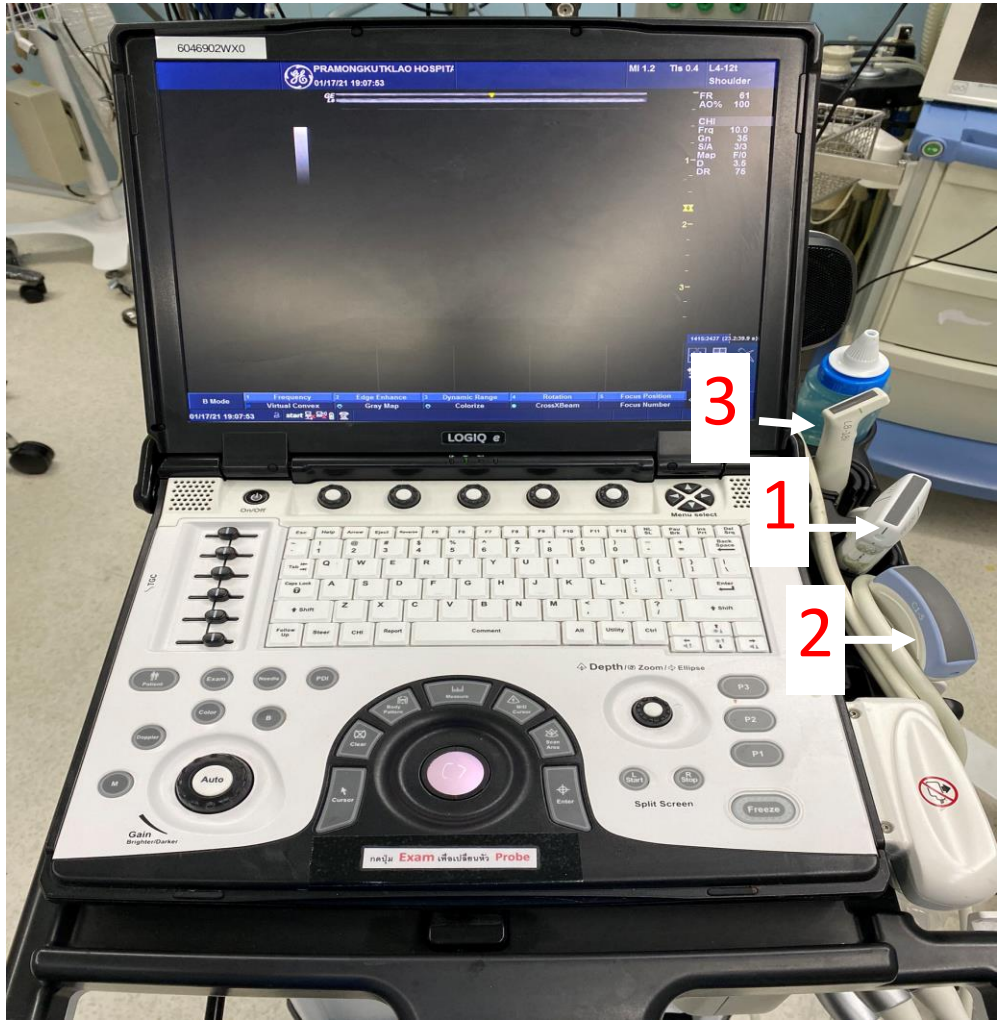
Ultrasound machine



1) **Linear-array** transducer :
   - scanning superficial anatomic structures (high frequency, small footprint)

2) **Curved-array** transducer :
   - deeper positioned structures (low frequency, wide footprint)

3) **Hockey stick transducer :**
   - vascular access or superficial block with limited space (smaller footprint)

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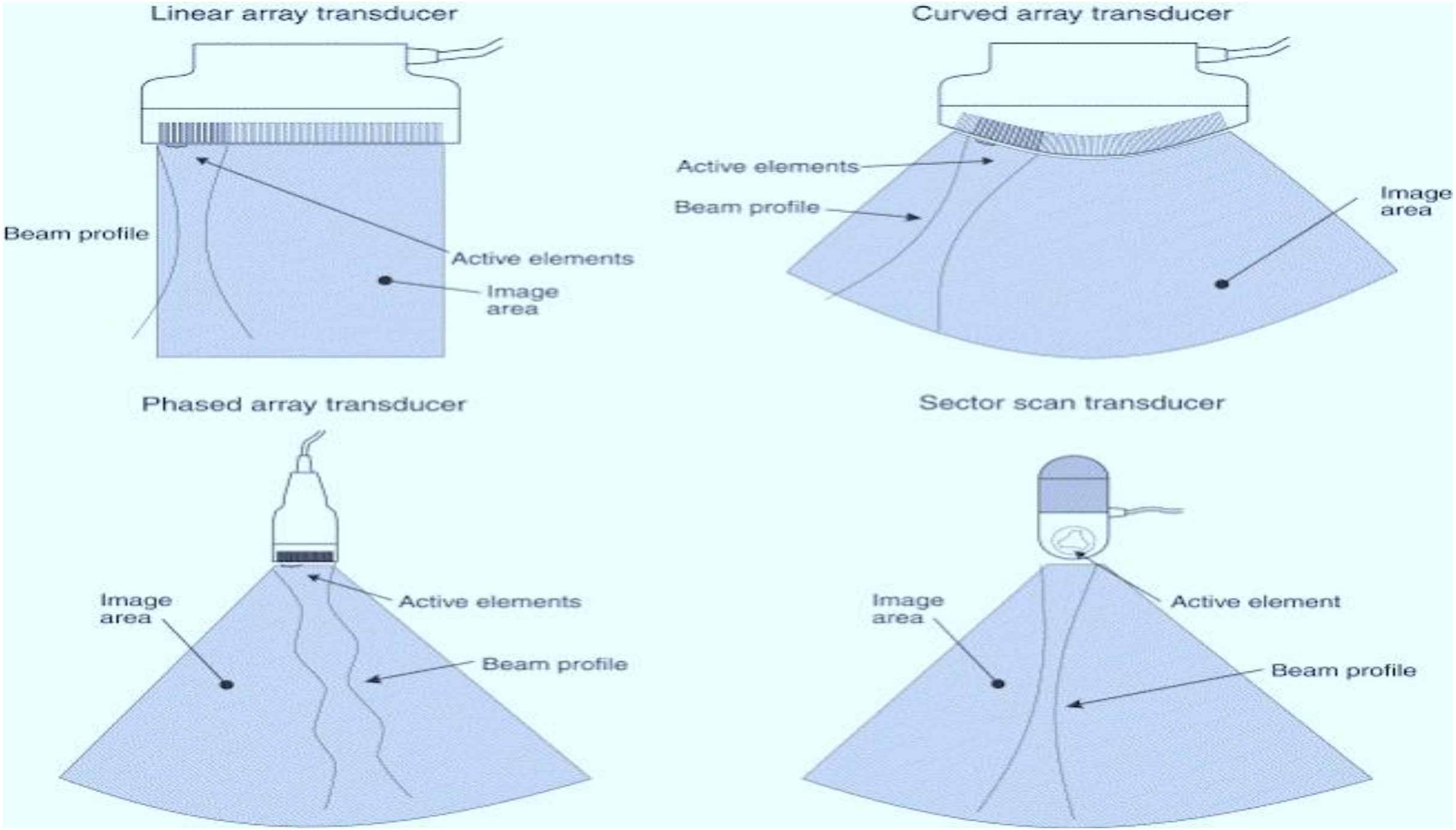
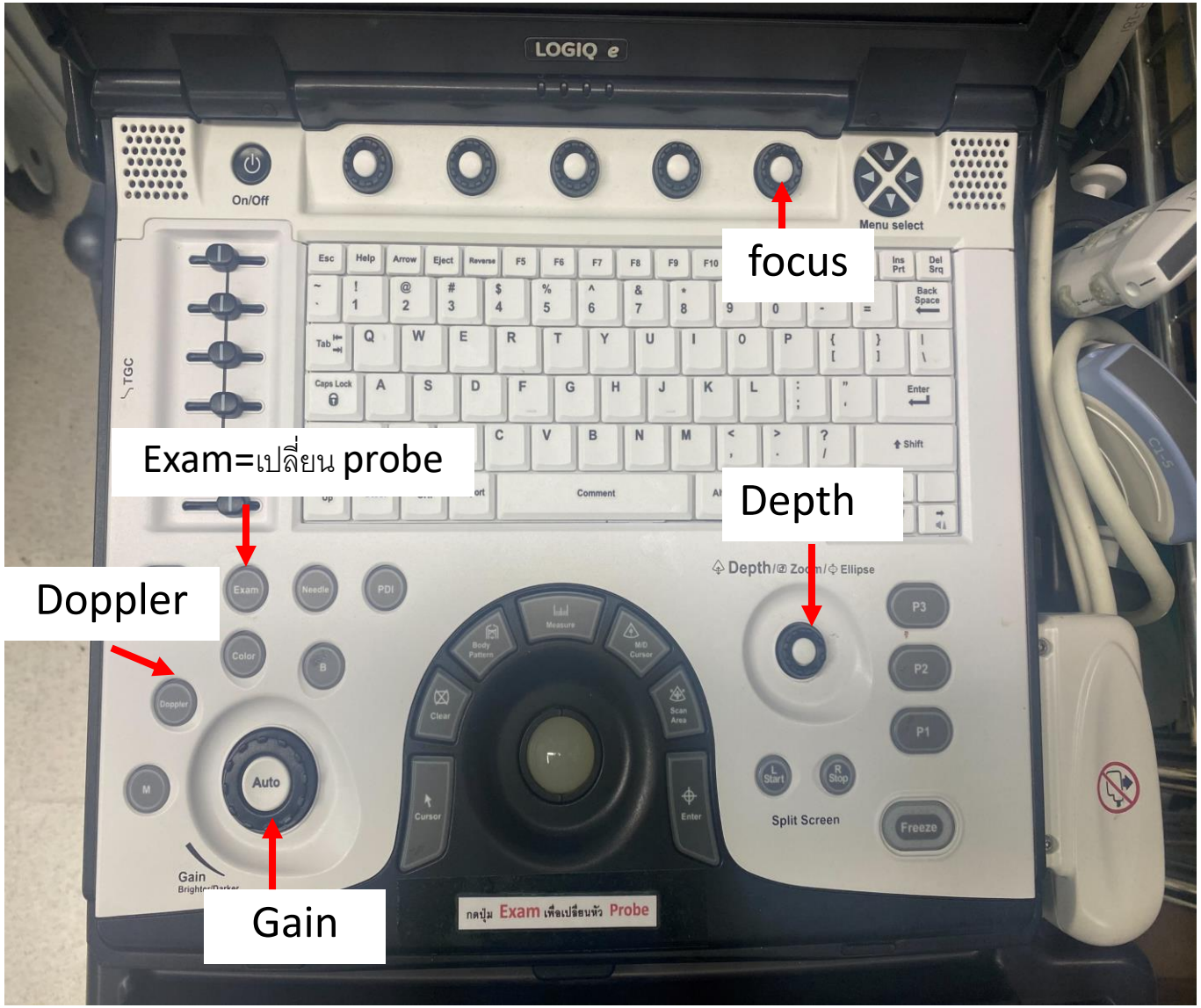

Linear array transducer
Beam profile
Active elements
Image area
Curved array transducer
Active elements
Beam profile
Image area
Phased array transducer
Image area
Active elements
Beam profile
Sector scan transducer
Image area
Active element
Beam profile

Ultrasound machine



Depth : optimal depth setting of the nerve

Frequency : the ultrasound transducer with optimal frequency range to best visualize the target nerve

Focusing : adjusted the level of target nerve

Gain : screen brightness can be adjusted which the best contrast is obtained between target nerve and other structures

Doppler : detect vascular structures

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Ultrasound guidance technique

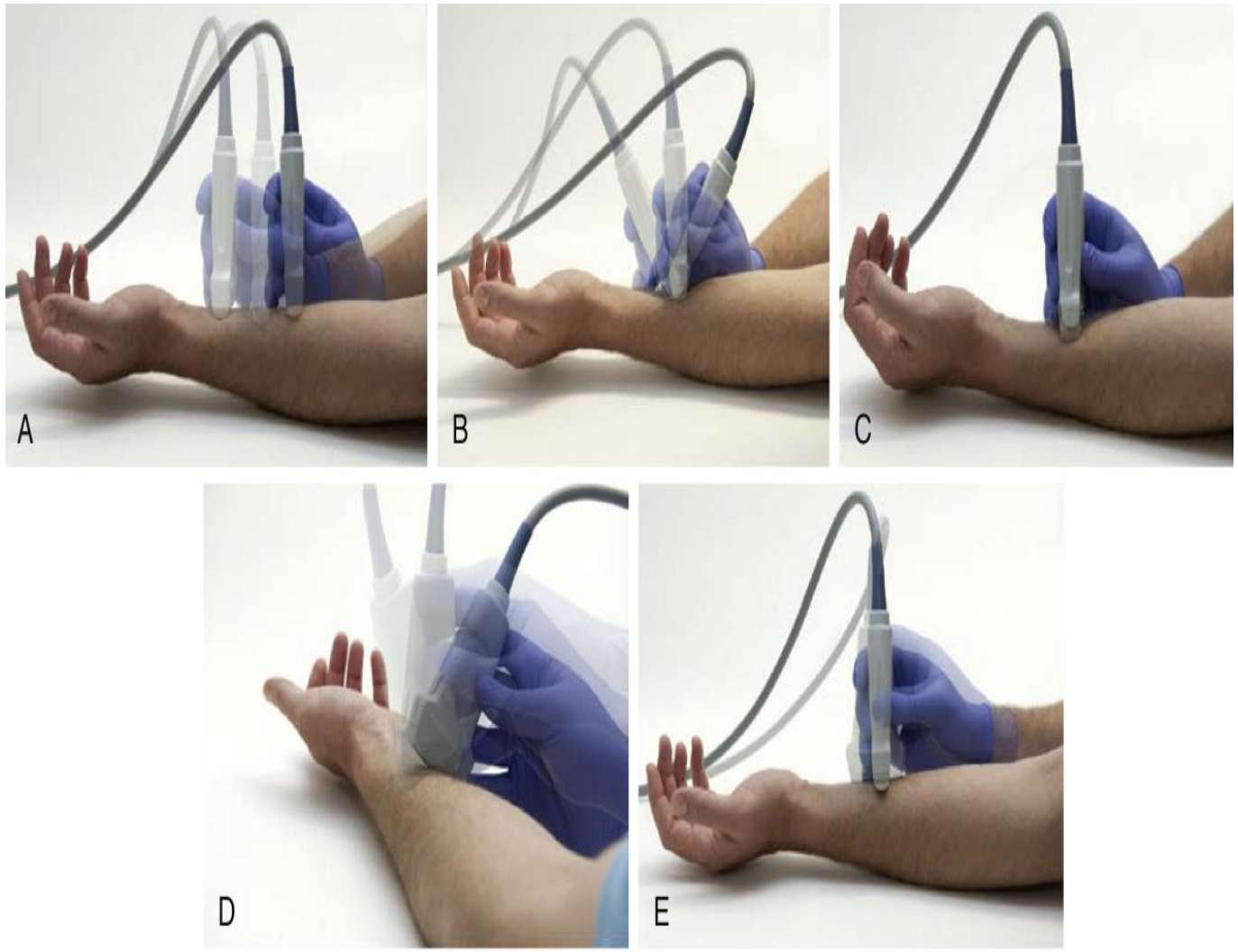

Fig. 46.6 **Transducer manipulation.** Sliding (A), tilting (B), compression (C), rocking (D), and rotation (E) of the transducer are shown.

- **Sliding** is moving contact the transducer along tract of nerve (short-axis view)
- **Tilting** will vary the echo brightness of nerve to promote nerve visibility
- **Compression** to improve imaging, bring structure closer to the surface of transducer
- **Rocking** to improve visibility of needle and anatomic structure when working room is limited
- **Rotation** will produce true short axis views rather than oblique or long axis view

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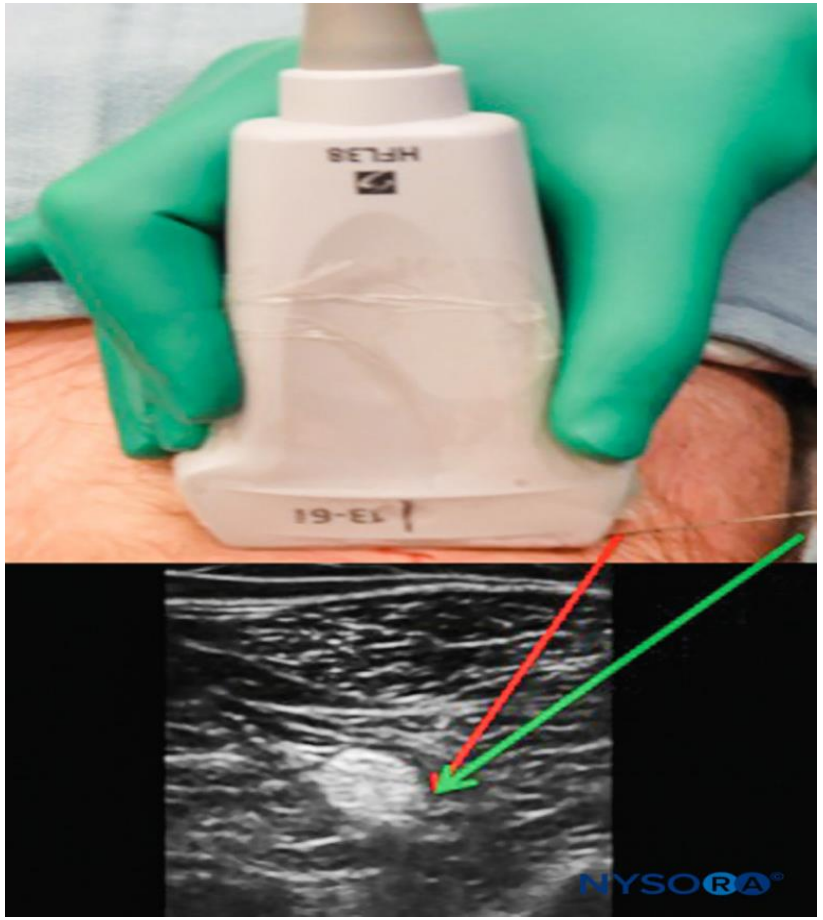
Safety tips during ultrasound guided nerve block



- Perform preblock scan to ascertain anatomy
- Do not advance needle if tip is not localized
  hydrodissection can be utilized to delineate anatomy
- when pushing through fascia toward nerve, approach tangentially
- pass through fascia slowly, felling *pop or sudden release*
- Reoptimize image of needle tip after passing fascia
- When doubt about needle nerve interface *; gently move needle to ascertain that the nerve doesn't move*

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Optimizing local anesthetic deposition

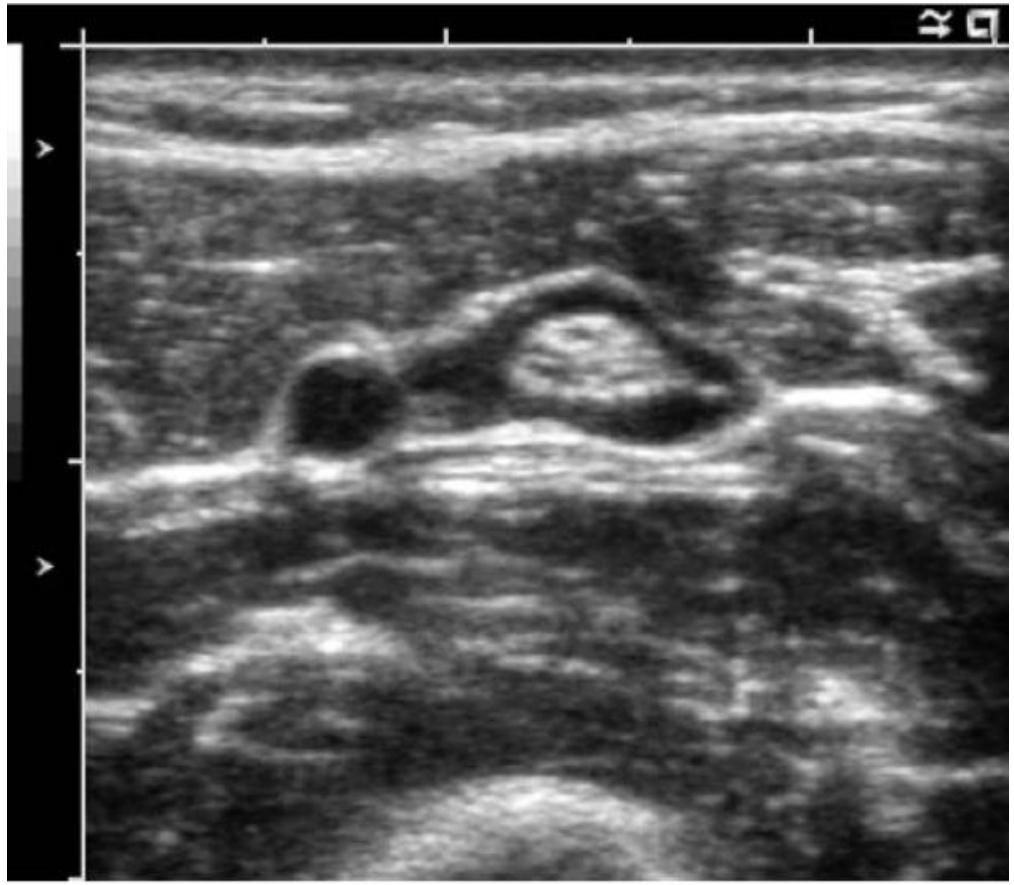

Fig. 46.14 Local anesthetic injection for successful peripheral nerve block. The ulnar nerve and ulnar artery are viewed in short axis in the forearm in this sonogram. The nerve is surrounded with anechoic local anesthetic.

- Inject LA solution in small aliquots
- Make certain that spread of fluid is observed at needle tip during injection
- Aspirate between injections
- Be aware of intervening fascial planes that may sequester
- Avoid deposition of LA into muscle ; solitary nerves in extremities, seek to create donut or halo around nerve
- For nerves within a fascial enclosure, seek to fill the fascial confines with solution

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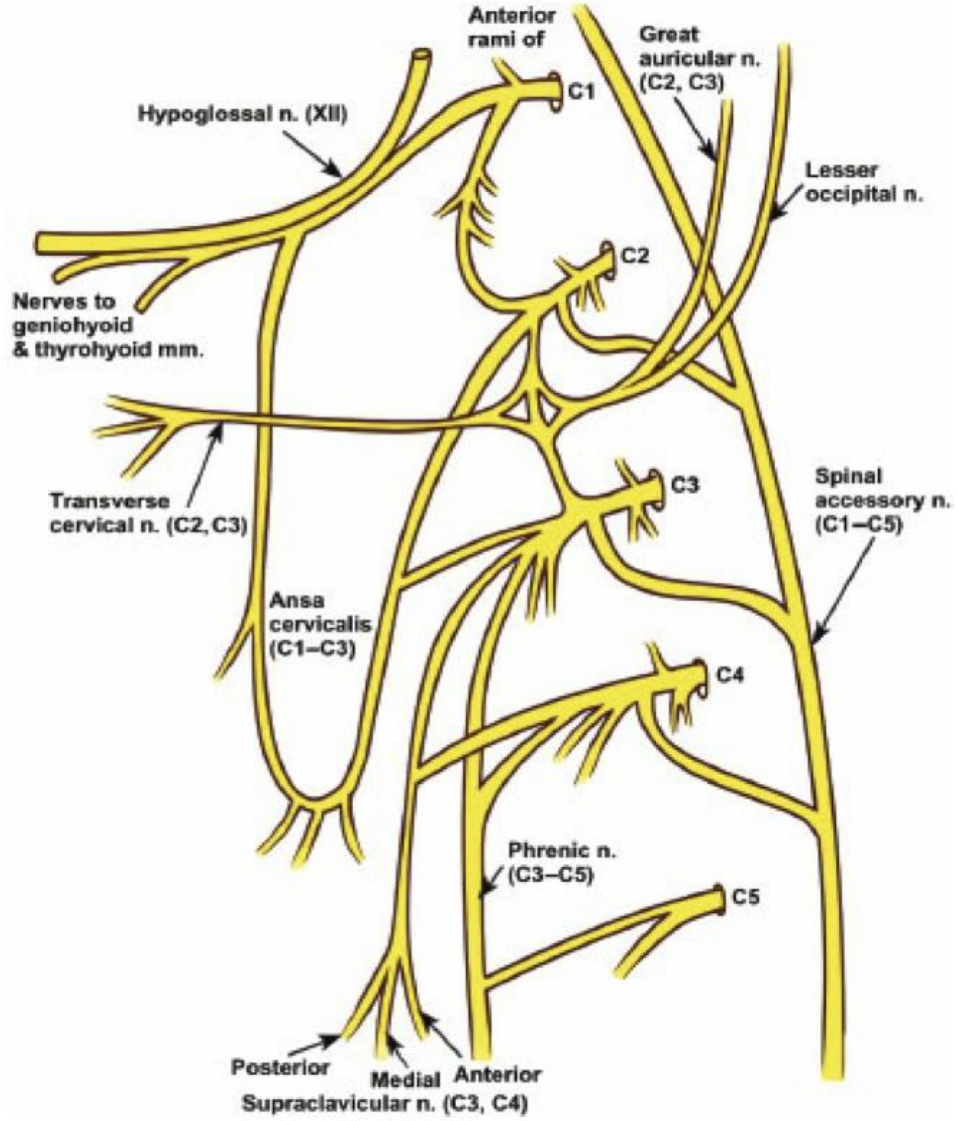
Cervical plexus anatomy



- Derived from C1-4 spinal nerve
- **Supply :** prevertebral muscles , strap muscles, phrenic nerve
- **Deep branch :** musculature of neck
- **Superficial branch :** cutaneous sensation of skin between CN V and T2 dermatome

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Cervical plexus block

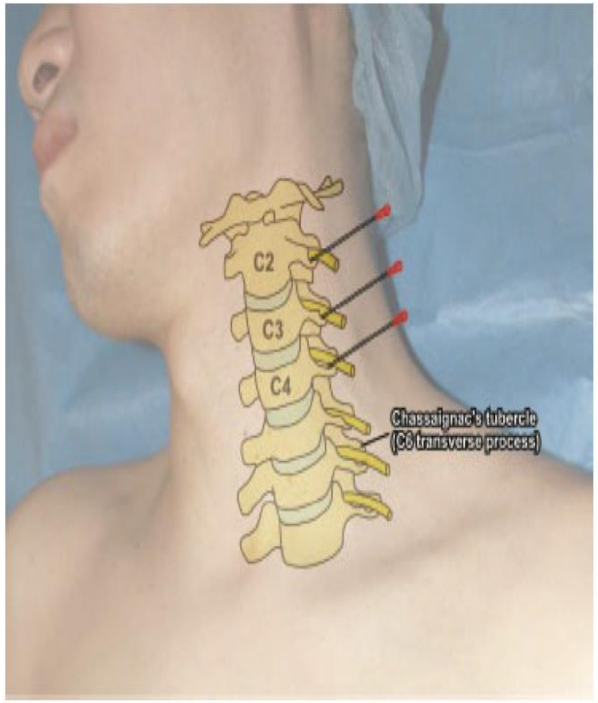

Figure 36-8 Needle insertion points and angles for deep cervical plexus block. The nerve roots exit the vertebral column via troughs formed by the transverse processes. Using caudad and posterior angulation, the needle is inserted to contact the articular pillars of C2–C4.

Clinical application

- Provide anesthesia in C2 to C4
- *Lymph node dissection, plastic surgery repair, carotid endarterectomy*
- **Bilateral block :** tracheostomy, thyroidectomy
- **Advantage :** continuously monitor the awake neurological status of patient

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Cervical plexus block

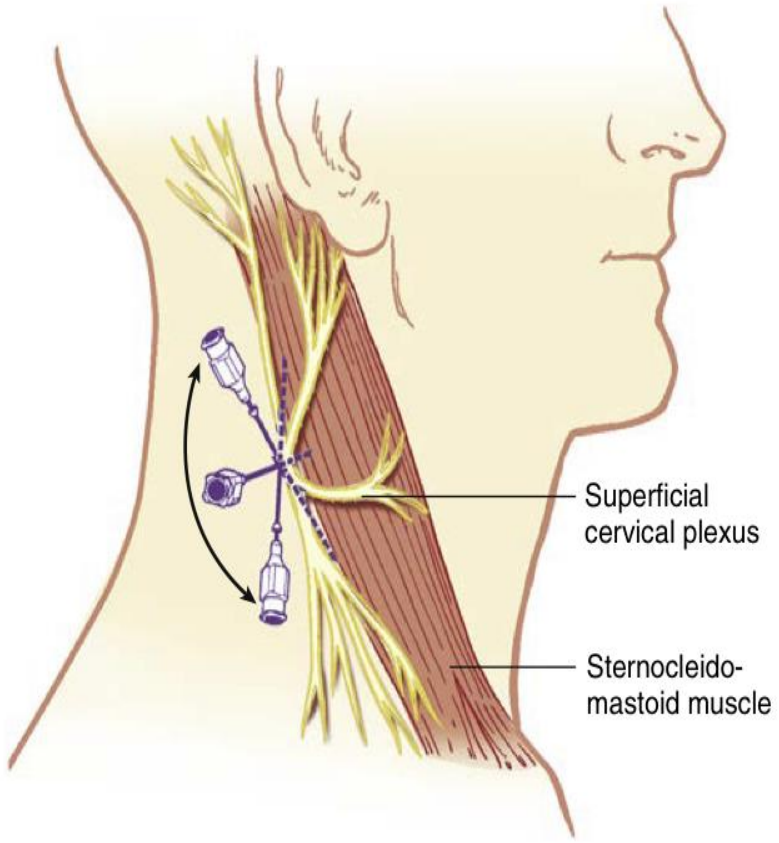

Fig. 46.15 **Anatomic landmarks and method of needle placement for a superficial cervical plexus block.**

Landmark : mid point of posterior border of SCM

22G, 4-cm needle advanced , injected 5 ml of solution along posterior border and medial surface of SCM

Accessory nerve block : temporary ipsilateral trapezius muscle paralysis

Deep cervical block : associated with respiratory complication

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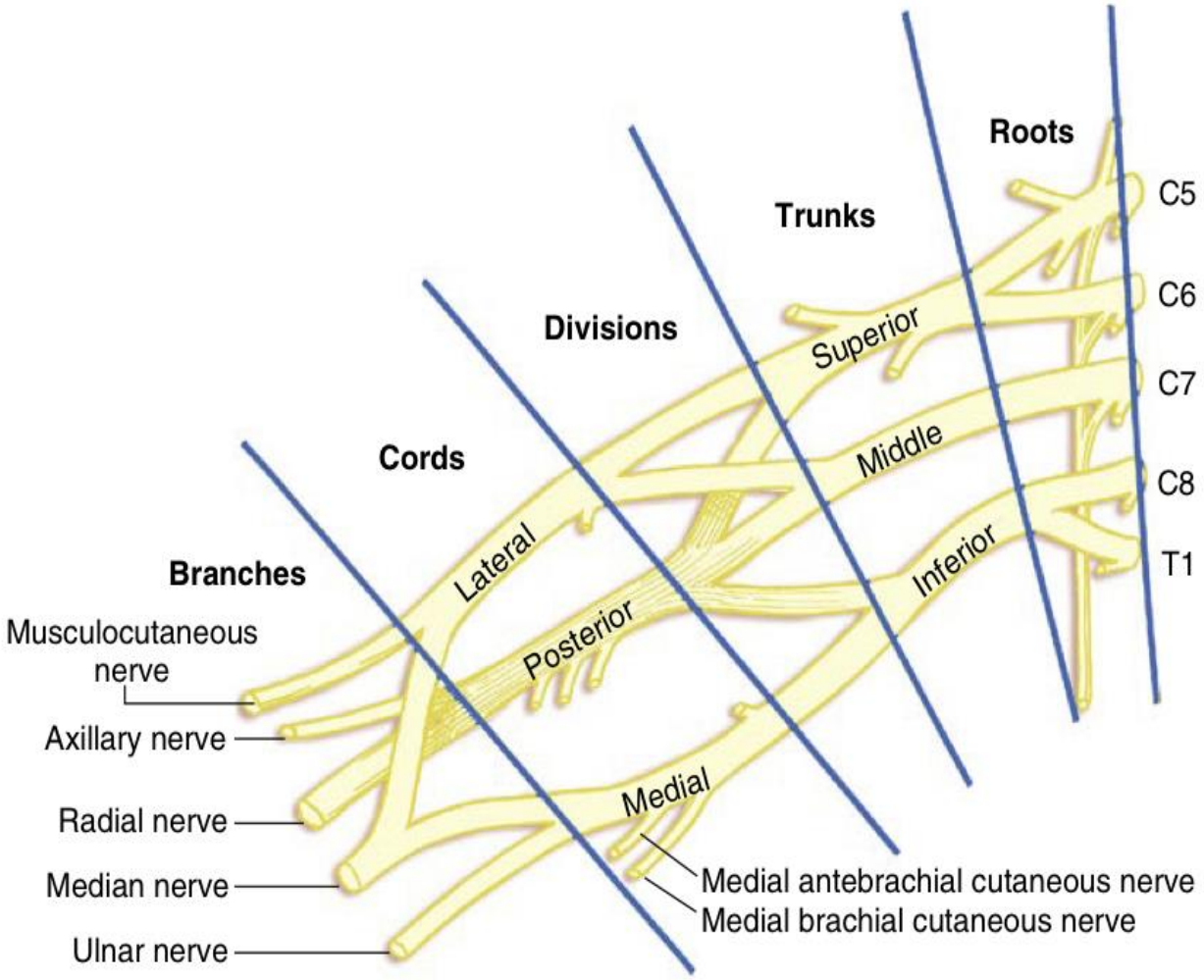
Branchial plexus anatomy



Intervertebral foramina

Lie between anterior and middle scalene muscles along subclavian groove

Prevertebral fascia invests the anterior and middle scalene muscles, fusing to enclose the branchial plexus in fascial sheath

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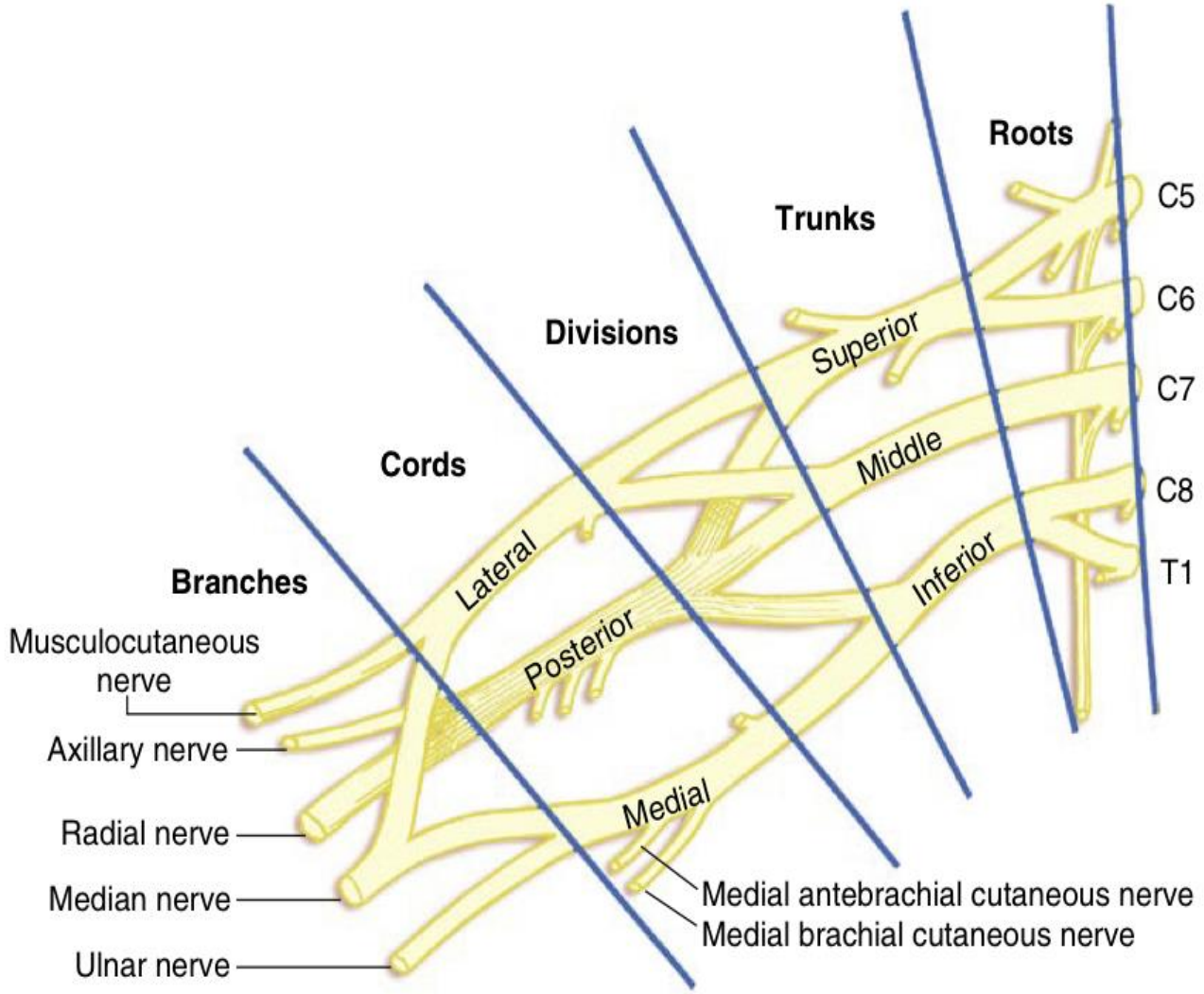
Branchial plexus anatomy



Emerge from interscalene space to *lie posterior to subclavian artery*

Interscalene muscle : nerve root unite to from 3 trunks

Lateral edge of 1st rib : trunks *anterior and posterior divisions* pass to midportion of clavicle

Axilla : divisions from the *lateral, posterior, medial cord*

Lateral border of pectoris minor : 3 cords divide into peripheral nerve

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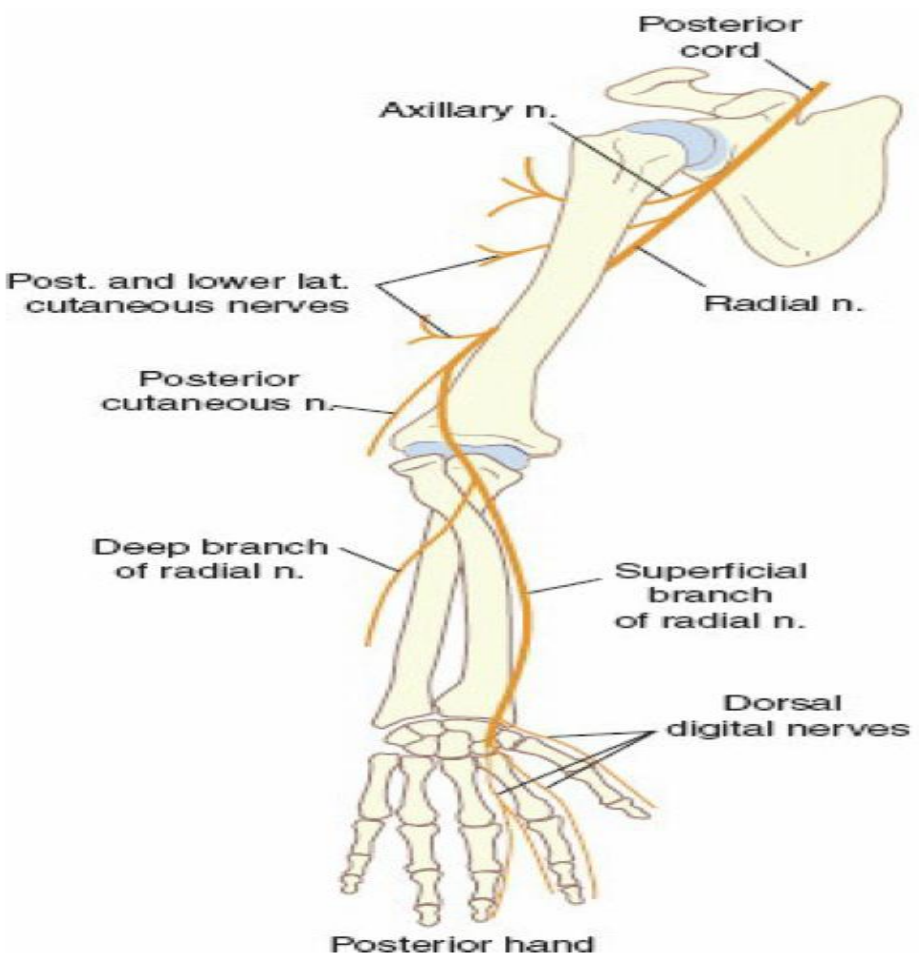
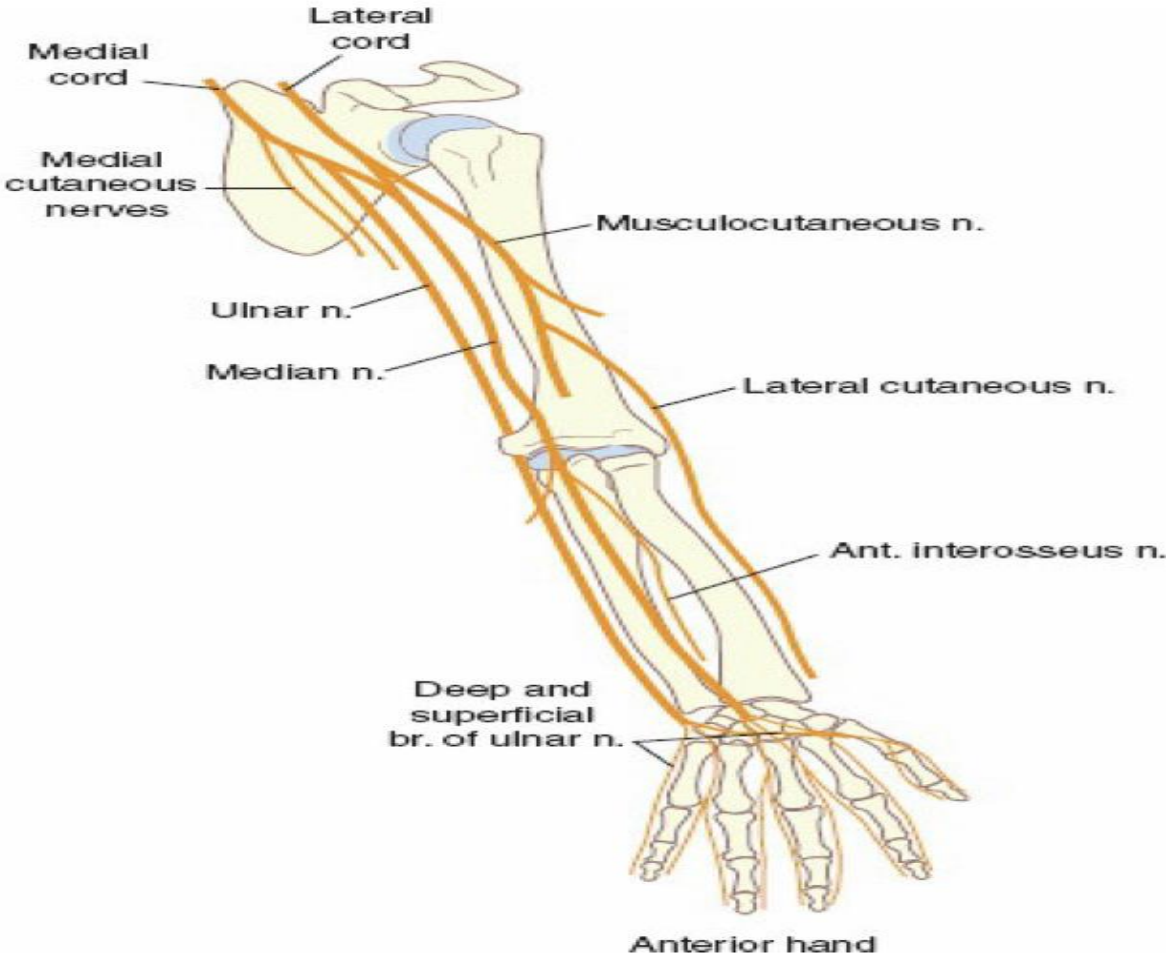
Terminal nerve of upper extremity





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Cutaneous distribution of cervical roots and peripheral nerves

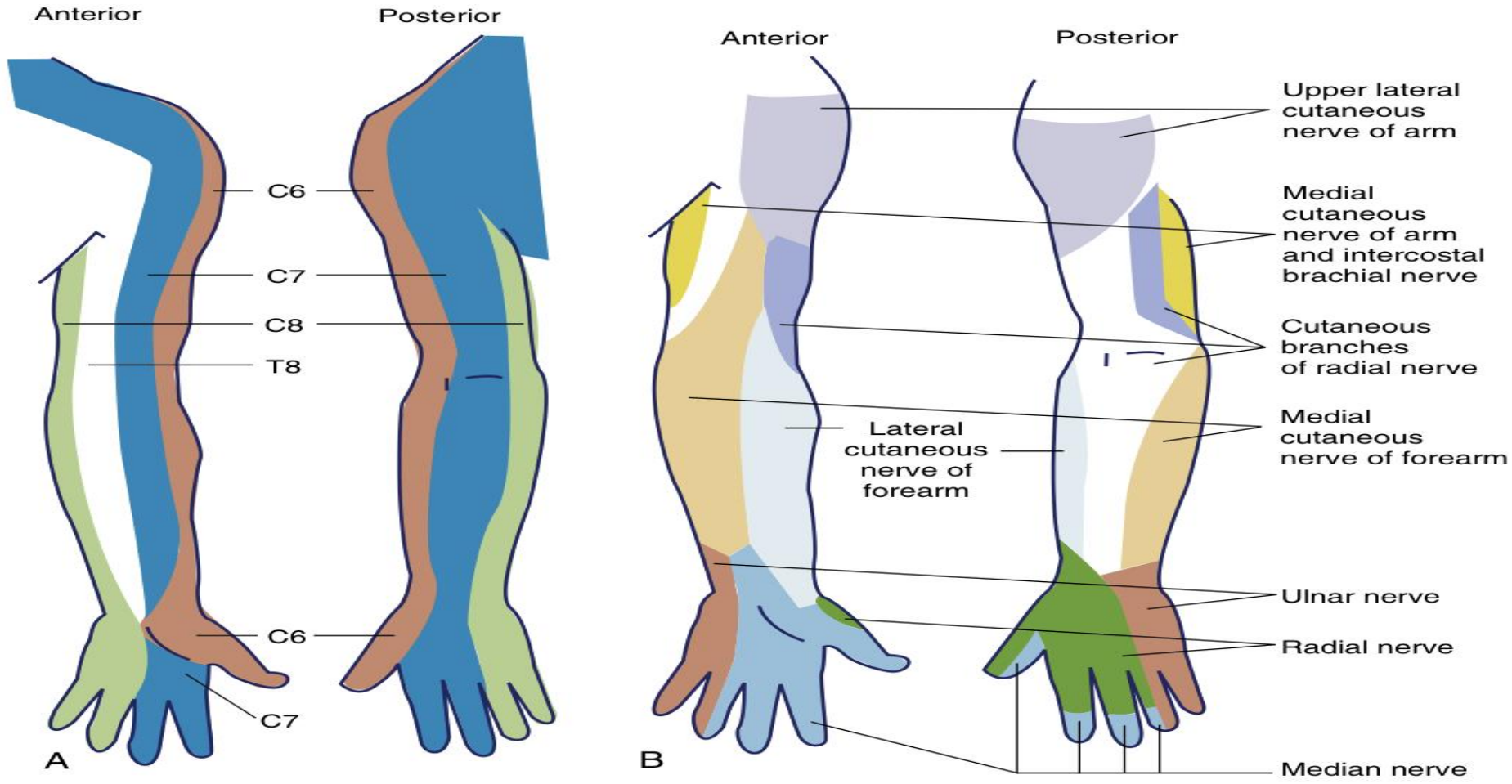

Fig. 46.17 (A) Cutaneous distribution of the cervical roots. (B) Cutaneous distribution of the peripheral nerves.

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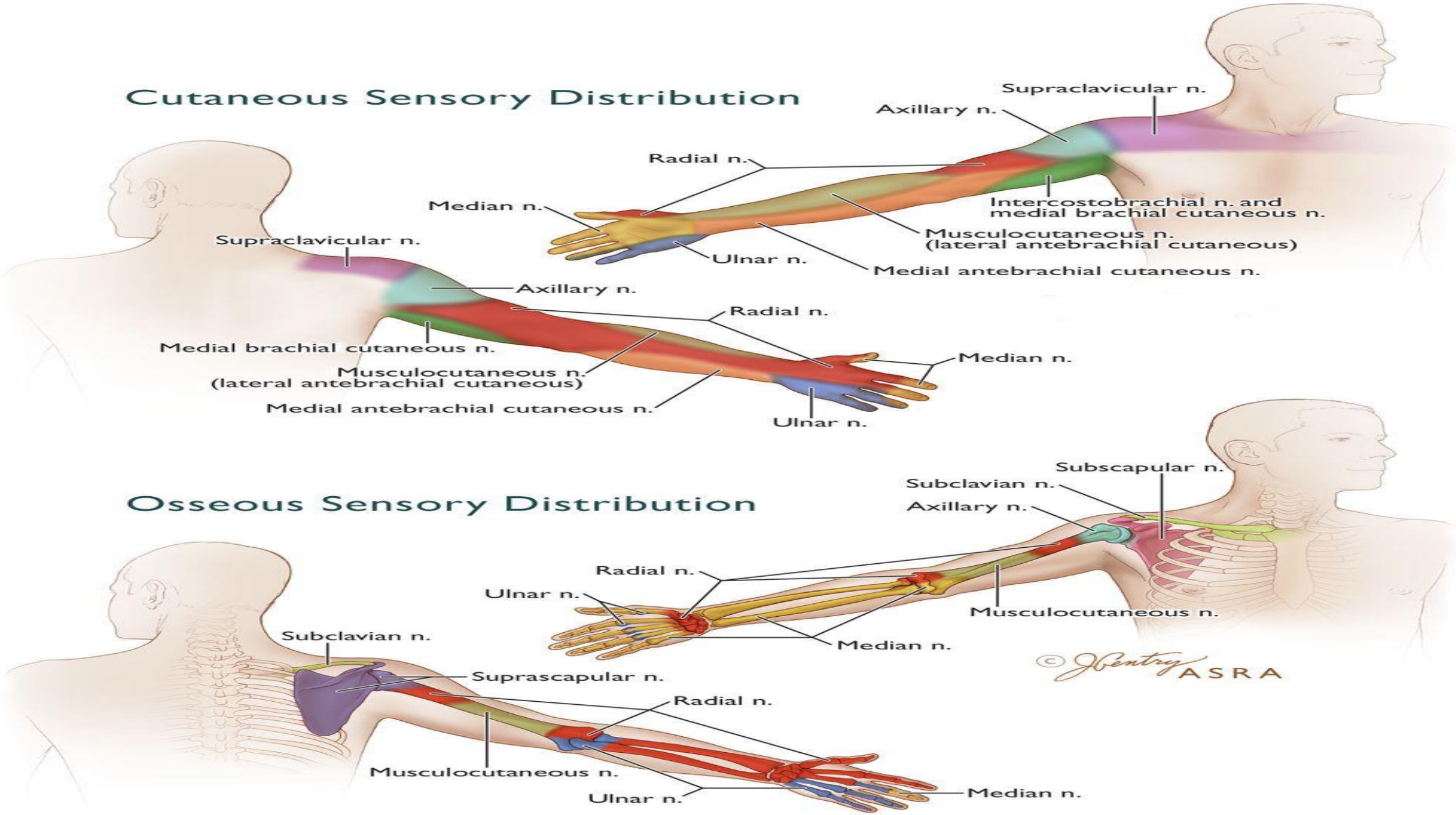

Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

Interscalene block

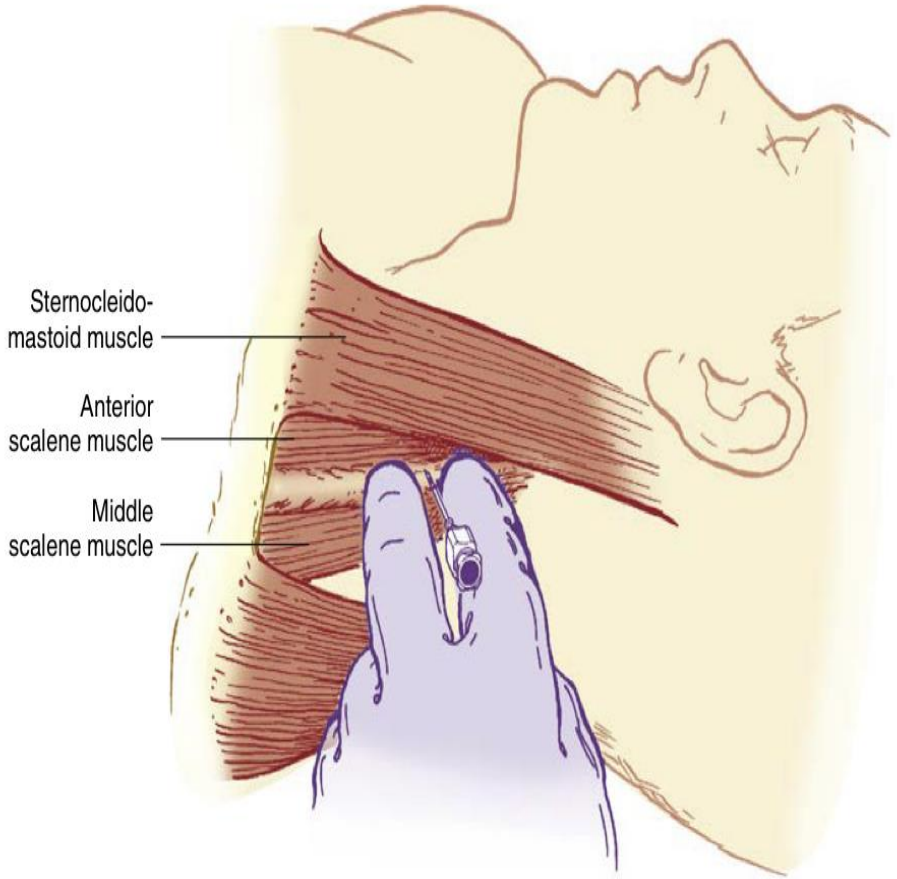

Fig. 46.18 Interscalene block guided by palpation. The fingers palpate the interscalene groove, and the needle is inserted with a caudad and slightly posterior angle.

Indication : Shoulder (superior & middle trunk) forearm, hand surgery (inferior trunk)

Position : supine with head turned away from site of block, slightly elevate of head

Target : hypoechoic structure between anterior and middle scalene (stoplight sign)

Side effect : ipsilateral phrenic nerve paralysis, pneumothorax
recurrent laryngeal,
cervical sympathetic nerve (rarely)

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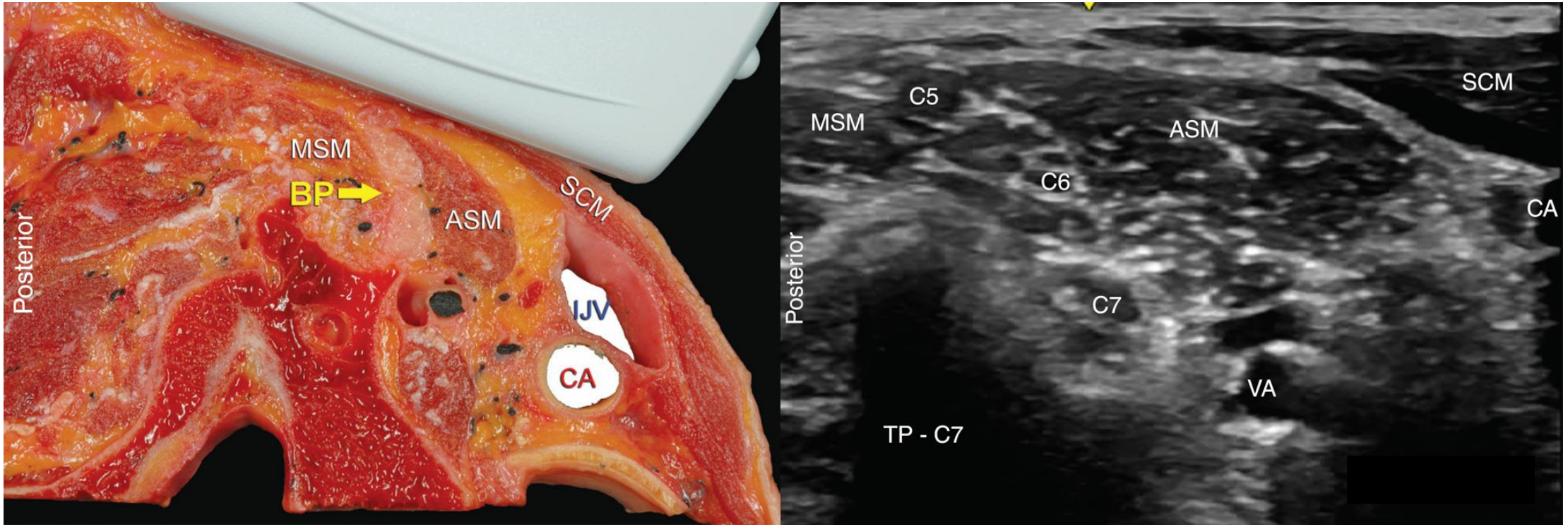
Interscalene block

Anatomy



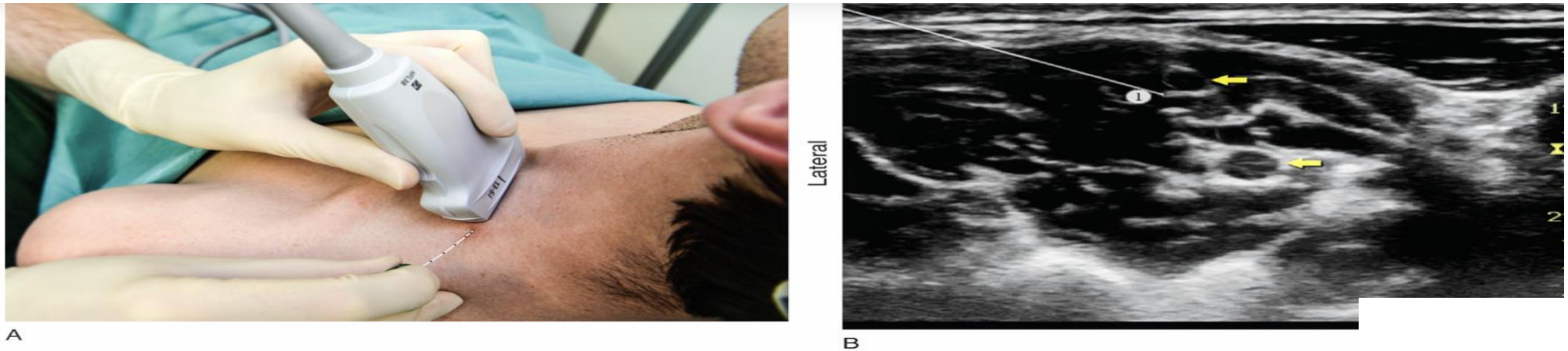


FIGURE 6. ***(A)*** *Transducer placement and needle insertion.* ***(B)*** *Position of the needle (1) for the interscalene brachial plexus block using an in-plane approach. The needle tip is seen in contact with the elements of the brachial plexus (yellow arrows); this always results in high injection pressure (> 15 psi)—indicating that the needle should be withdrawn slightly away from the trunk.*

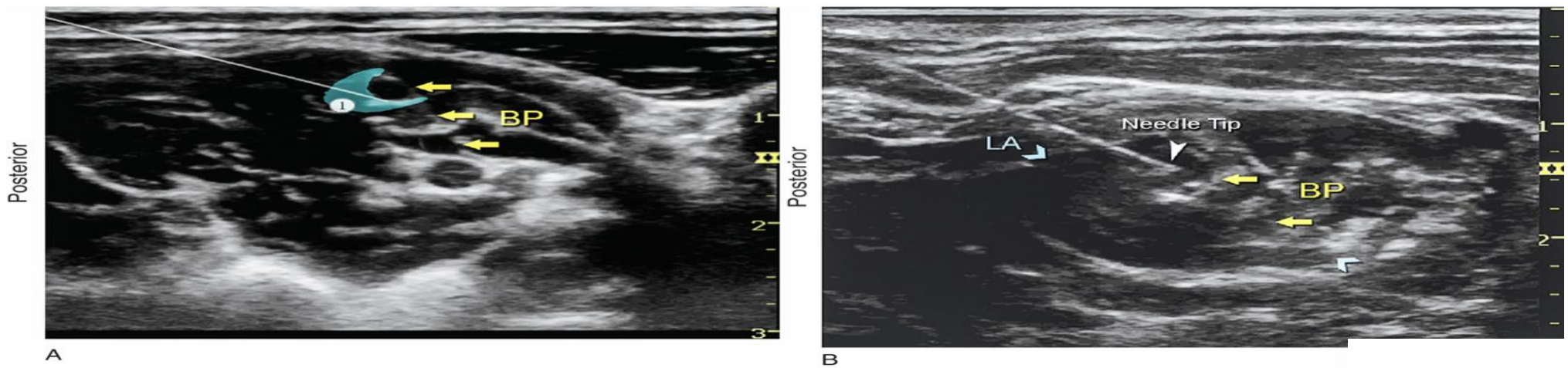
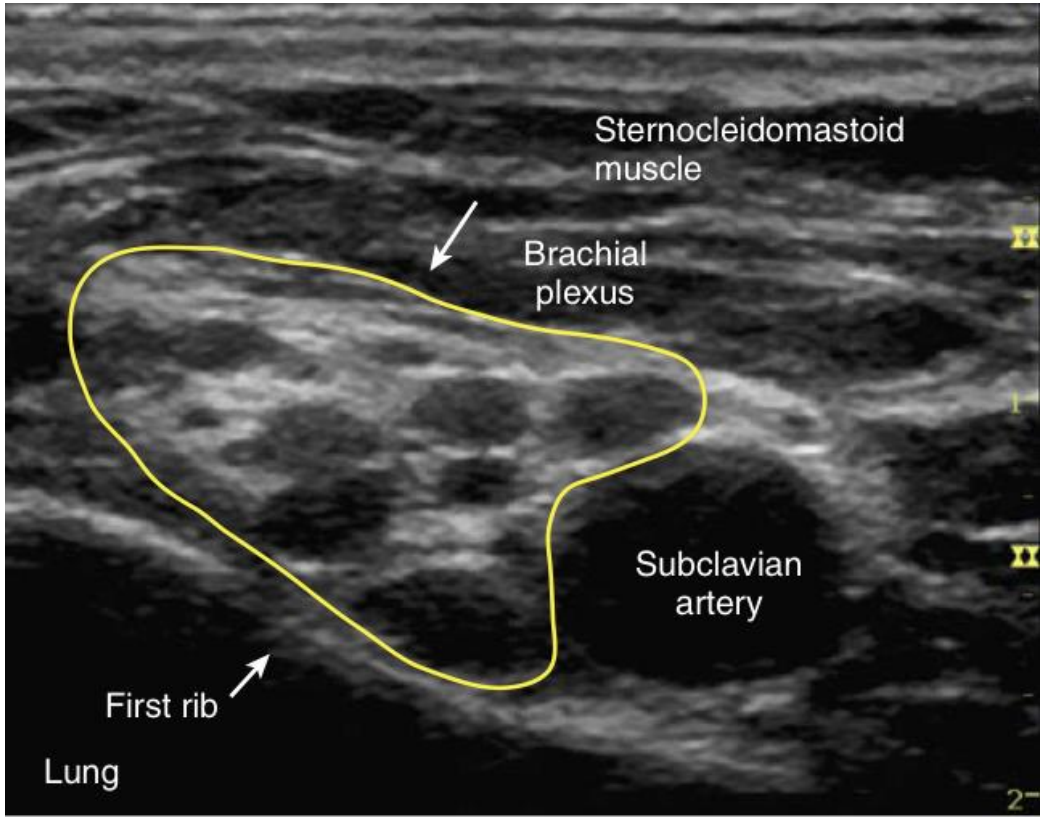


FIGURE 7. ***(A)*** *A small volume of local anesthetic (blue-shaded area) is injected through the needle to confirm proper needle placement. A properly placed needle tip will result in distribution of local anesthetic between and/or alongside roots of the brachial plexus (BP).* ***(B)*** *An actual needle (white arrowhead) placement in the interscalene groove, with dispersion of local anesthetic (LA) (blue-shaded area or arrows) surrounding the BP.*

Supraclavicular nerve block



Indication : elbow , forearm, hand

Target : distal trunk-proximal division level

Position : supine position with the hand turned away from the side of block

Side effects : pneumothorax (0.5-6%)
Phrenic nerve block (40-60%)
Horner's syndrome, neuropathy

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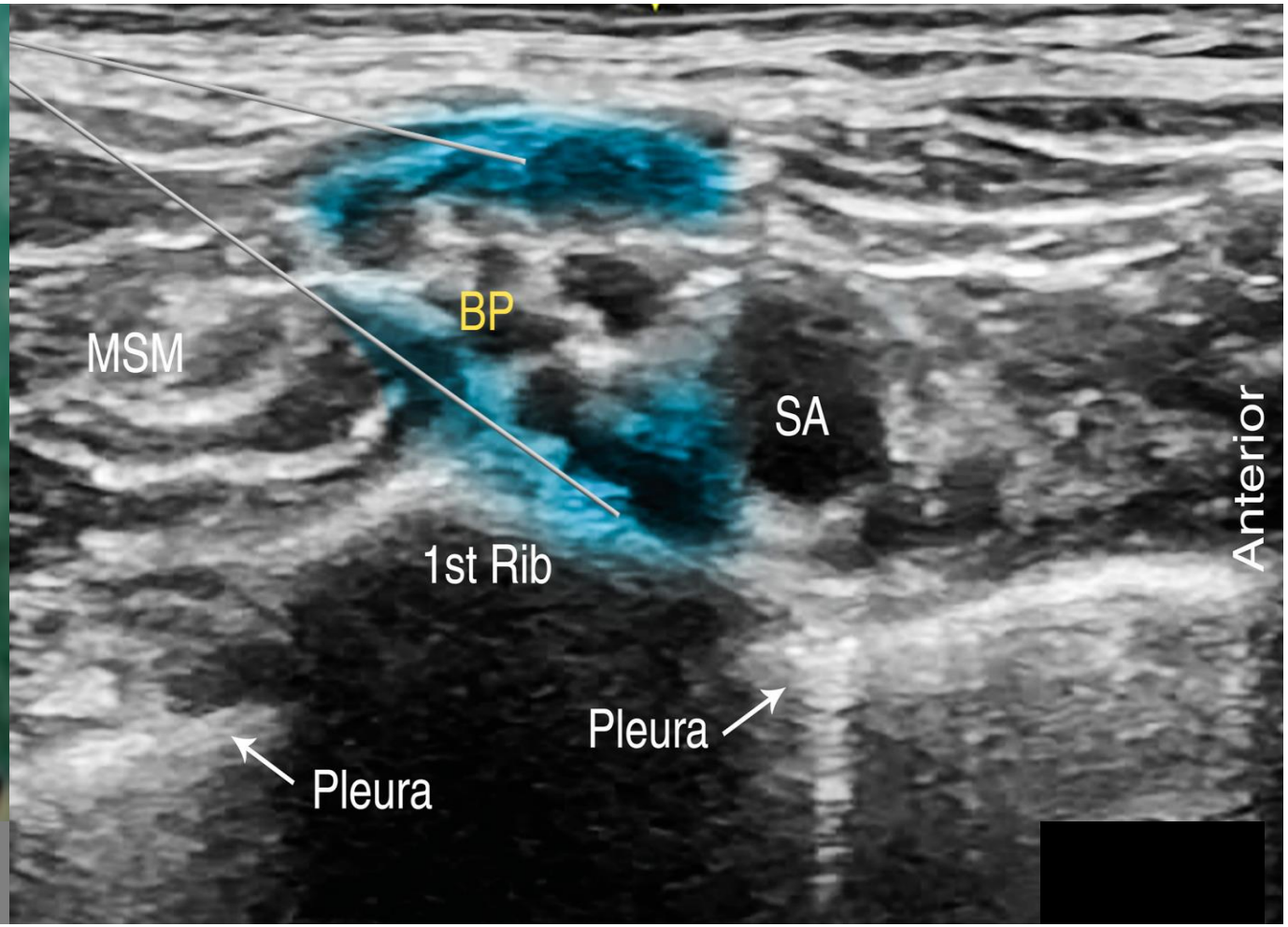
Supraclavicular nerve block



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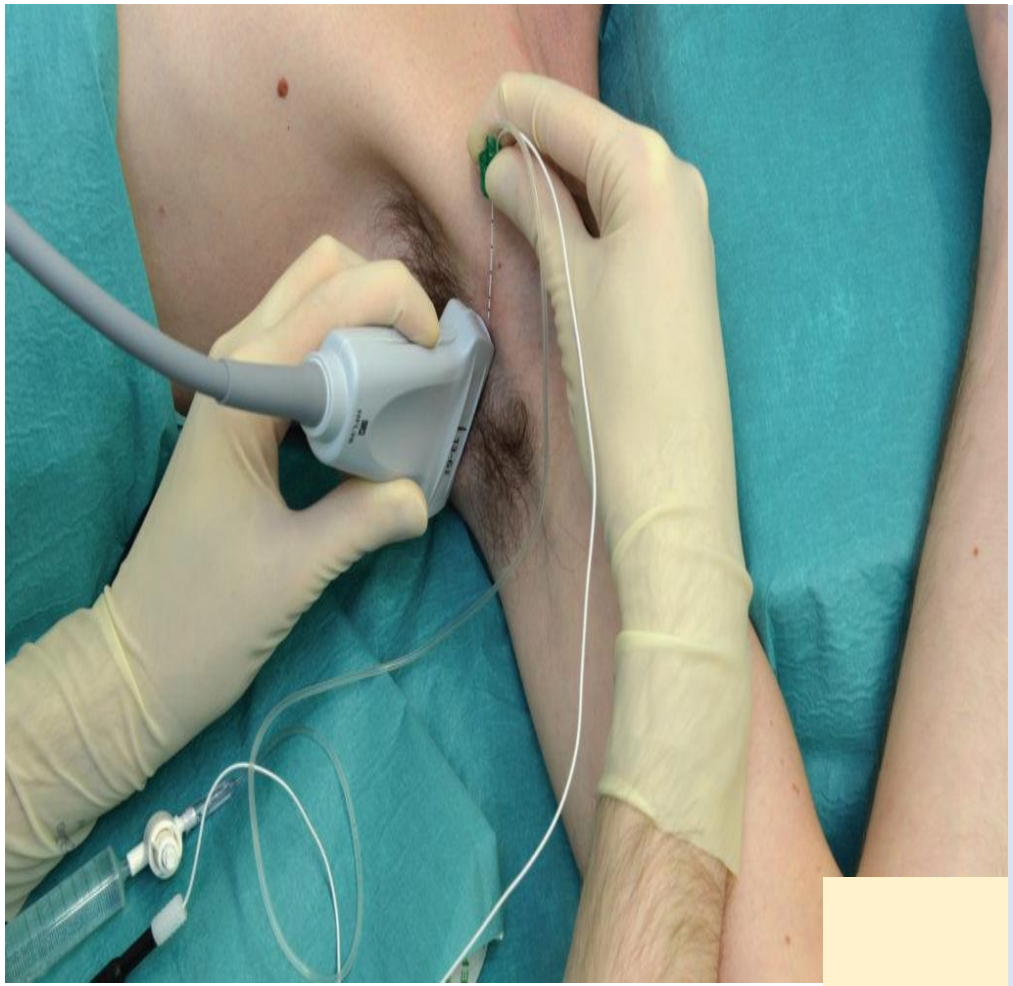
Axillary blocks



Indication : elbow , distal upper extremity

Target : three arterial wall-hugging branch (median , ulnar, radial)
medial-to-lateral course in axilla (musculocutaneous)

landmark : axillary artery

Position : supine position with arm abducted 90° and elbow flexed

Side effects : neurovascular injury

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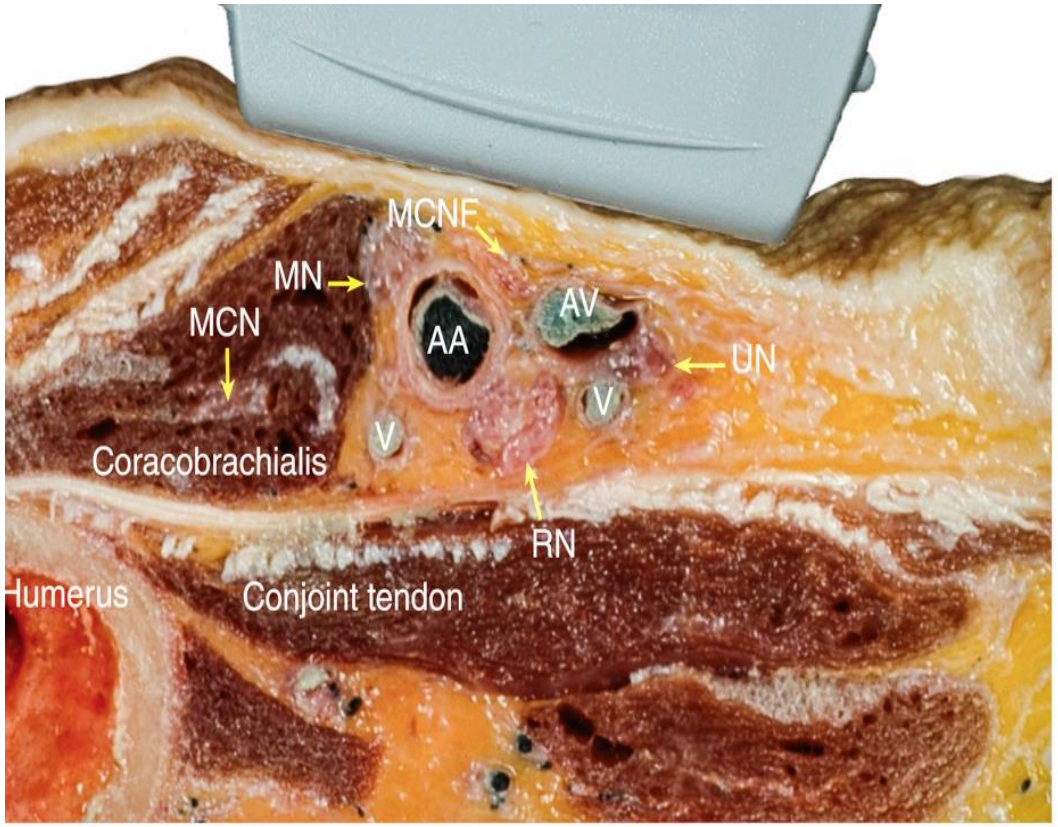
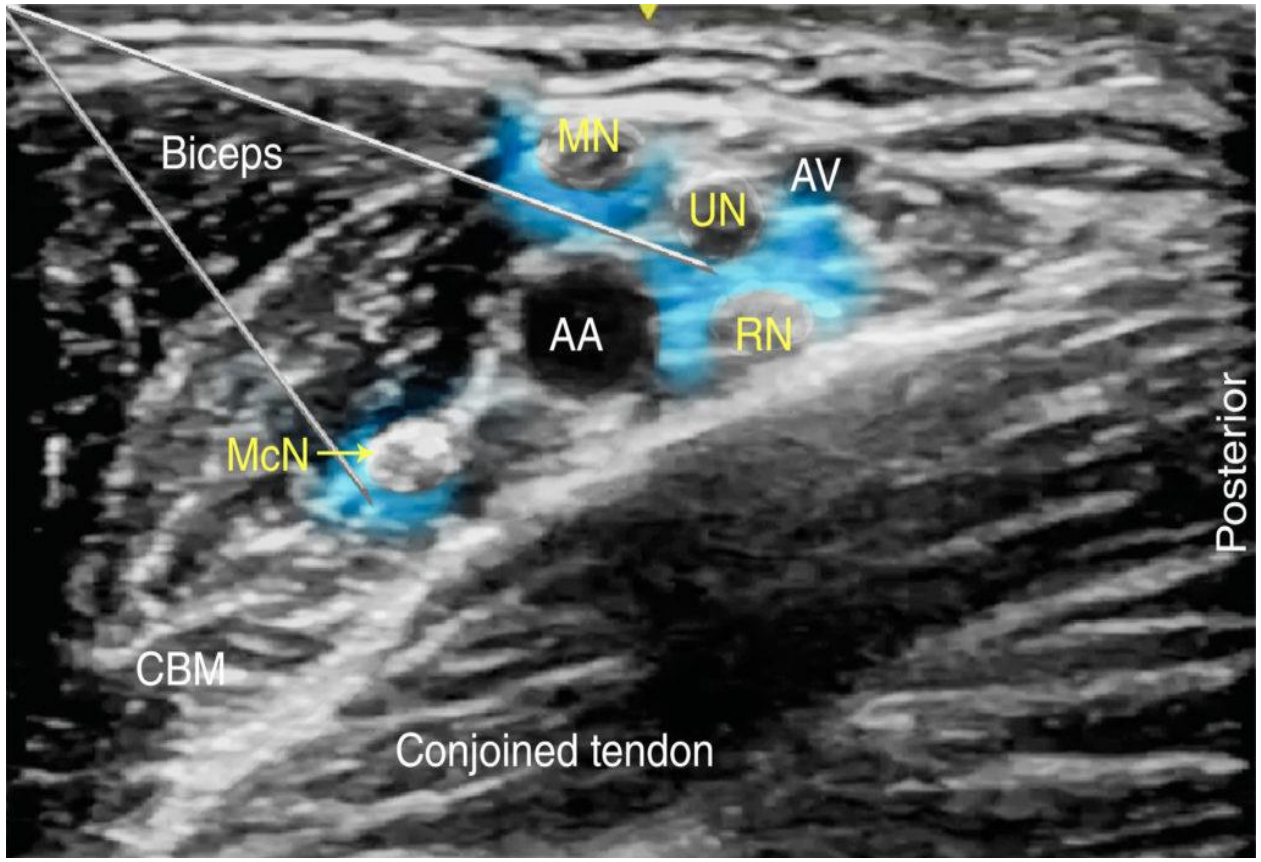
Axillary blocks





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Trunk blocks

- Intercostal nerve blocks
- Transversus abdominis plane block
- Ilioinguinal and iliohypogastric nerves blocks

Intercostal nerve blocks

Anatomy

1° rami of T1-T12 (subcostal nerve)

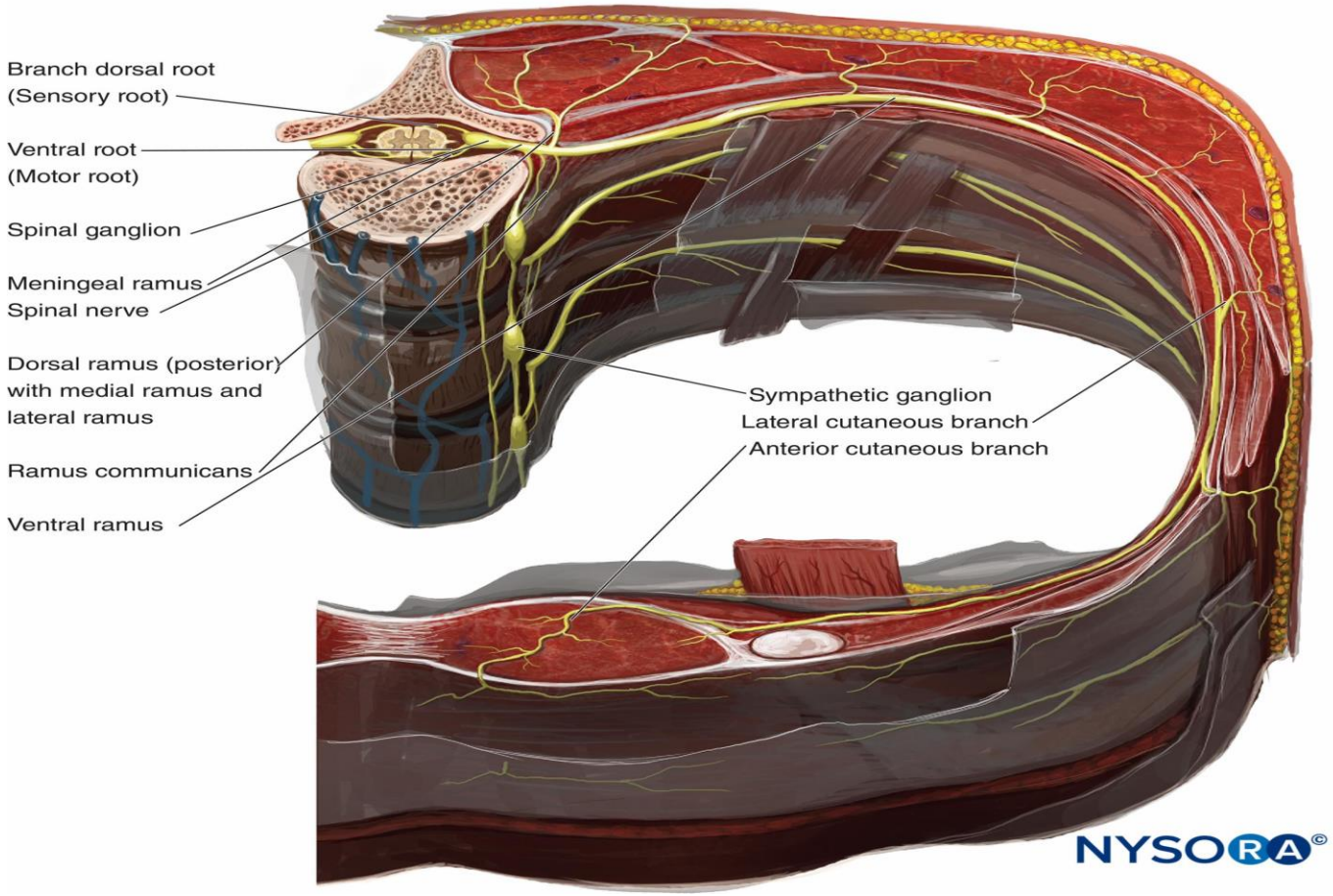
4 branch

1.1 posterior cutaneous branch
supply skin & muscle paravertebral area

1.2 lateral cutaneous branch
(arising just anterior to mid axillary line)
- Anterior & Posterior subcutaneous branch

1.3 Anterior subcutaneous branch

1.4 gray ramus communication
(Anterior to sympathetic ganglion)



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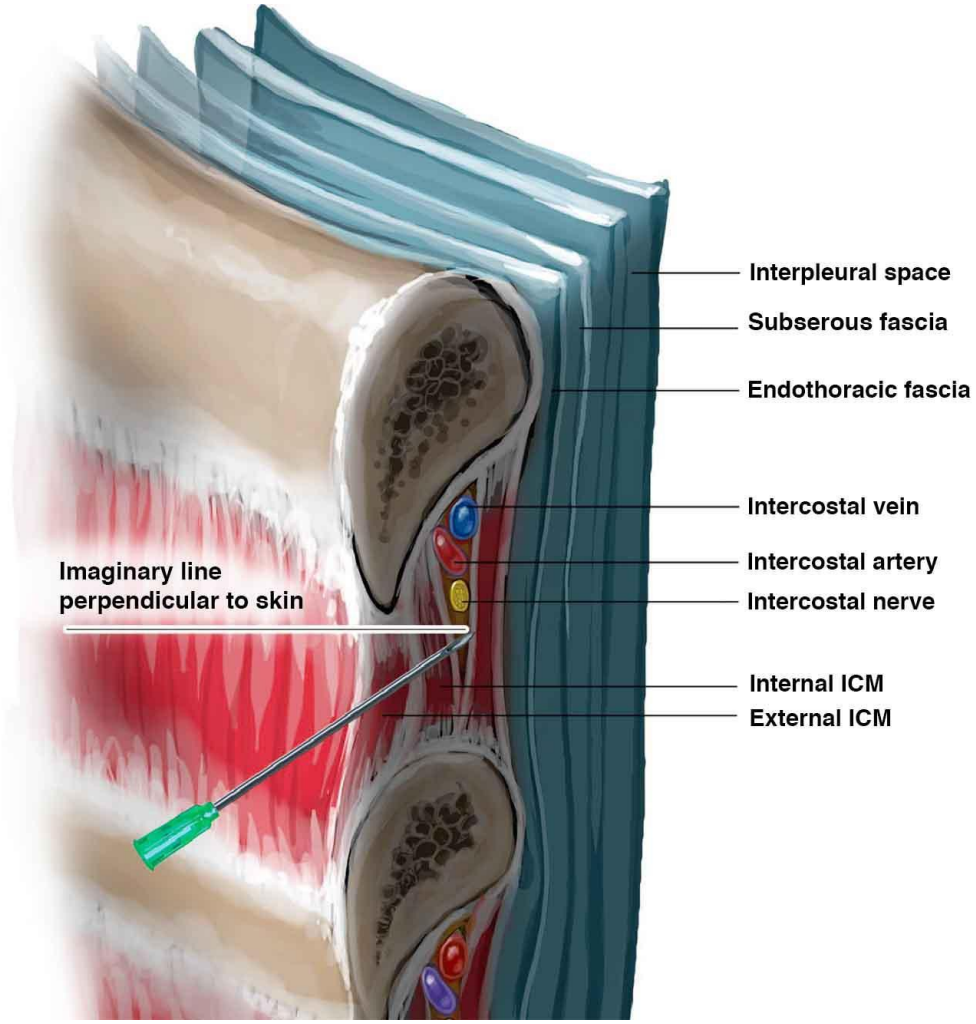
Intercostal nerve blocks



Indication : intraabdominal procedure
(postoperative analgesia)

Target : subcostal groove both distally & proximally

landmark : angle of the rib (*7 cm. lateral to midline*)

Position : sitting, prone, lateral

Side effects : pneumothorax, LAST
asymptomatic pneumothorax (0.7%)

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Intercostal nerve blocks

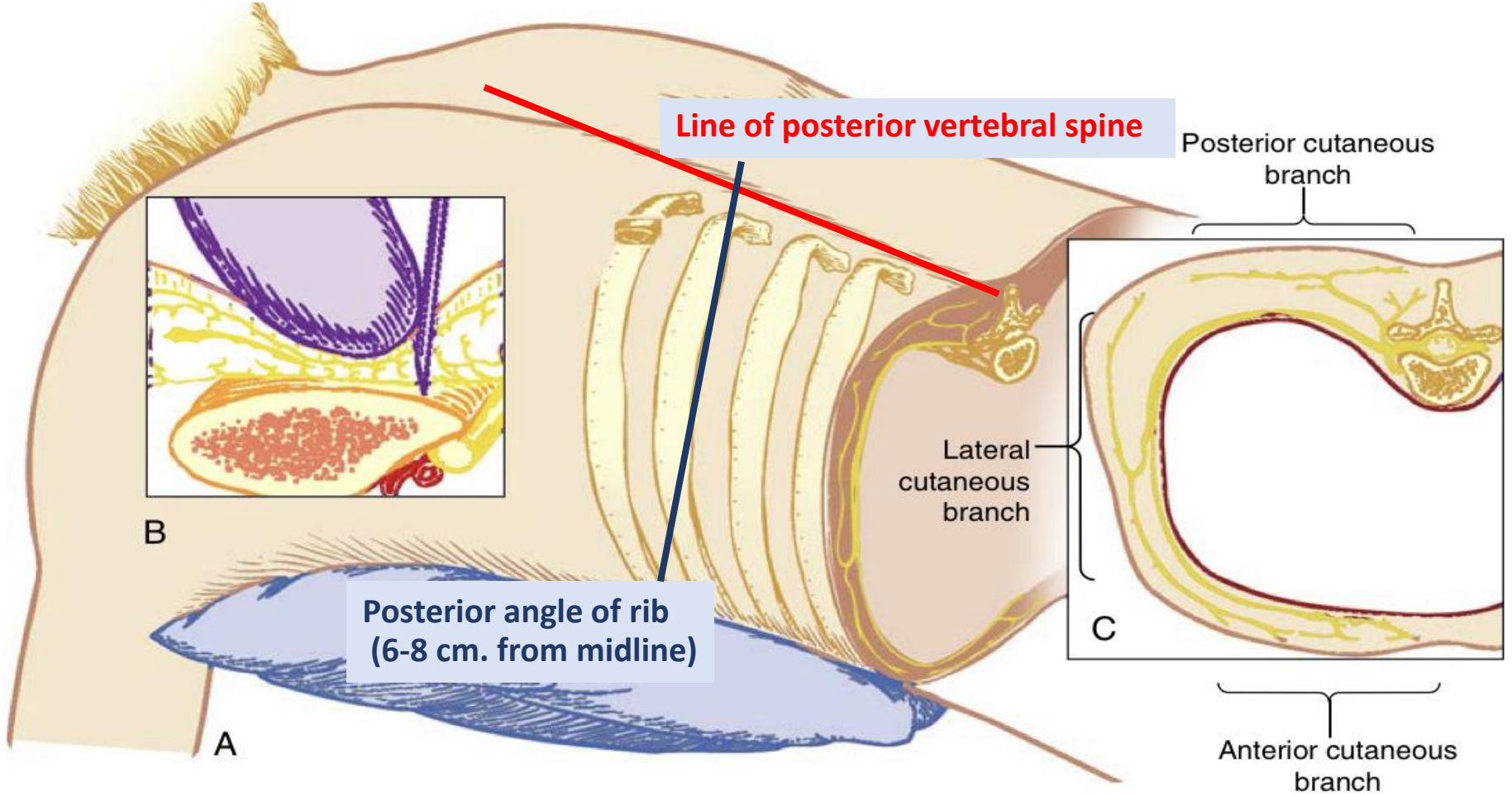

Fig. 46.24 (A) Patient positioning for an intercostal nerve block. (B) The index finger displaces the skin up over the rib. The needle is inserted at the tip of the finger and rests on the rib. The needle is walked off the lower rib edge and inserted 3 to 5 mm. (C) An intercostal nerve and its branches.

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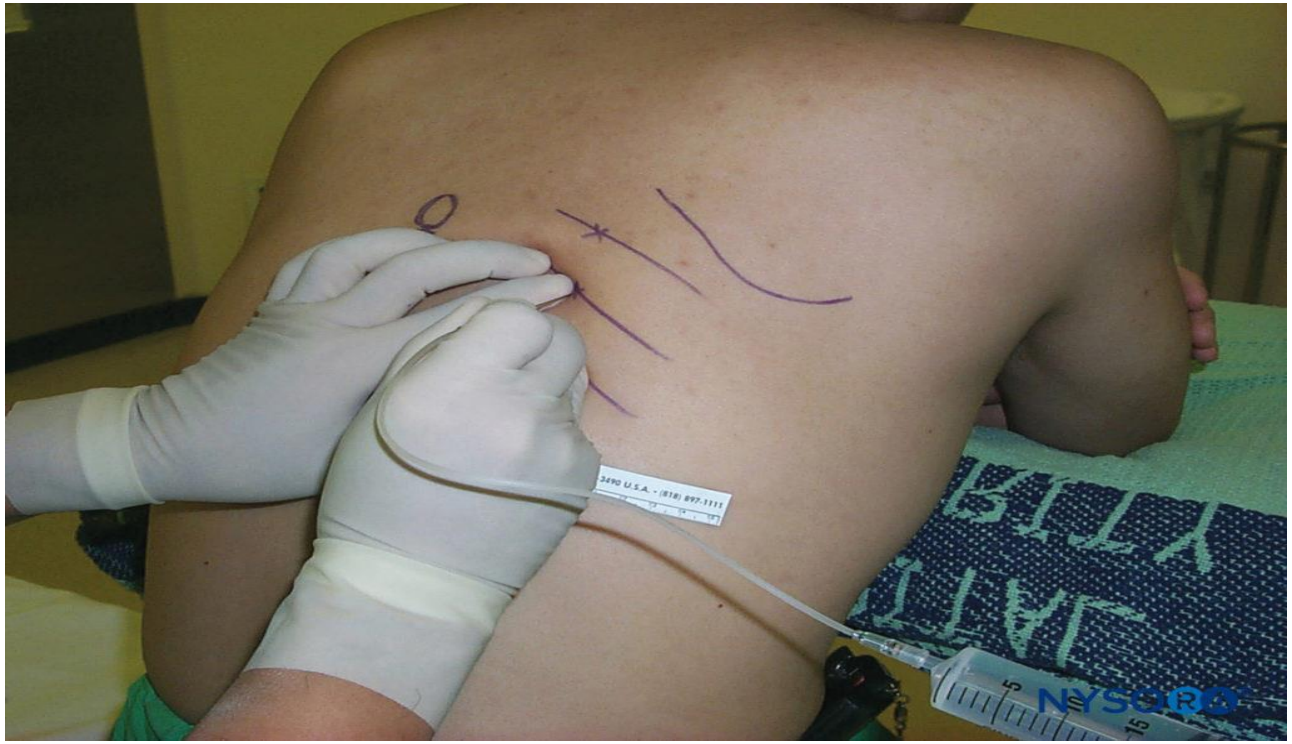
•Ribs can be counted starting from the 12th rib, or from the 7th rib (inferior tip of the scapula).
•The inferior edges of the ribs to be blocked are marked just lateral to the lateral border of the sacrospinalis (paraspinous) muscle group (usually 6–8 cm from the mid-line at the lower ribs and 4–7 cm from the midline at the upper ribs), corresponding to the angles of the ribs.



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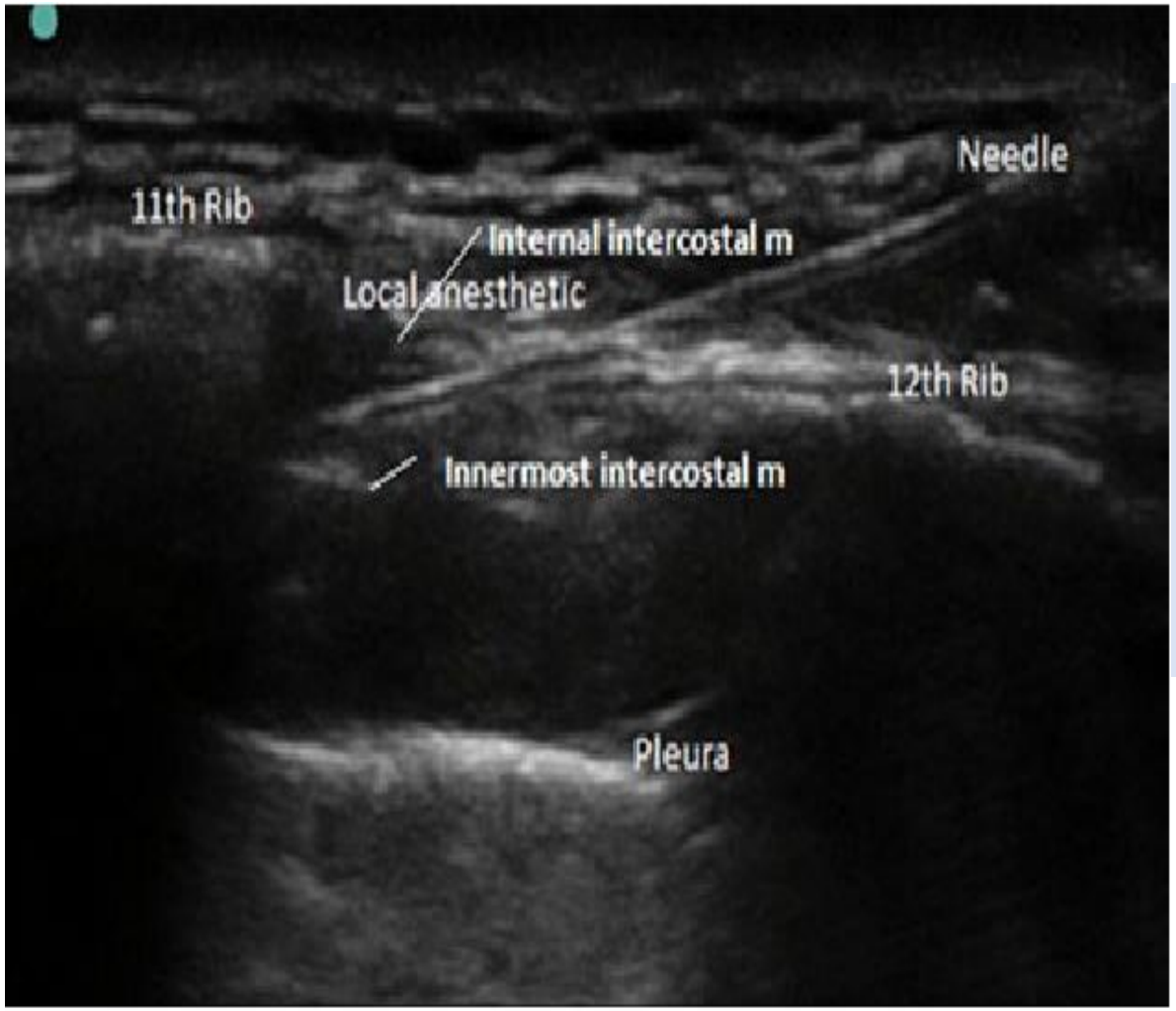
Intercostal nerve blocks



- The best needle insertion for ICNB is the angle of rib, about 7 cm lateral to midline
- The ideal angle of entry into the subcostal groove is about 20° cephalad
- ICNB above T7 may be difficult because of the scapulae ; alternative technique such as epidural or paravertebral block should be consider

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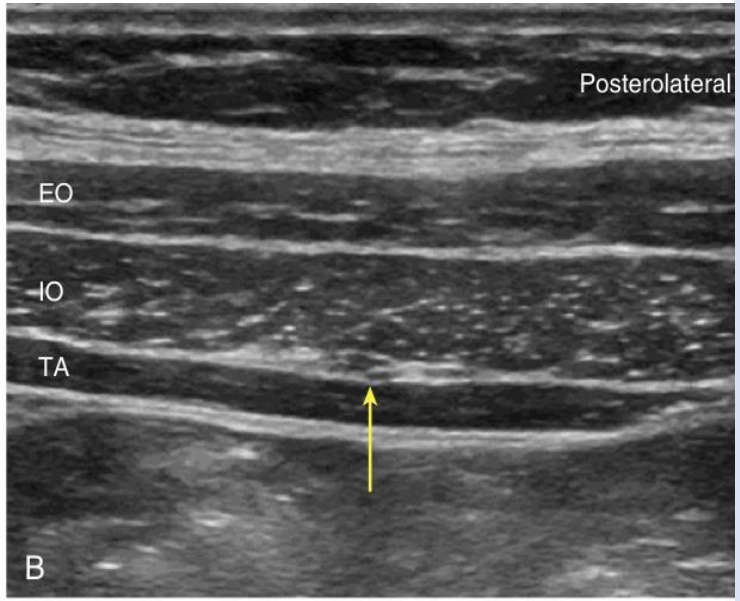
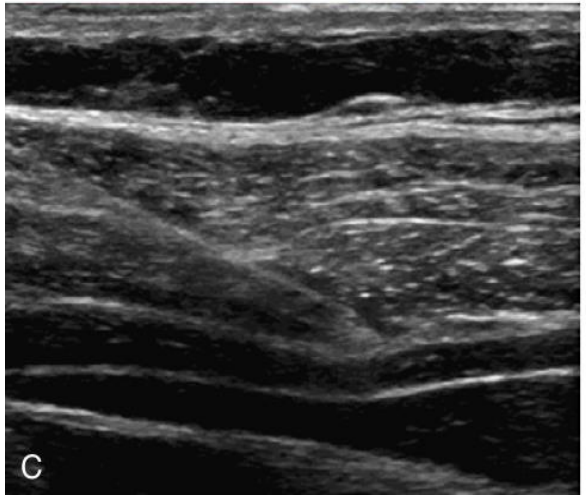
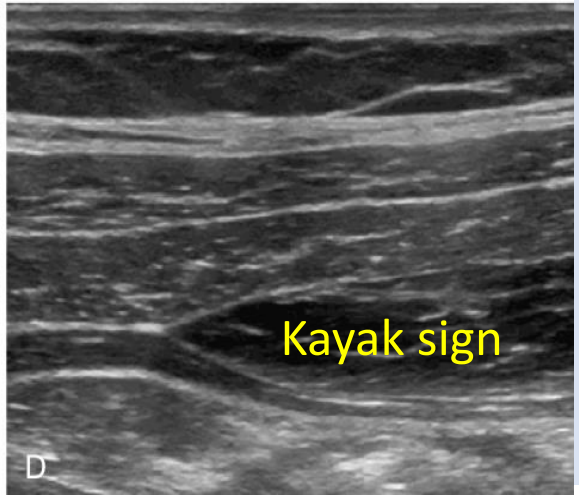
Transversus abdominis plane block







Indication : intraabdominal procedure
(postoperative analgesia)

Target : *intercostal T7-T11,subcostal T12,*
ilioinguinal, iliohypogastric , genitofemoral (L1)

landmark : layer between transversus abdominis
internal oblique muscle

Position : supine

Side effects : intraabdominal organ injury

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Subcostal TAB block

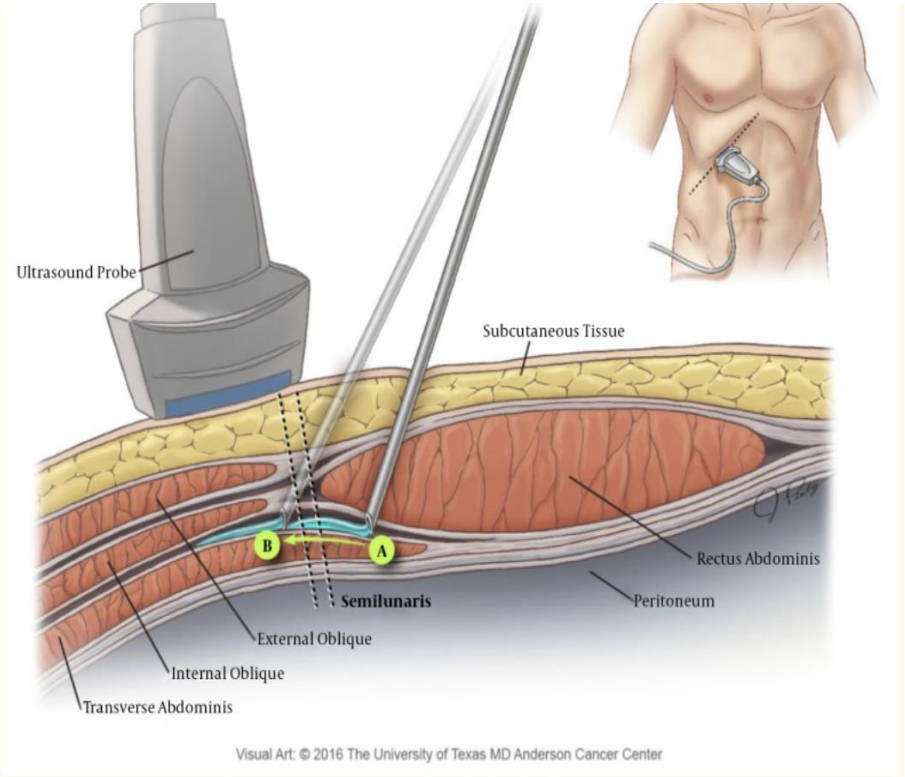


Figure 7.

Illustration of Needle Placement Medial to the Semilunaris

The TAP plane is entered with the needle. While local anesthetic is injected, the needle is advanced laterally resulting in lateral spread of the local anesthetic.

Indication : upper abdominal procedure (postoperative analgesia)

Target : *intercostal nerves T6-T9*

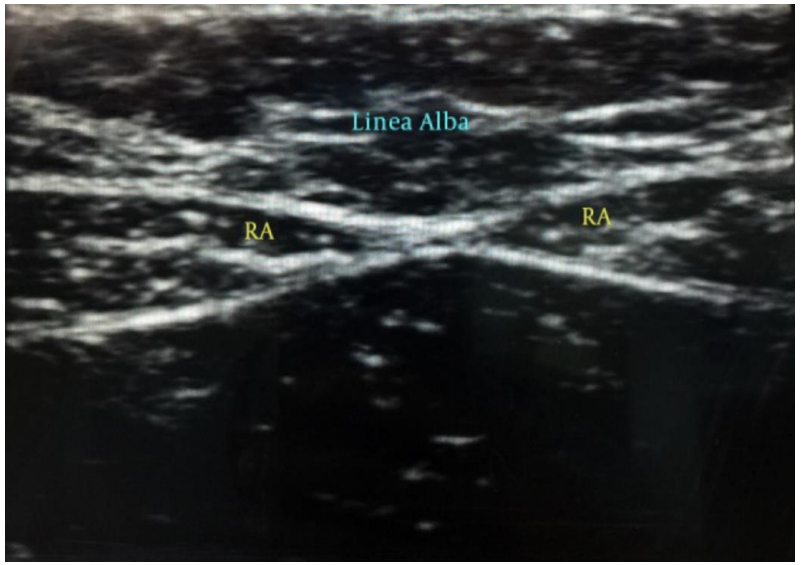
landmark : fascia between the rectus abdominis and transverse abdominis muscle

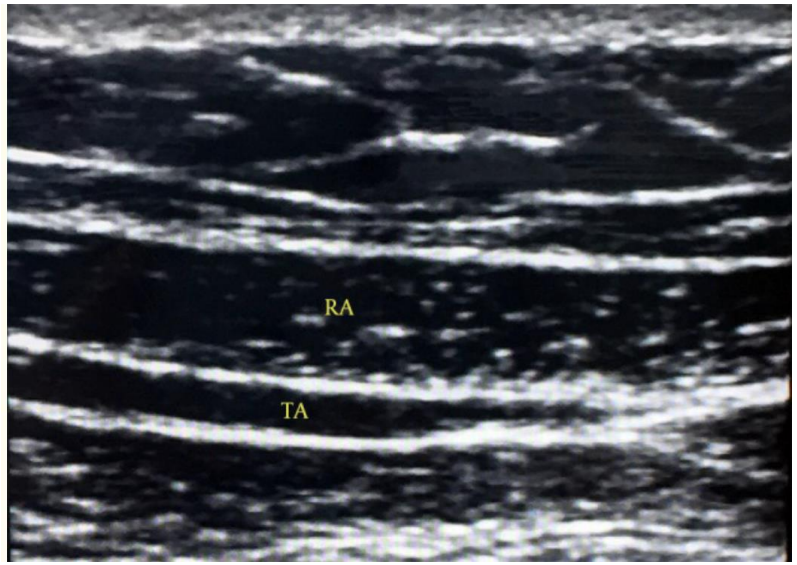
Position : supine with arm extended

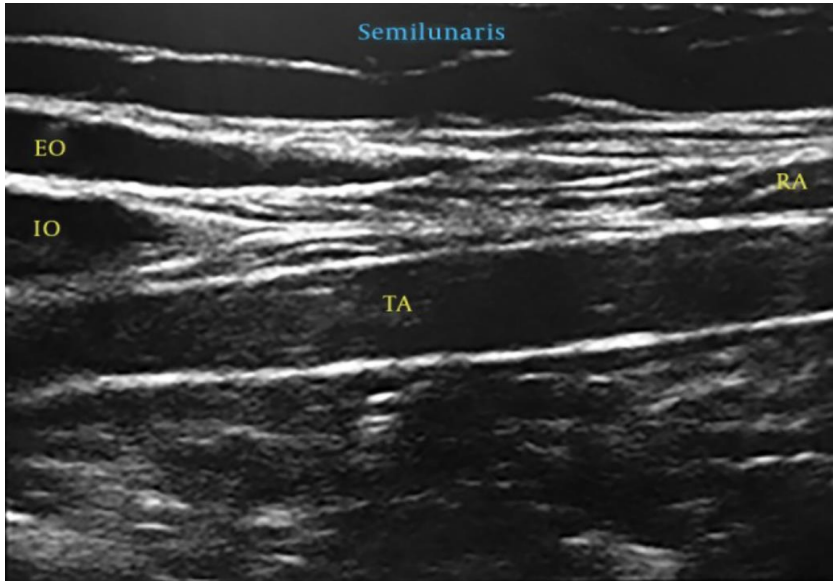
Side effects : bowel or diaphragm perforation liver laceration

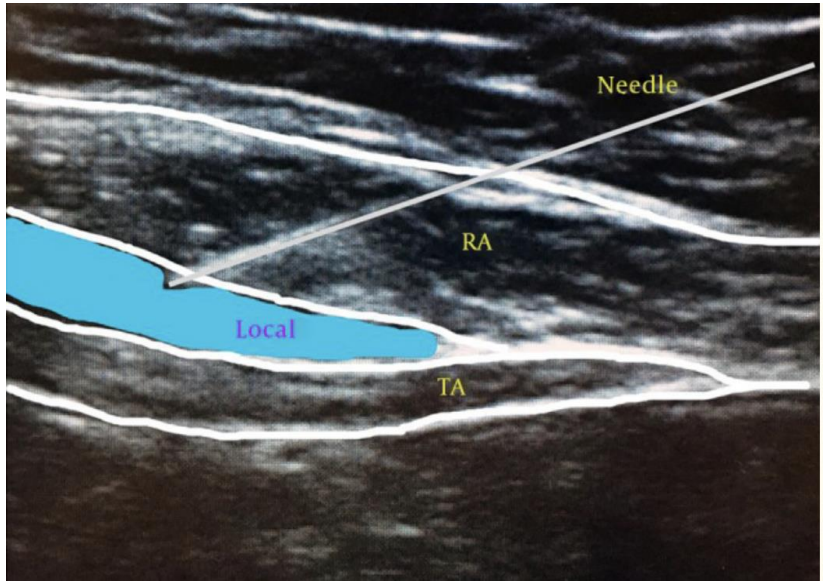
Soliz JM, Lipski I, Hancher-Hodges S, Speer BB, Popat K. Subcostal Transverse Abdominis Plane Block for Acute Pain Management: A Review. Anesth Pain Med. 2017;7(5):e12923. Published 2017 Oct 20. doi:10.5812/aapm.12923

Subcostal TAB block



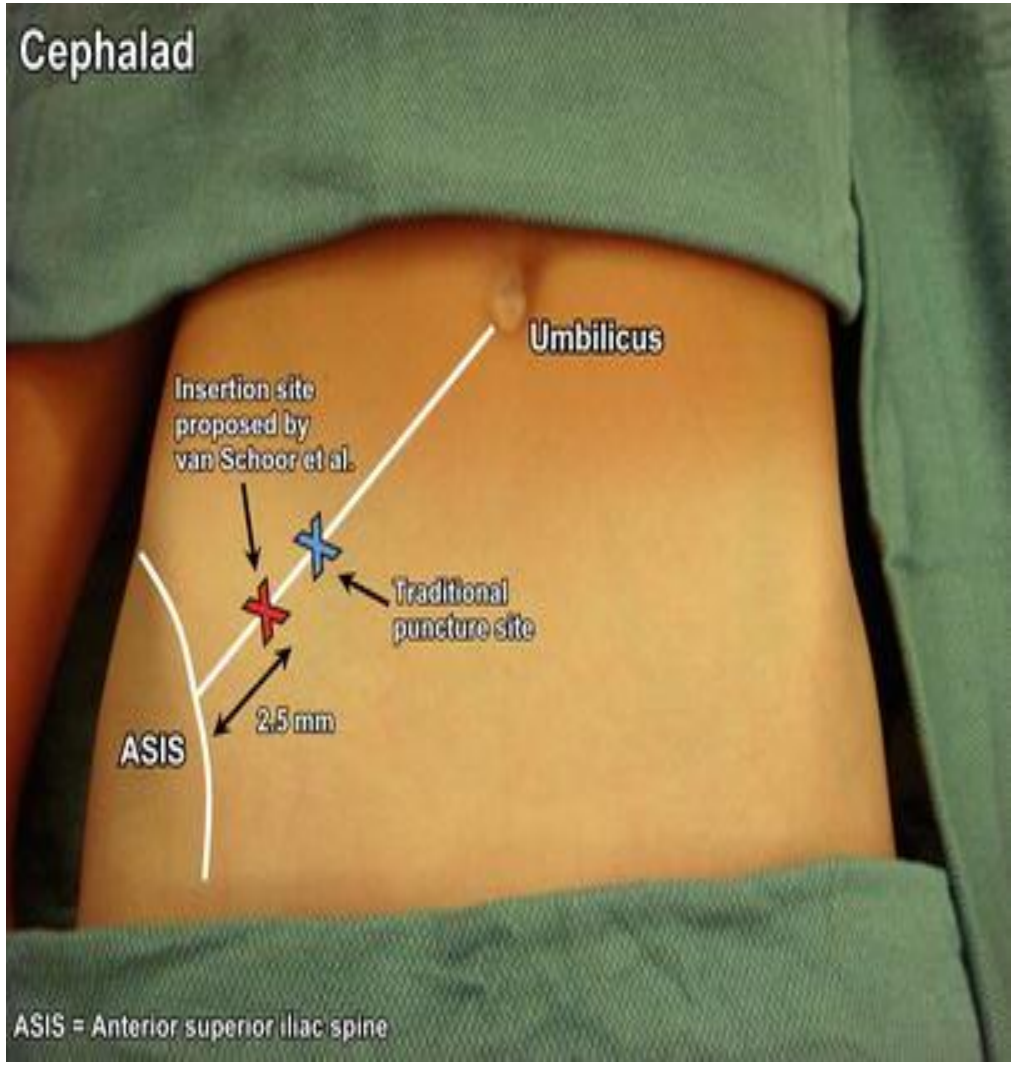






Soliz JM, Lipski I, Hancher-Hodges S, Speer BB, Popat K. Subcostal Transverse Abdominis Plane Block for Acute Pain Management: A Review. Anesth Pain Med. 2017;7(5):e12923. Published 2017 Oct 20. doi:10.5812/aapm.12923

Ilioinguinal and iliohypogastric nerve blocks



Indication : inguinal hernia repair
lower abdomen procedure

Target : *ilioinguinal, iliohypogastric*

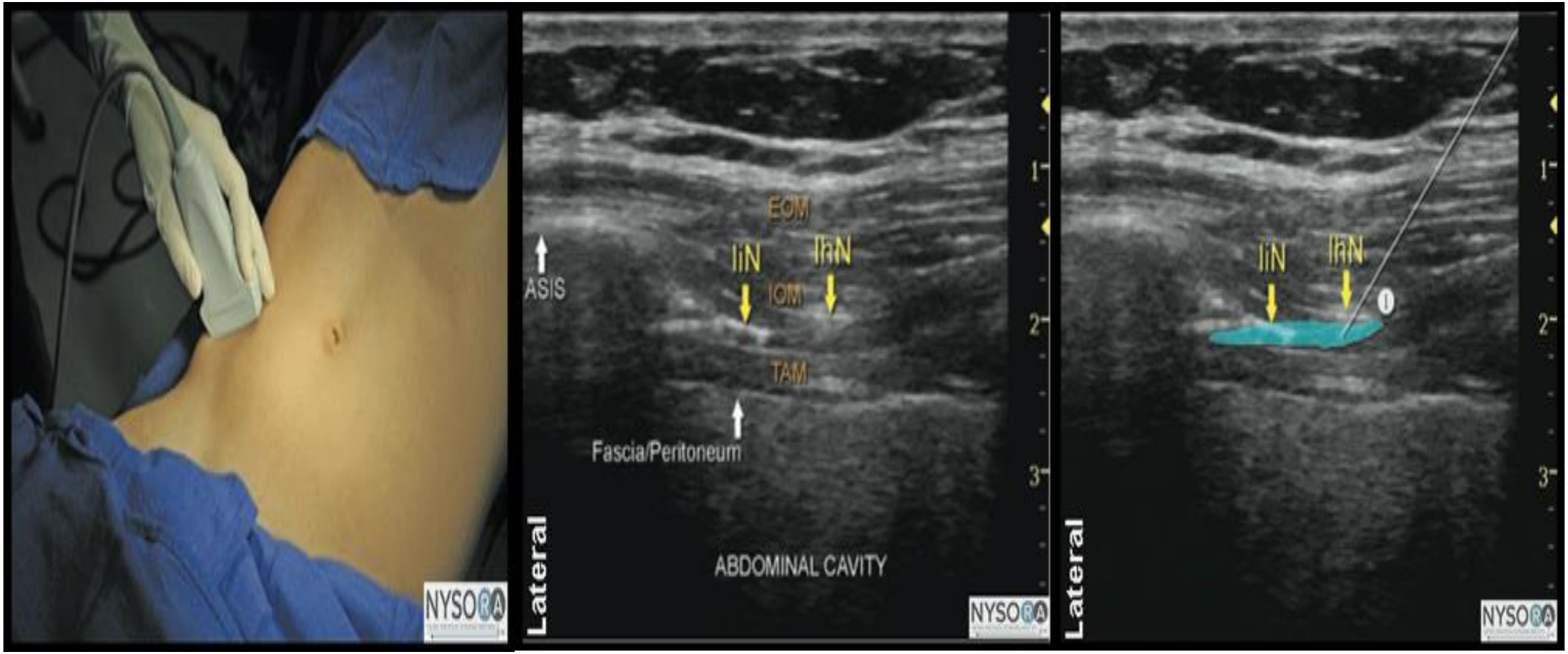
landmark : ASIS is located and mark 2 cm.
cephalad & 2 cm. medial

Position : supine

Side effects : injury to intestine or blood vessels
perforation of large or small bowel
pelvic hematoma, lower limb weakness

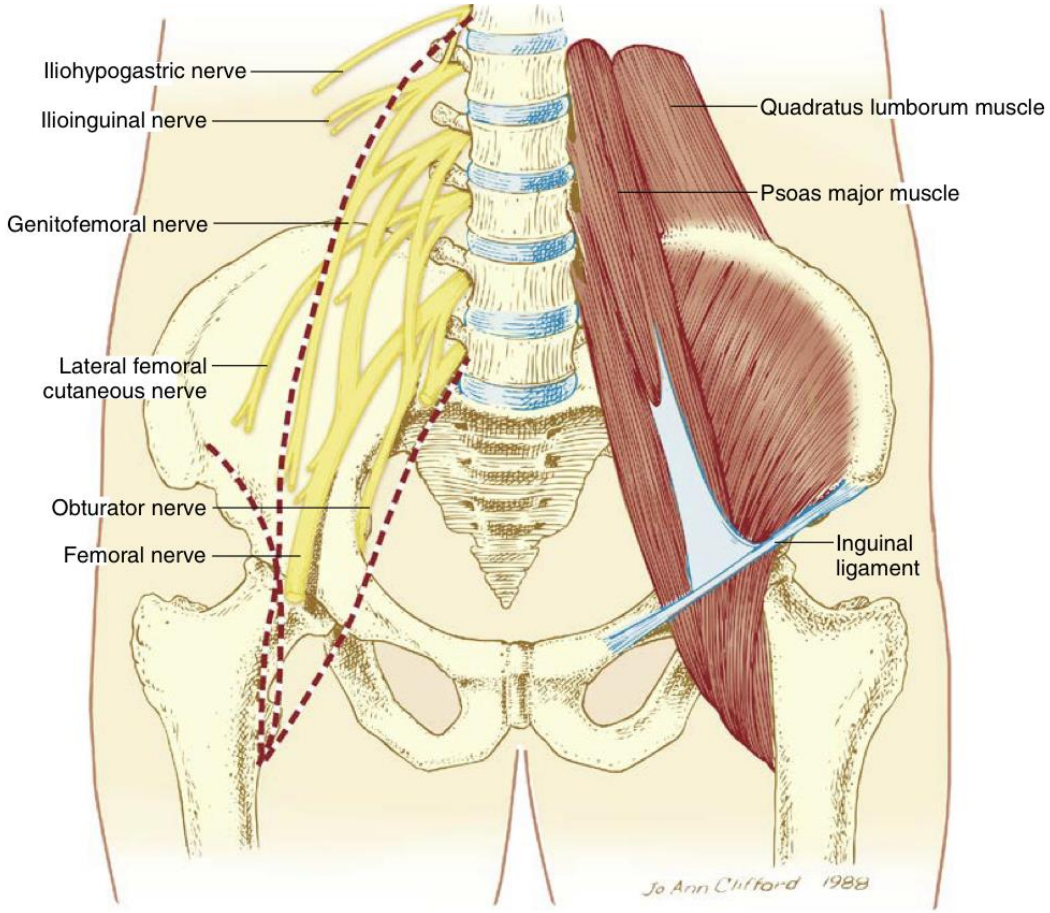
Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Ilioinguinal and iliohypogastric nerve blocks



Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Lower extremity nerve anatomy

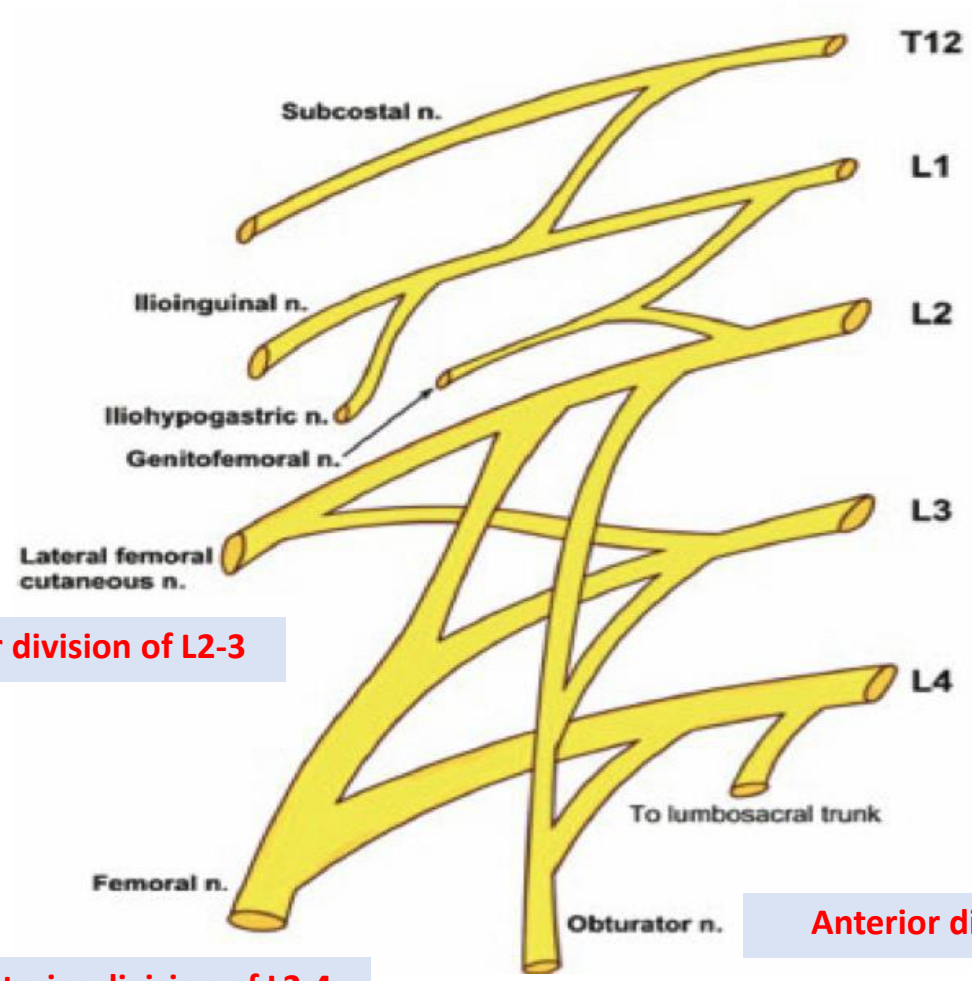


Lumbar plexus is formed by anterior rami of L1-4 & T12 occasionally from L5

The plexus *lies between psoas major & quadratus lumborum muscles*

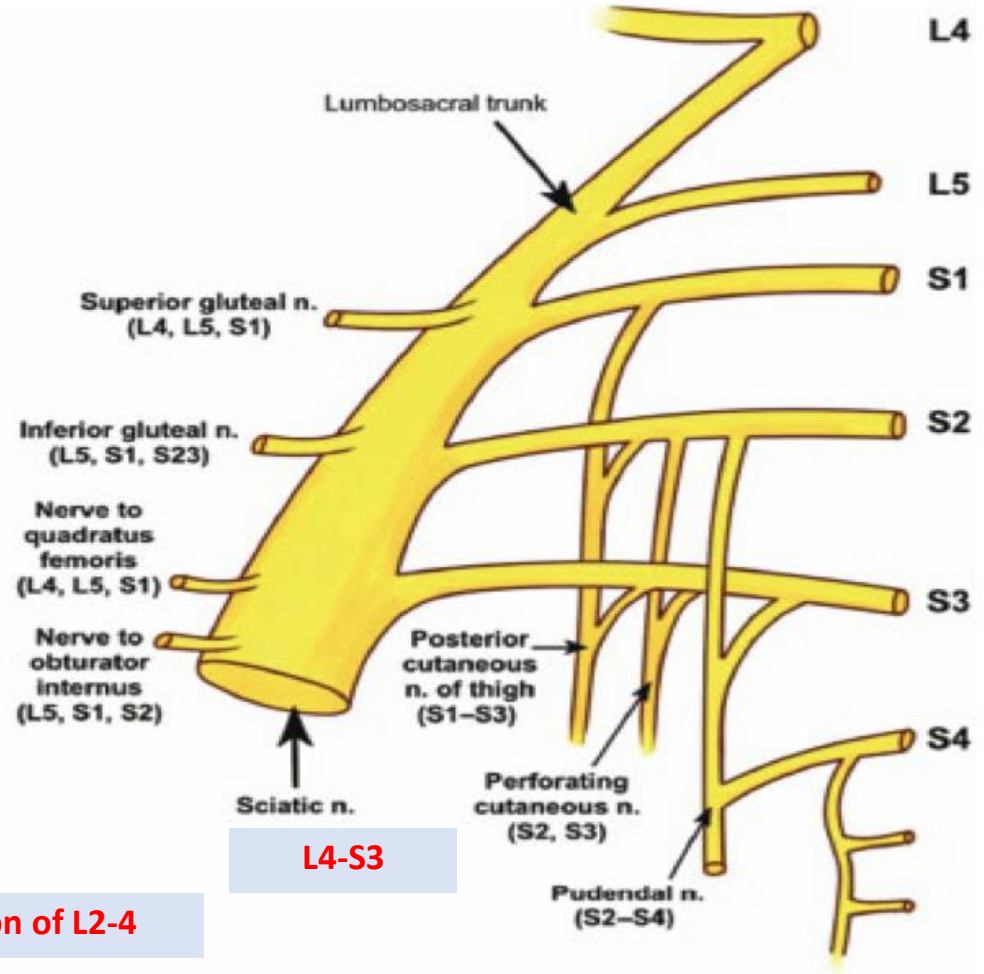
Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Lower extremity nerve anatomy



posterior division of L2-3

posterior division of L2-4

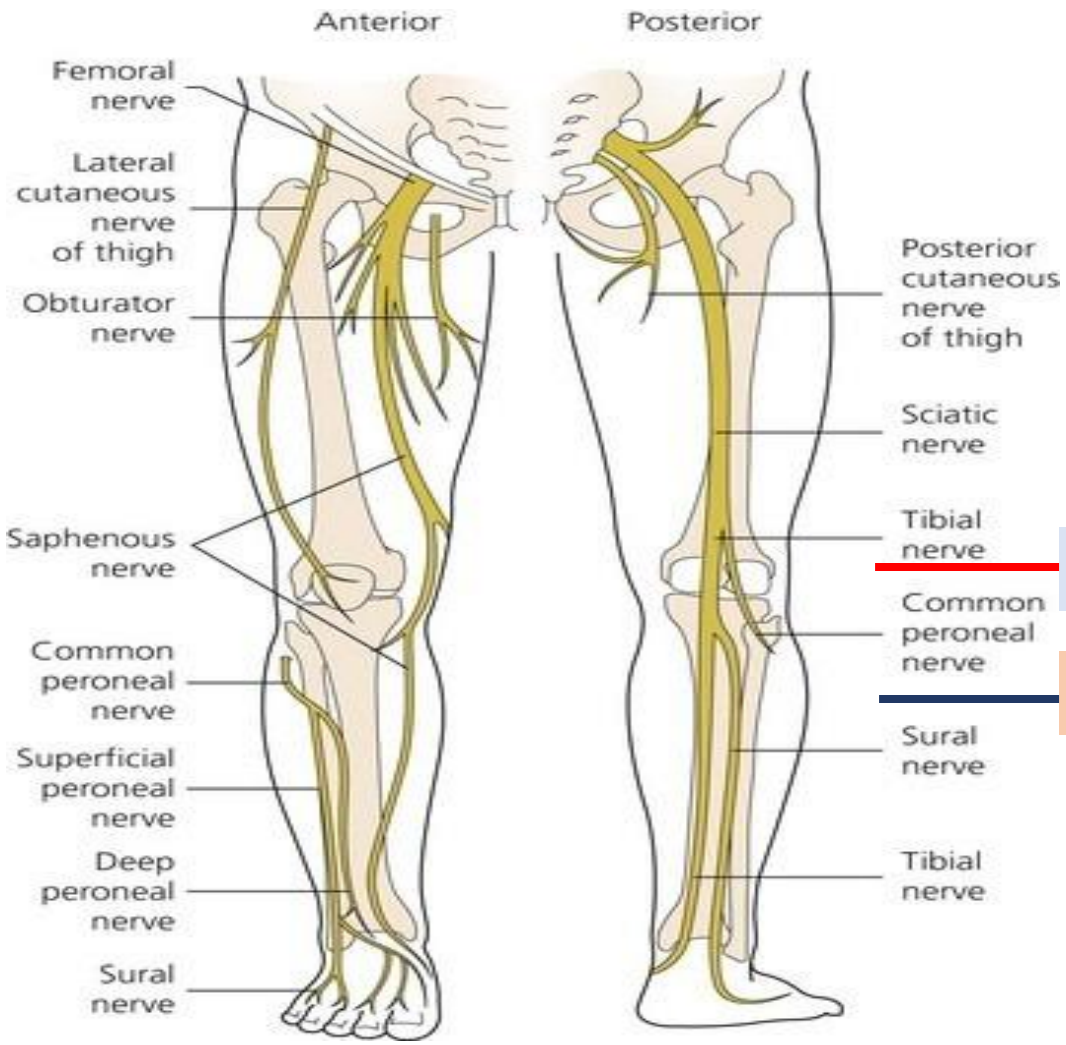


Anterior division of L2-4

L4-S3

Clinical anesthesia 8th edition 2017; peripheral nerve blockade

Lower extremity nerve anatomy



Ventral branch of anterior rami L5-S3

Dorsal branch of anterior rami L4-S3

Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Cutaneous distributions of lumbosacral and peripheral nerves

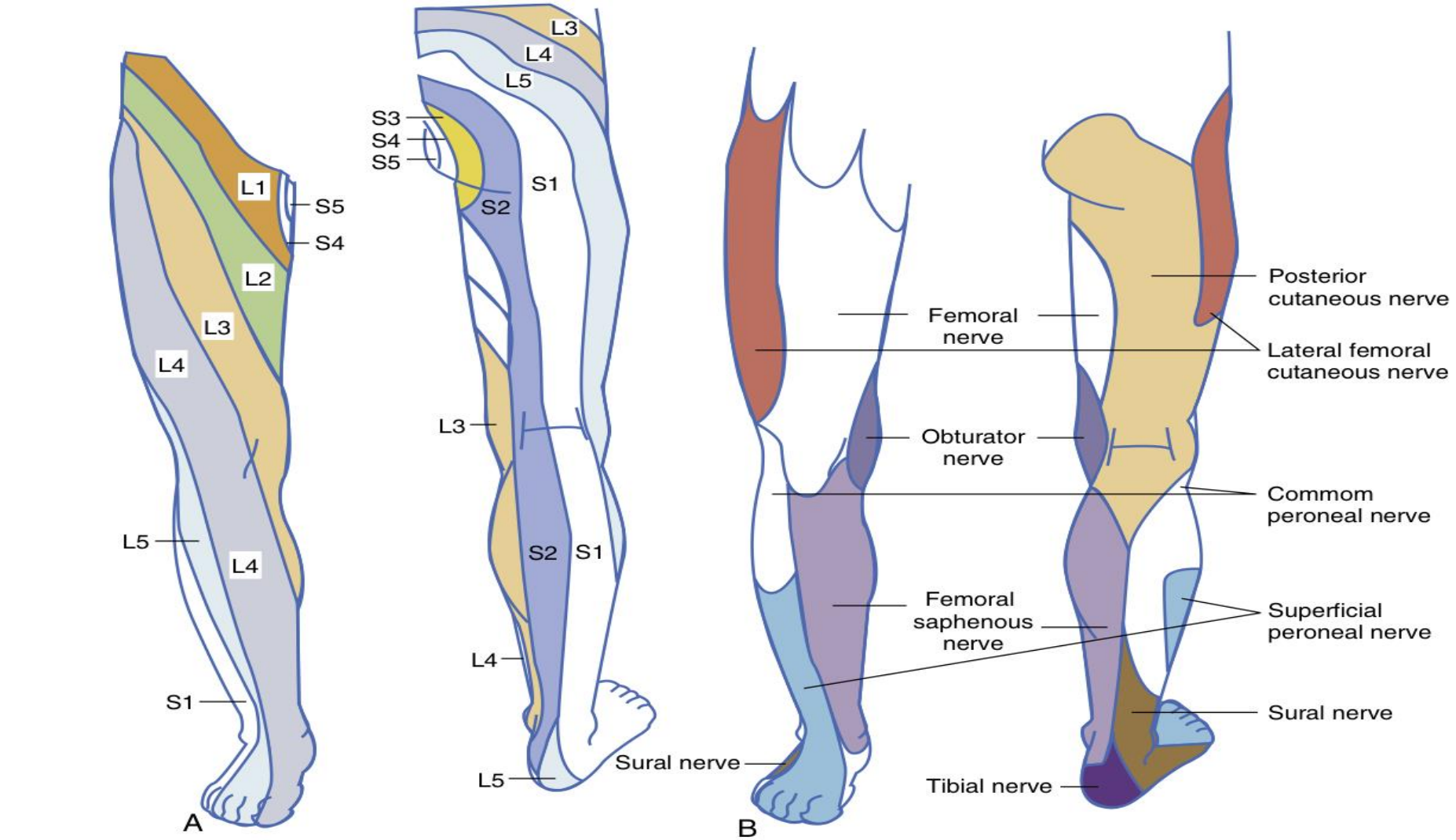
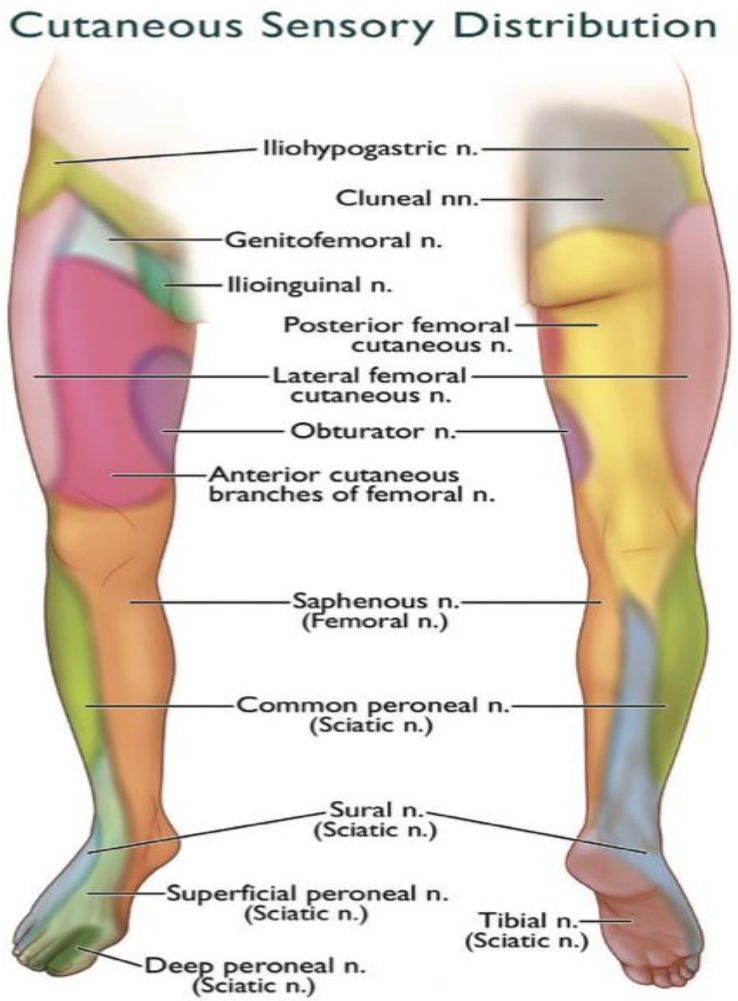
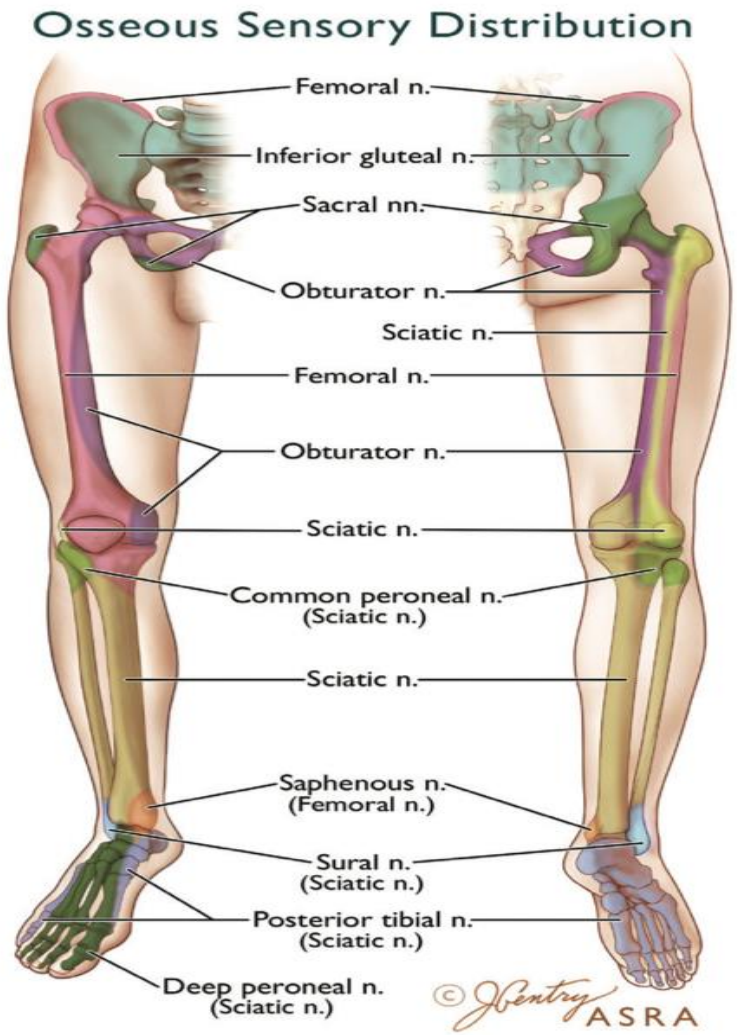


Fig. 46.27 (A) Cutaneous distribution of the lumbosacral nerves. (B) Cutaneous distribution of the peripheral nerves of the lower extremity.

Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

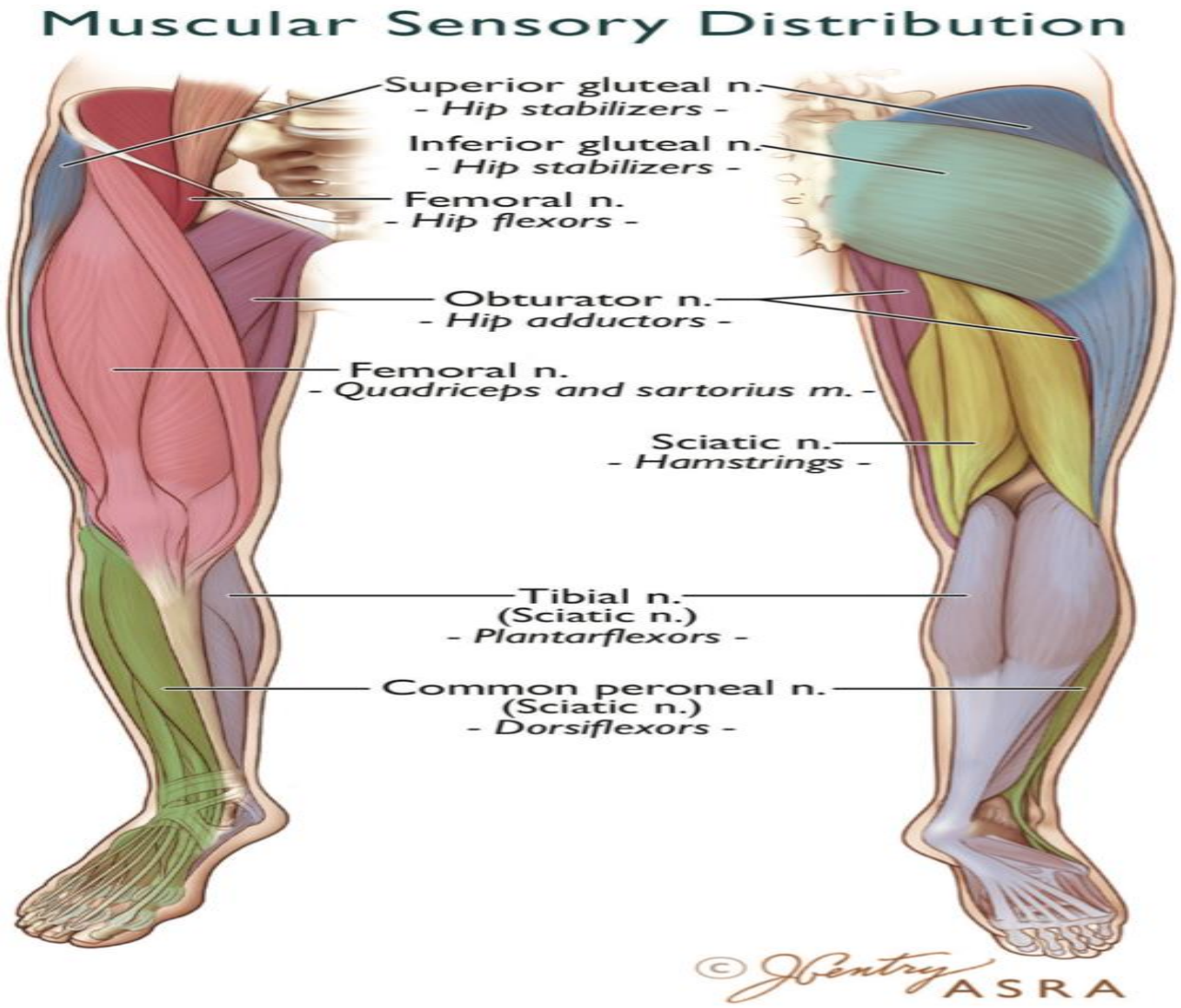
Cutaneous distribution and osteotome distribution





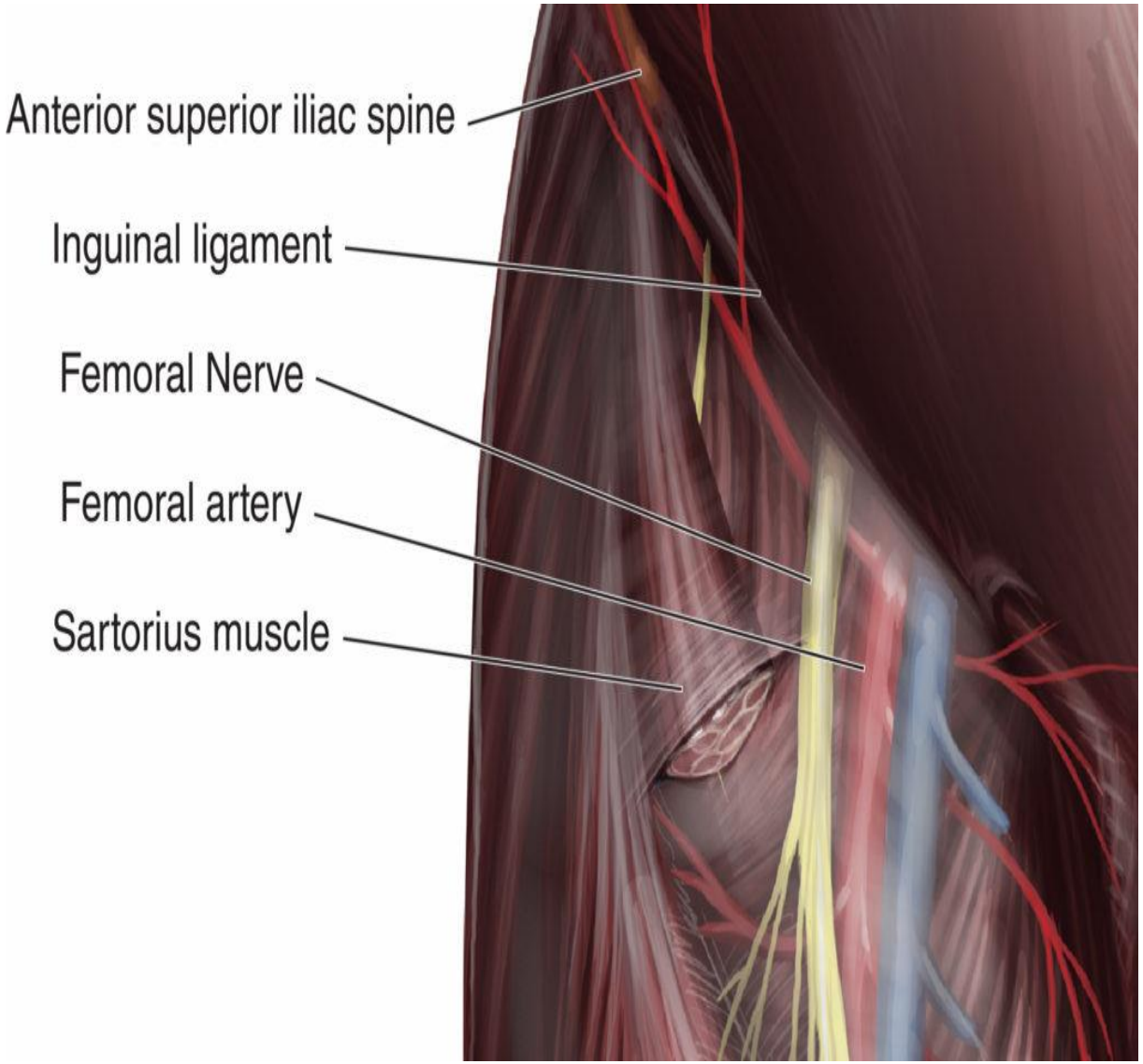
Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

Muscular sensory distribution



Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

Femoral nerves block



Indication : surgery of anterior aspect of thigh
surgery of medial aspect of leg below knee

Target : *femoral nerve*

landmark : femoral nerve is form 10 cm. proximal to 5 cm. distal to inguinal ligament

Position : supine and ipsilateral extremity is abducted 10°-20°, external rotate with lateral side of foot

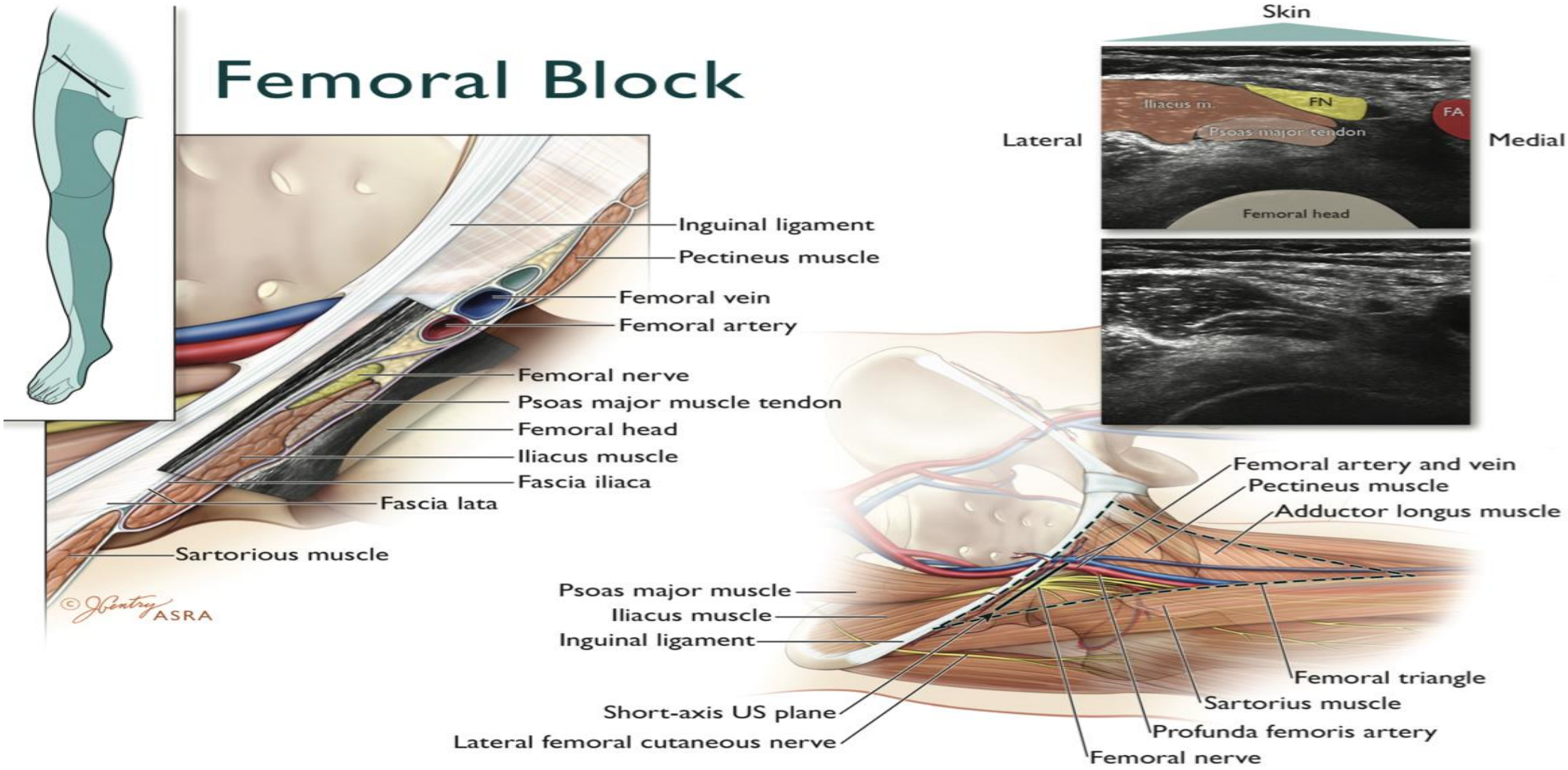
Side effects : intravascular injection, hematoma, nerve injury, catheter infection,

Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Femoral nerves block

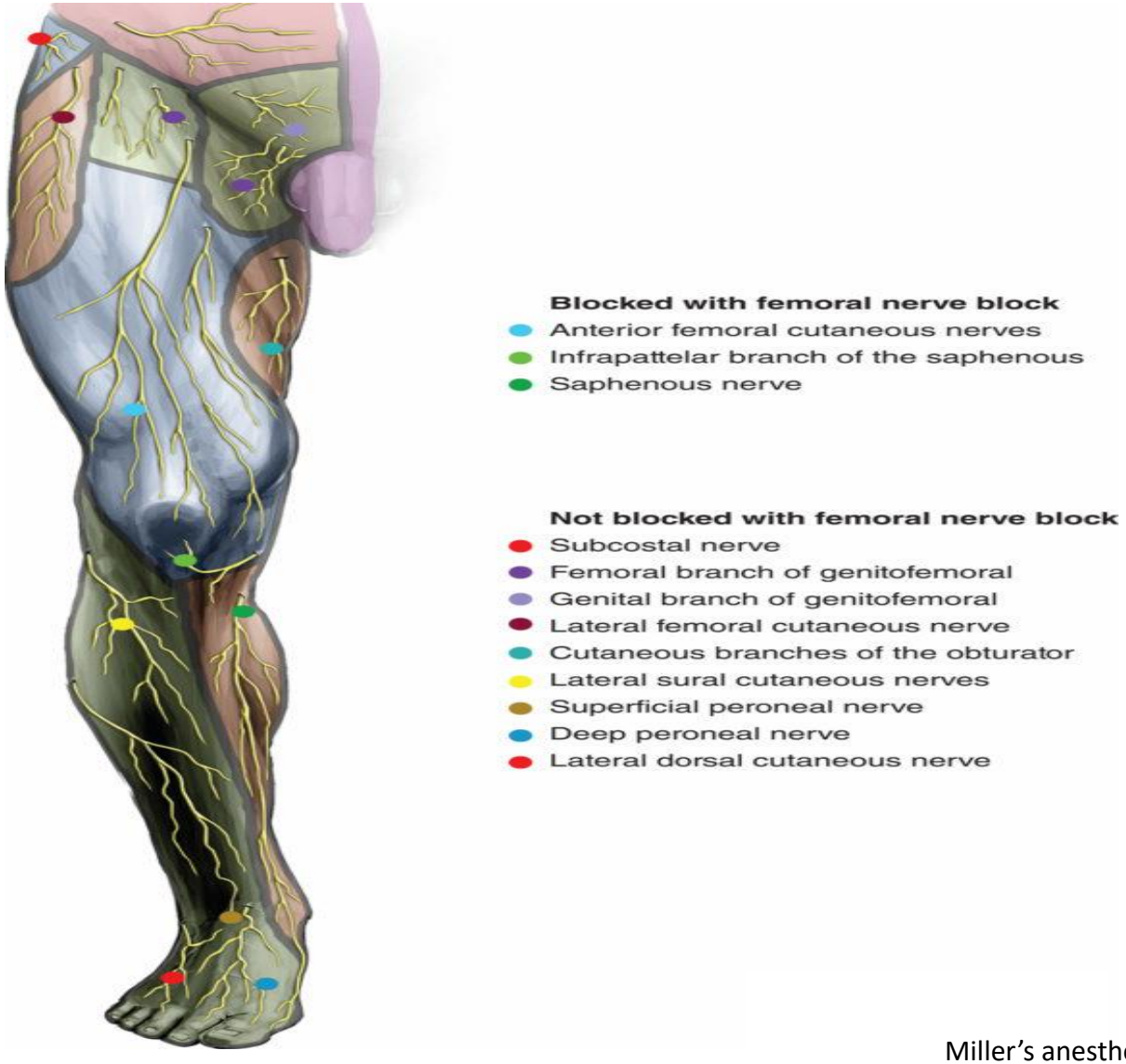
Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Femoral nerve block



Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

Femoral nerves block



Blocked with femoral nerve block
- Anterior femoral cutaneous nerves
- Infrapattelar branch of the saphenous
- Saphenous nerve

Not blocked with femoral nerve block
- Subcostal nerve
- Femoral branch of genitofemoral
- Genital branch of genitofemoral
- Lateral femoral cutaneous nerve
- Cutaneous branches of the obturator
- Lateral sural cutaneous nerves
- Superficial peroneal nerve
- Deep peroneal nerve
- Lateral dorsal cutaneous nerve

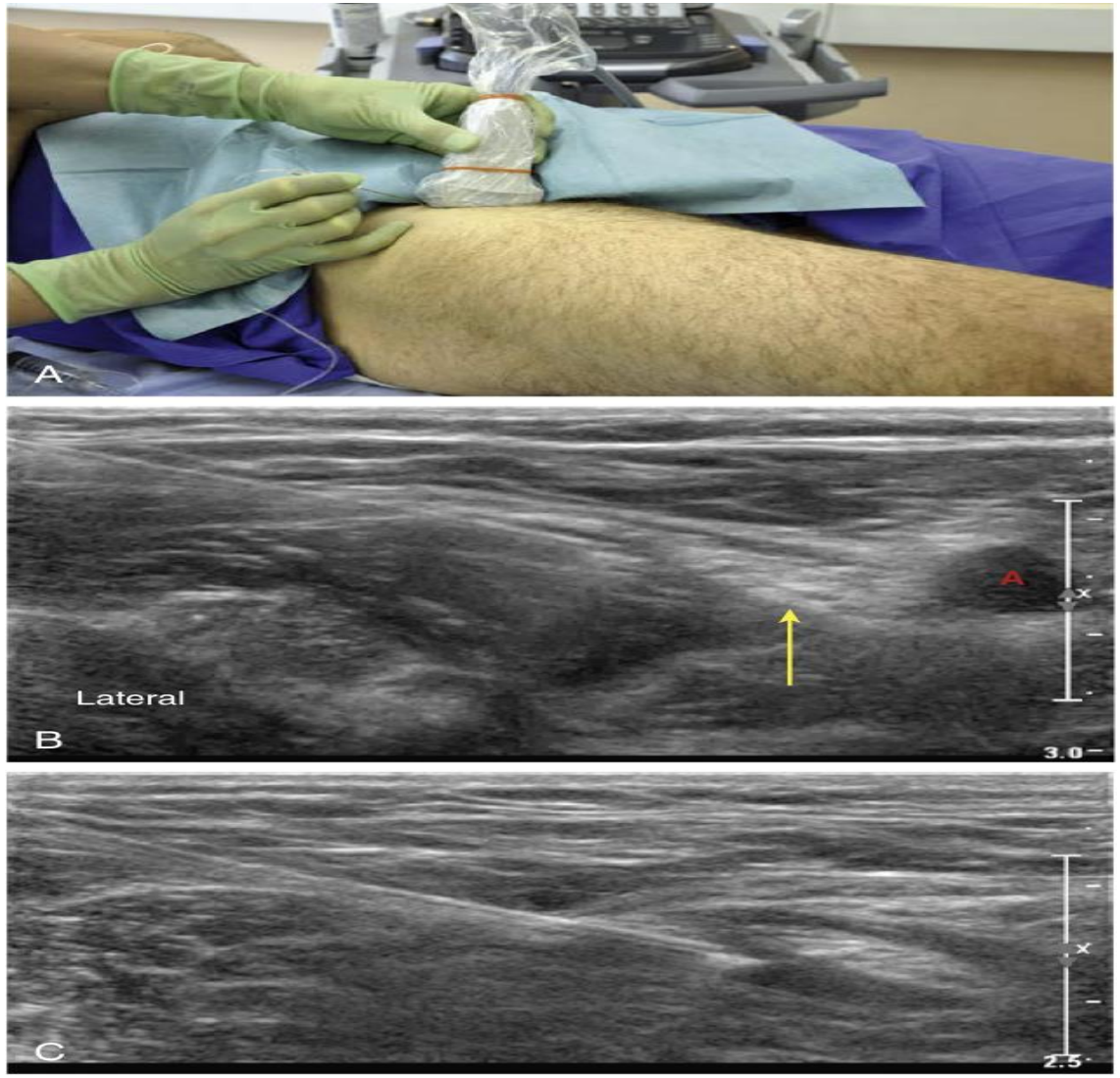


Fig. 46.28 Femoral nerve block with ultrasound imaging (in-plane approach). (A) External photograph shows the setup for femoral nerve block. (B) The needle tip is in position before injecting adjacent to the femoral nerve *(yellow arrow)*. The femoral nerve lies lateral to the femoral artery (A). (C) Local anesthetic surrounds the femoral nerve after injection. (Modified from Gray AT. *Atlas of Ultrasound-Guided Regional Anesthesia*. 3rd ed. Philadelphia: Saunders; 2018.)

Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

Fascia Iliaca block (Suprainguinal approach)

Indication : anterior thigh and knee surgery, hip

Target : *femoral, lateral femoral cutaneous, obturator nerve*

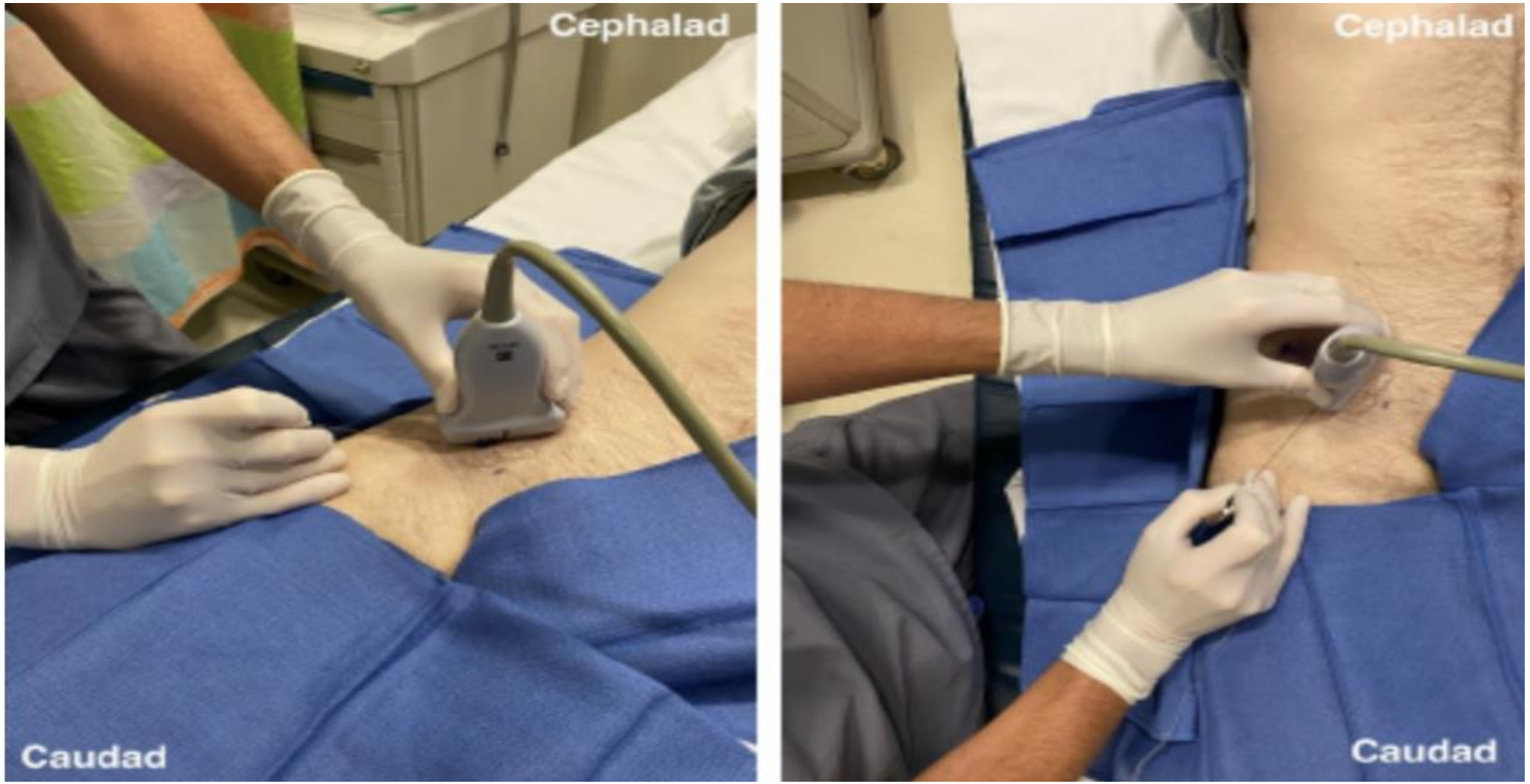
landmark : X marks a location 1/3 the distance between ASIS & pubic tubercle

Position : supine with extended hip

Side effects : intravascular injection, hematoma, nerve injury, catheter infection,

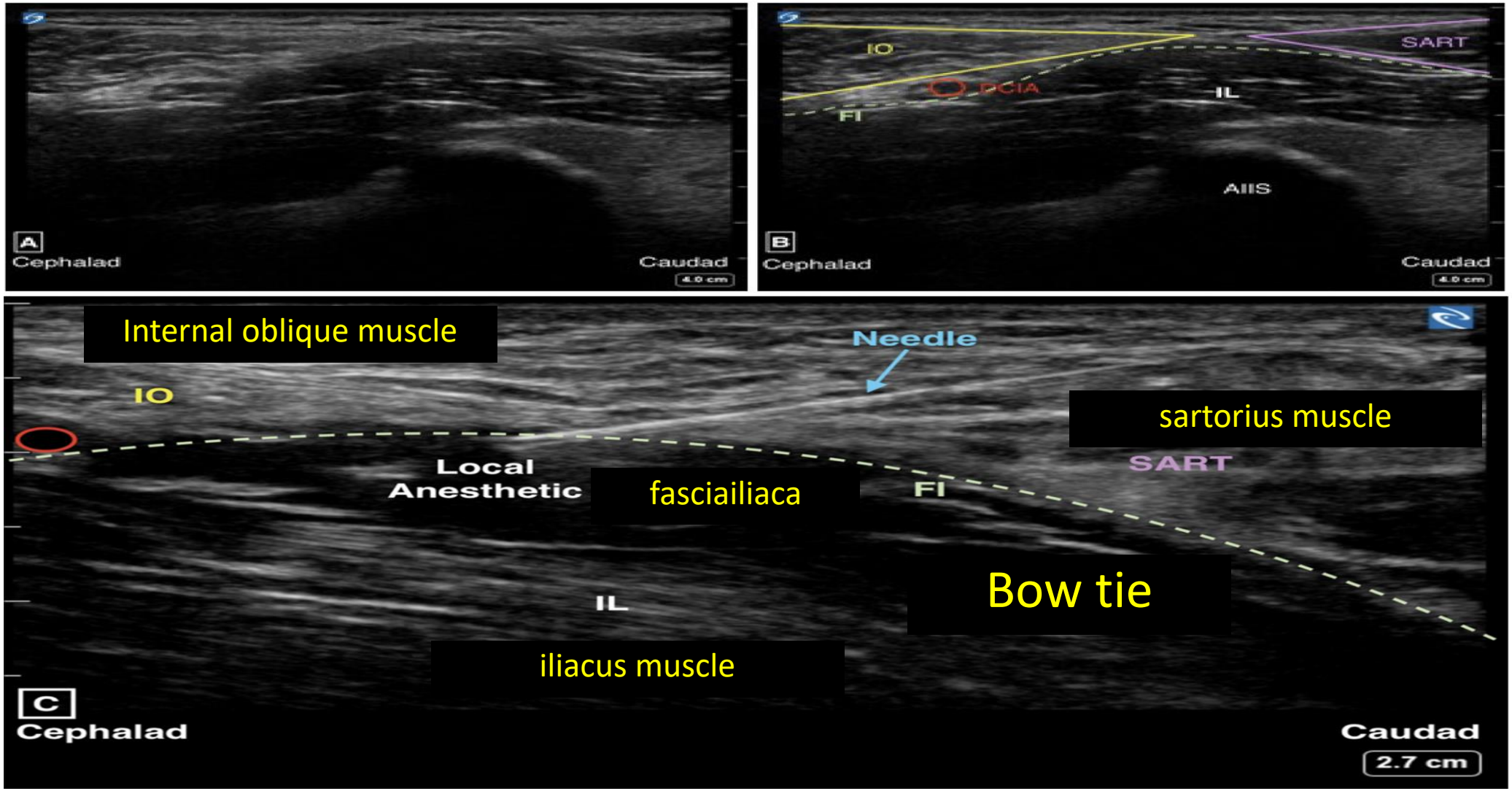
American society of regional anesthesia and pain medicine : fascia iliaca block (suprainguinal approach)

Fascia Iliaca block
(Suprainguinal approach)



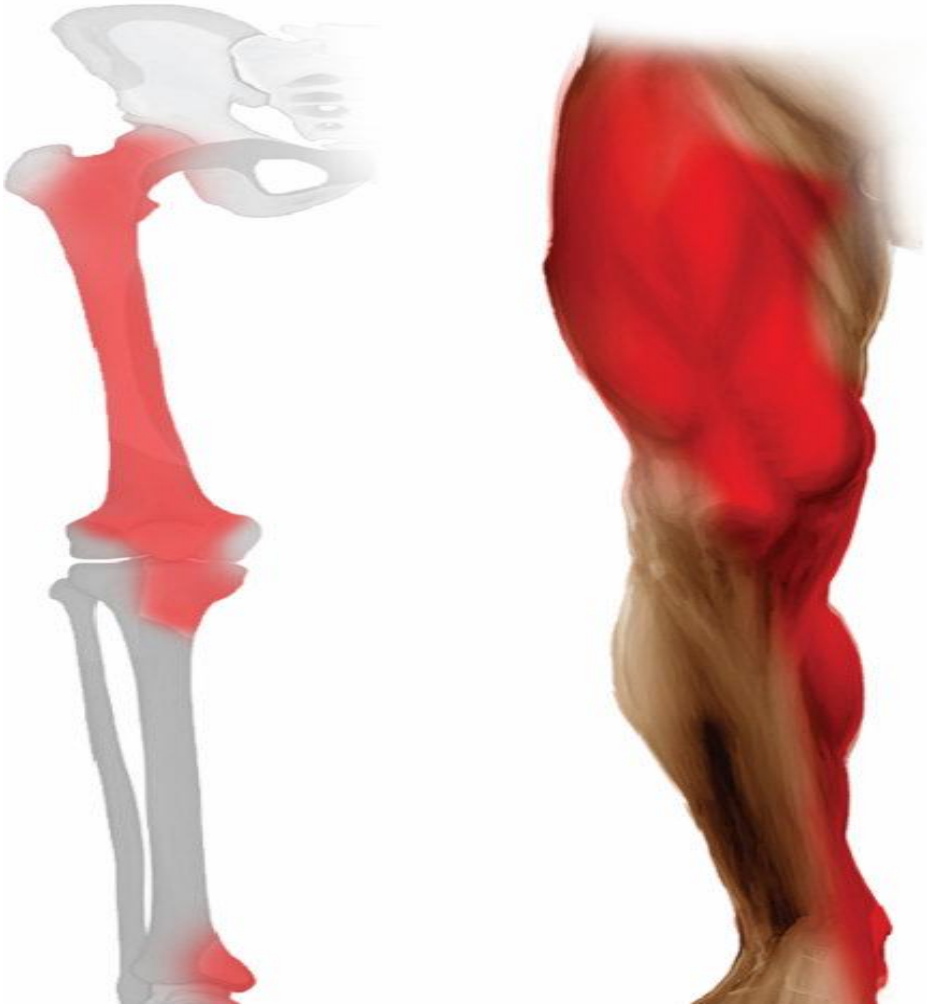
American society of regional anesthesia and pain medicine : fascia iliaca block (suprainguinal approach)

Fascia Iliaca block (Suprainguinal approach)



American society of regional anesthesia and pain medicine : fascia iliaca block (suprainguinal approach)

Distribution of analgesia Fascia Iliaca block



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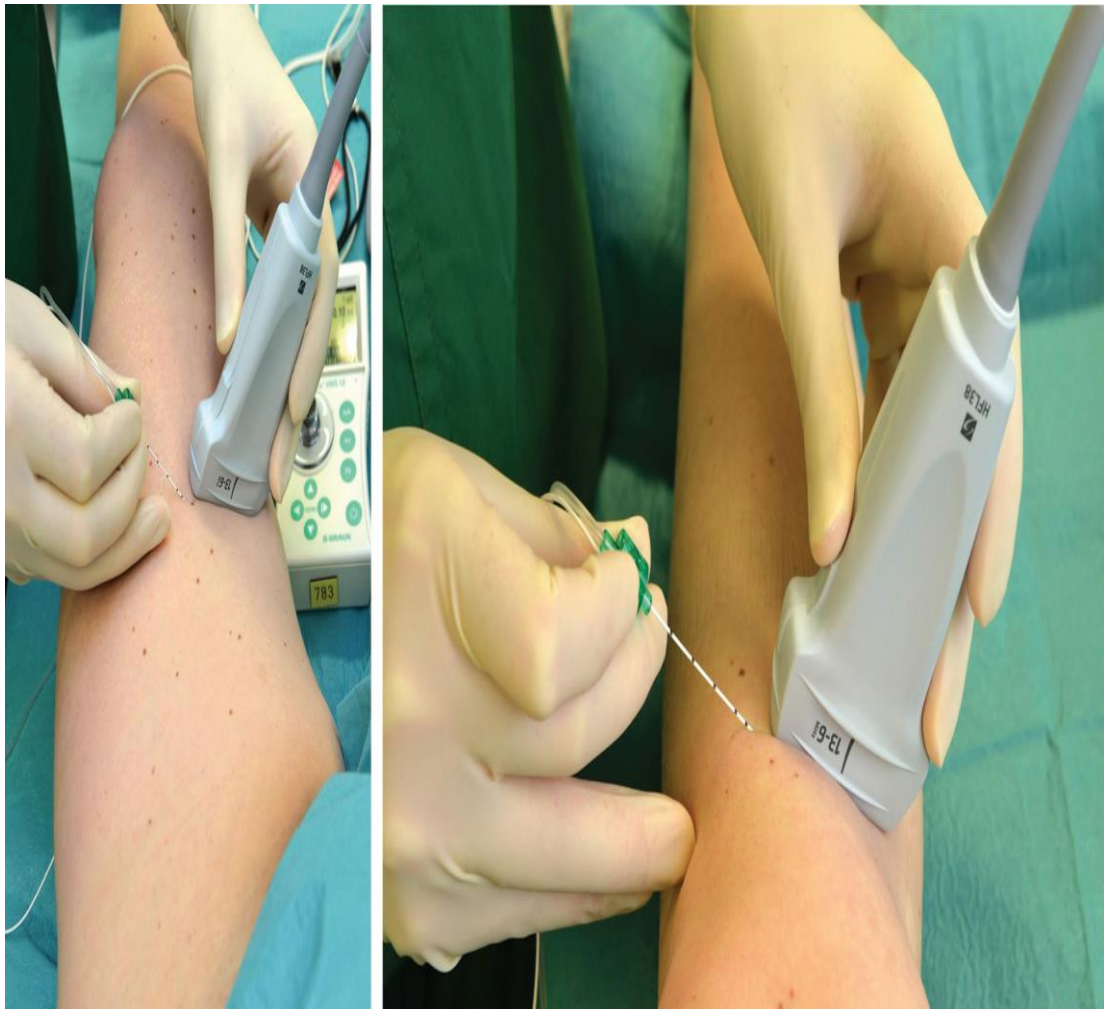
Saphenous (adductor canal) block



Indication : saphenous vein stripping or harvesting , supplementation for medial foot/ankle surgery, analgesia for knee surgery

Target : *saphenous nerve*

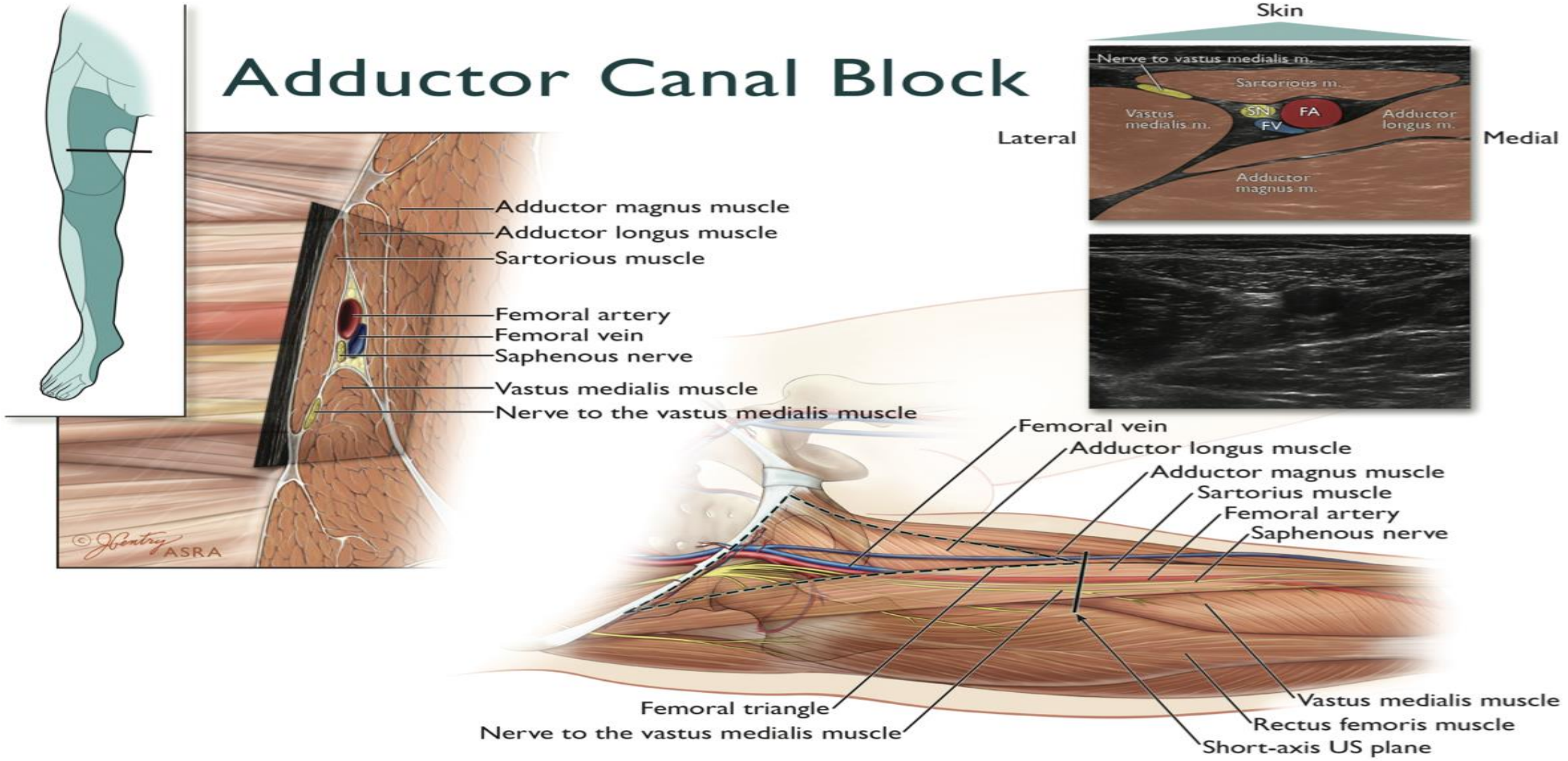
landmark : LA spread lateral to femoral artery and deep to sartorius muscle

Position : supine position with the thigh abducted and externally rotated

Side effects : intravascular injection, nerve injury

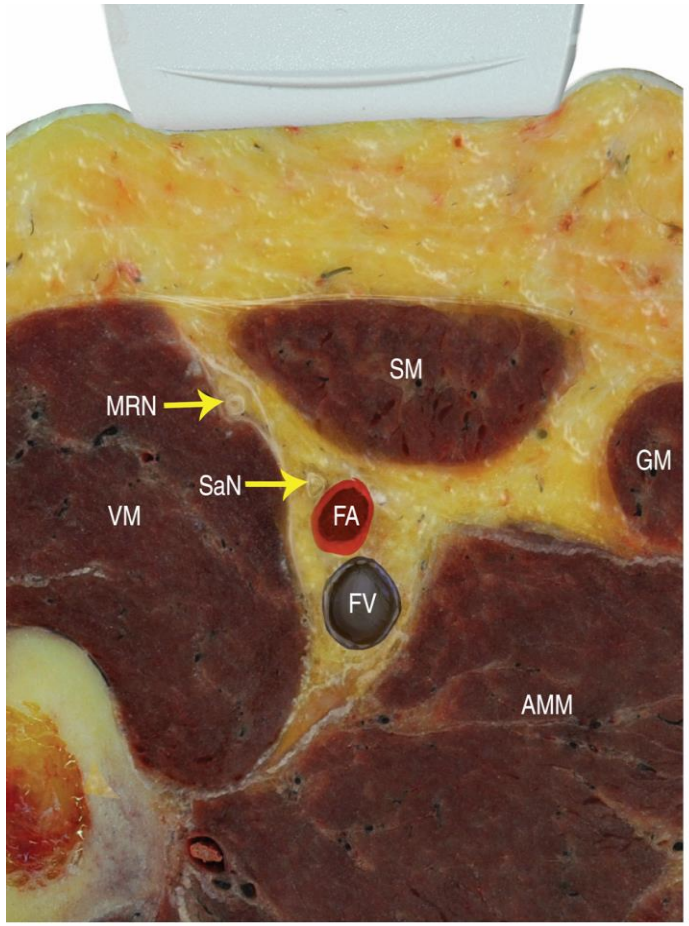
www.nysora.com ; ultrasound-guided saphenous (adductor canal) block

Adductor canal block

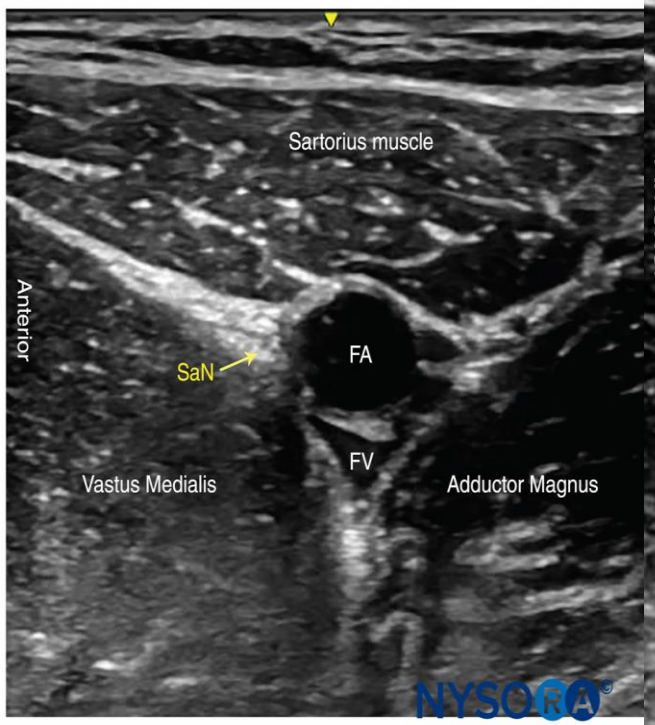


Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

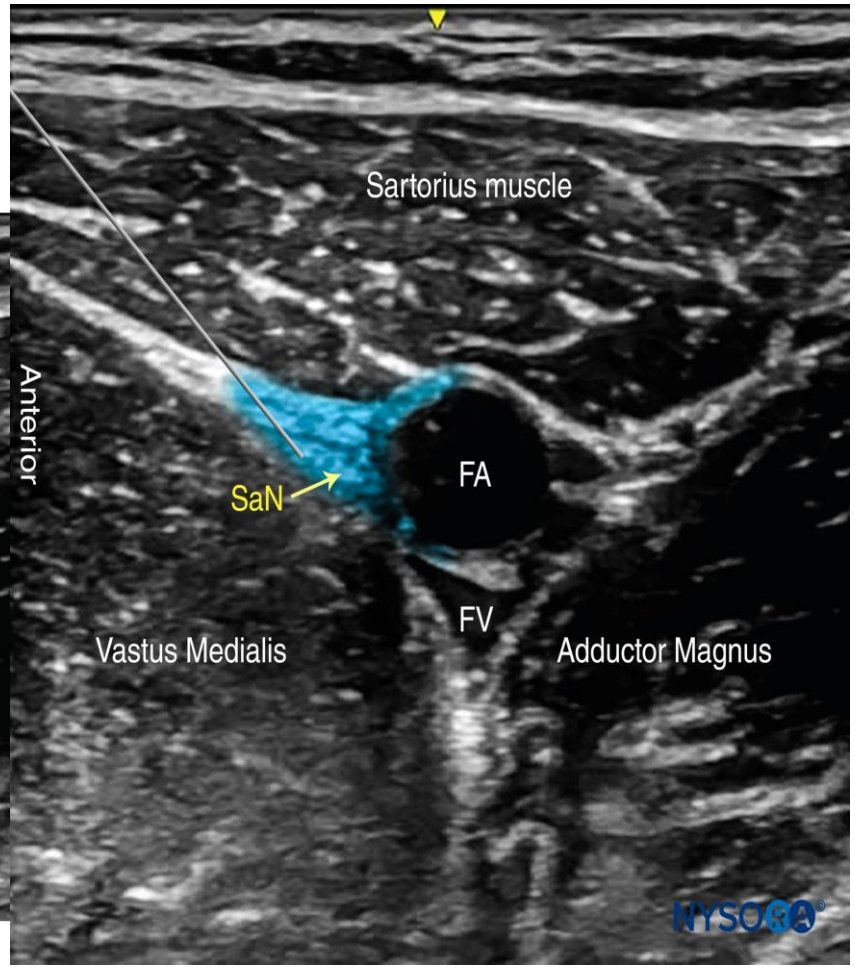
Saphenous (adductor canal) block



A



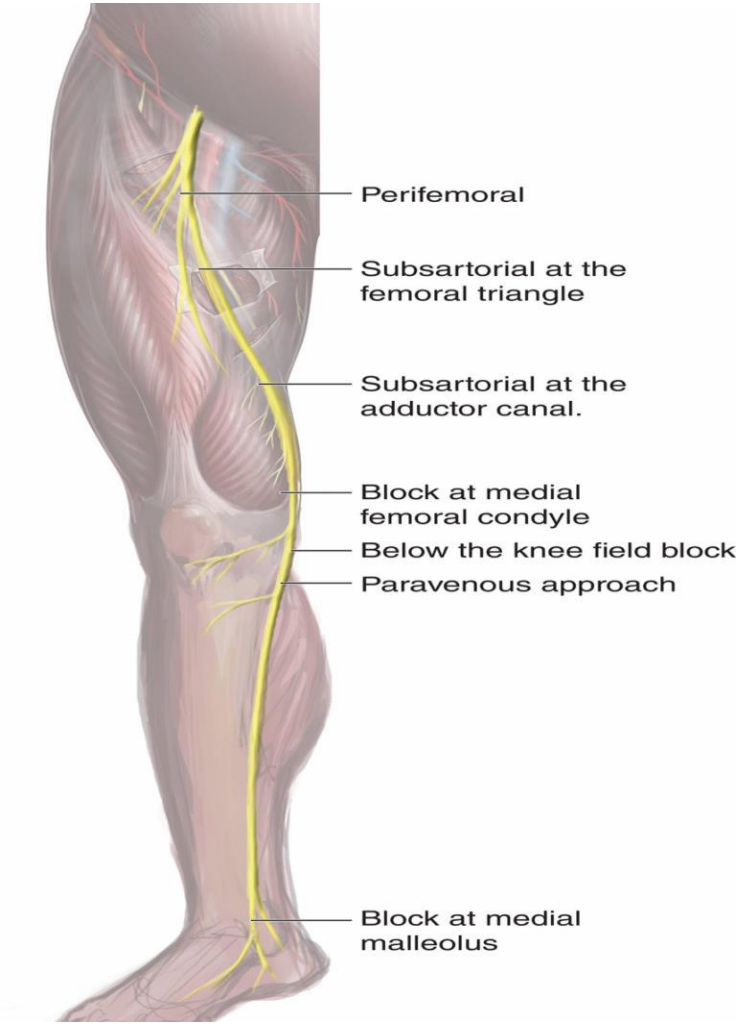
B



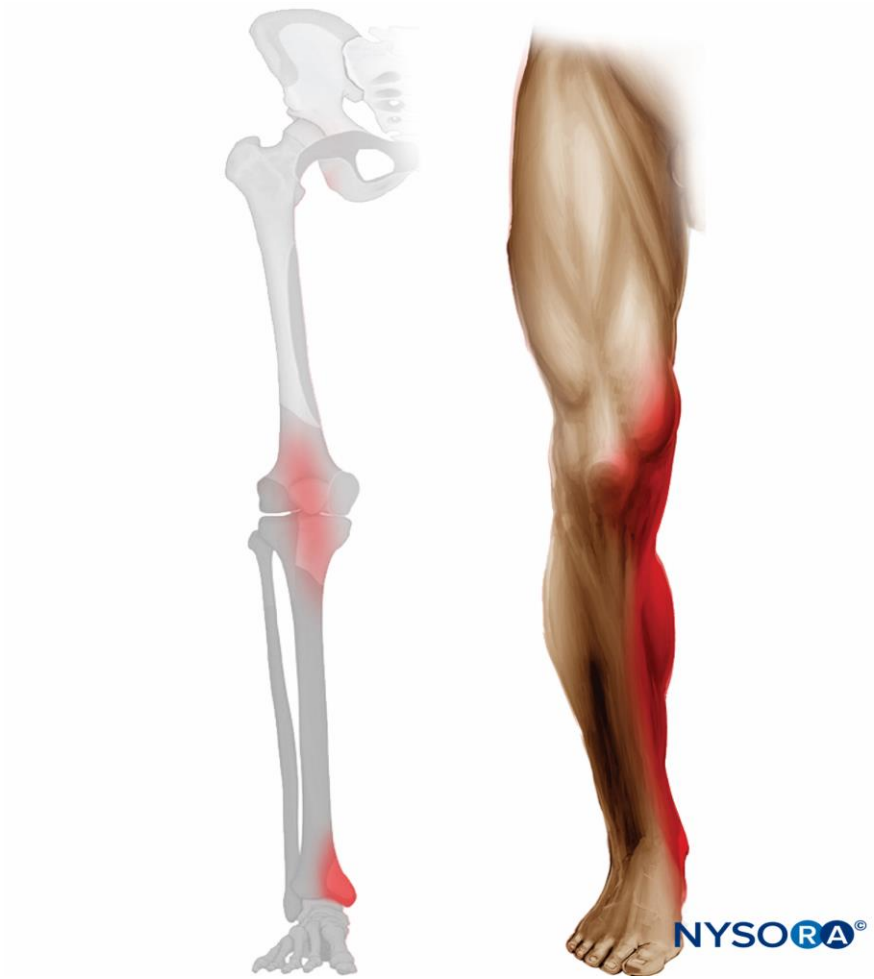
www.nysora.com ; ultrasound-guided saphenous (adductor canal) block

Saphenous (adductor canal) block

Anatomy

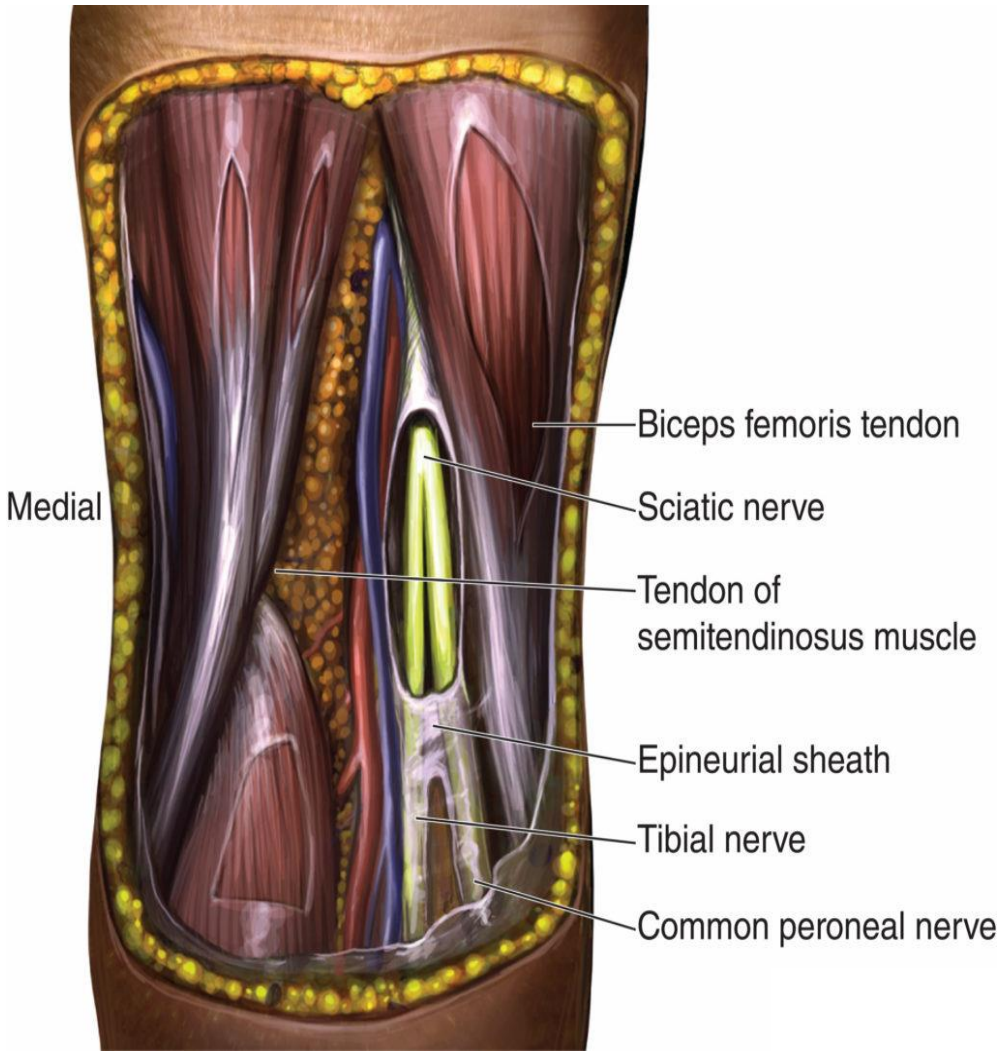


Distribution of analgesia



www.nysora.com ; ultrasound-guided saphenous (adductor canal) block

Sciatic nerve blocks (popliteal approach)



Indication : foot and ankle surgery, below knee amputation , following knee surgery involve posterior compartment

Target : *sciatic nerve sheath (tibial and common peroneal)*

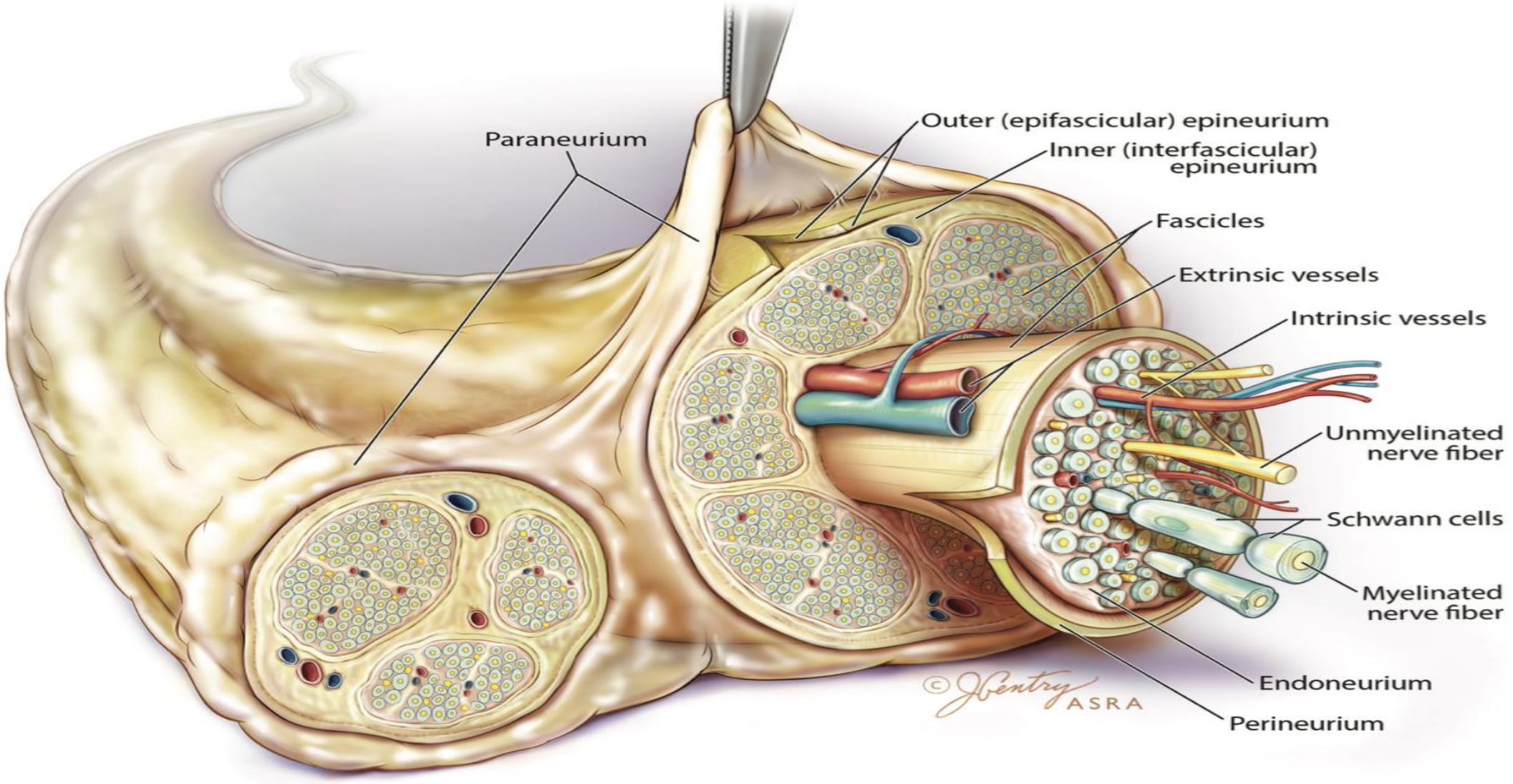
landmark : popliteal artery and vein at popliteal crease

Position : supine and leg elevated

Side effects : intravascular injection, hematoma, nerve injury, catheter infection

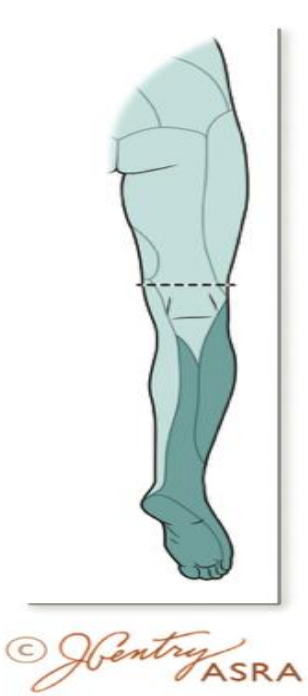
Miller's anesthesia : peripheral nerve blocks and ultrasound guidance for regional anesthesia,9th ed;2020

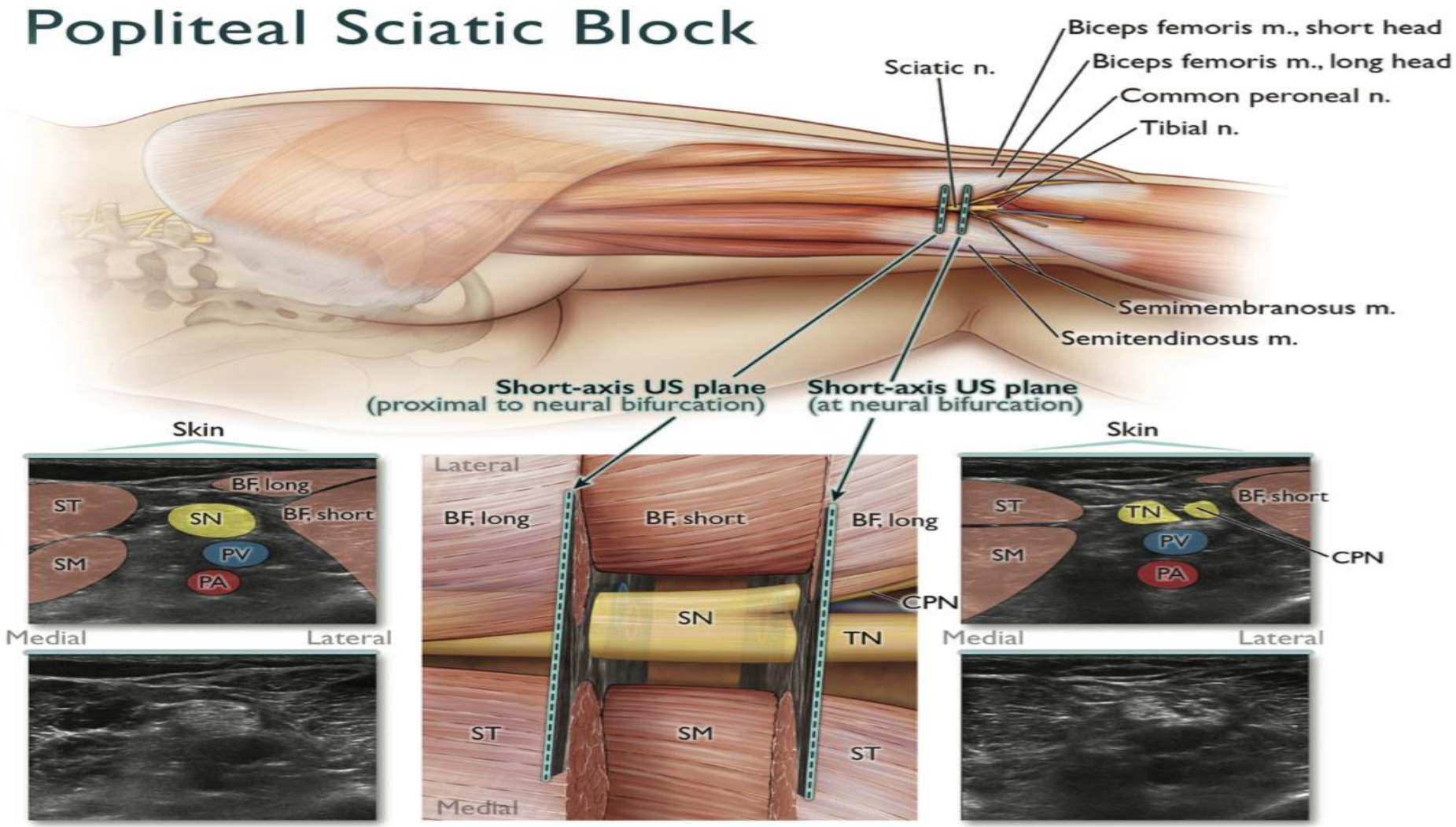
Peripheral nerve anatomy



Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

Popliteal sciatic block





Regional anesthesia & pain medicine 2019 ; Tran DQ et al.

Sciatic nerve blocks

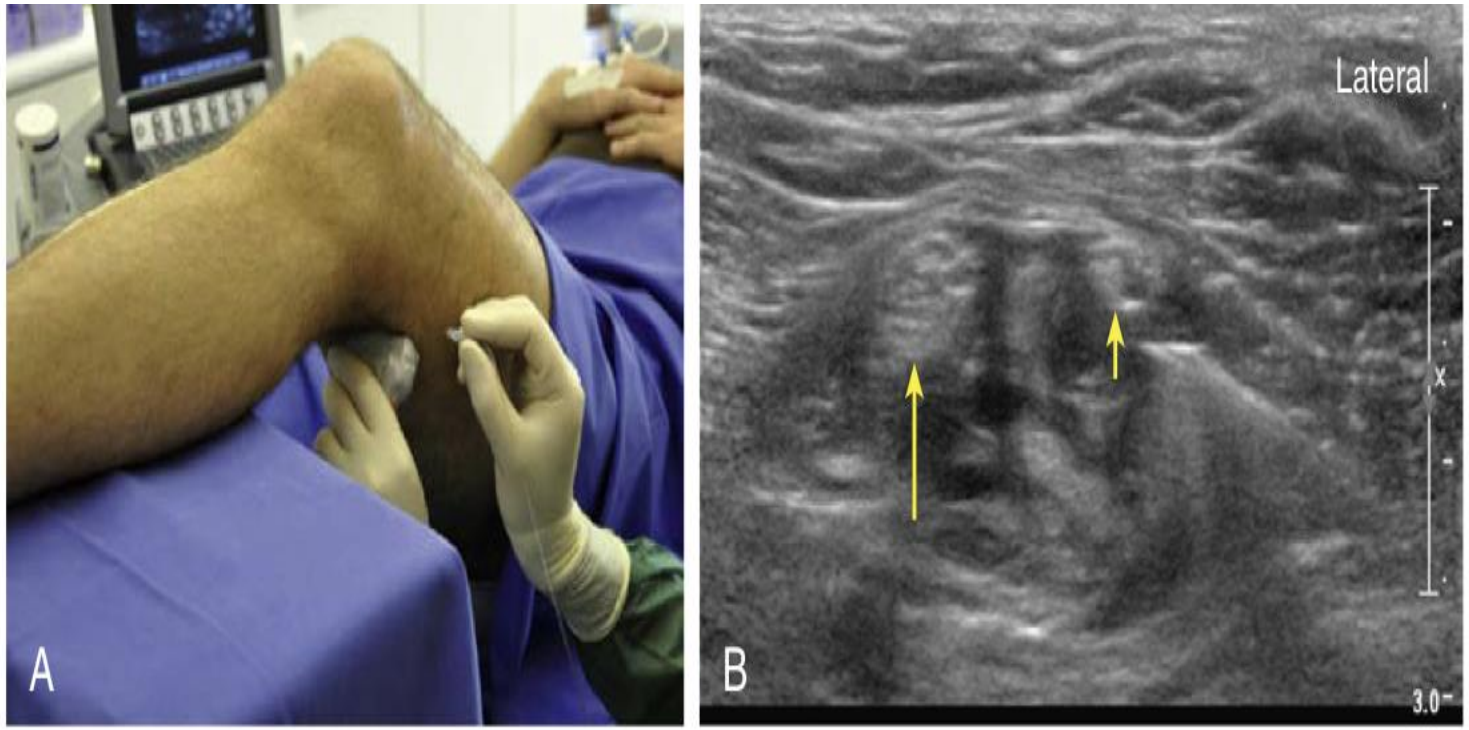


Fig. 46.30 Popliteal block with ultrasound imaging (in-plane approach). (A) External photograph shows the setup for popliteal nerve block in the supine position. The leg is elevated, and the transducer is applied to the posterior surface of the leg. (B) The needle approaches the bifurcation of the sciatic nerve in the plane of imaging from the lateral aspect of the leg. The needle tip is positioned between the tibial *(long yellow arrow)* and common peroneal *(short yellow arrow)* nerves.

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Sciatic nerve blocks

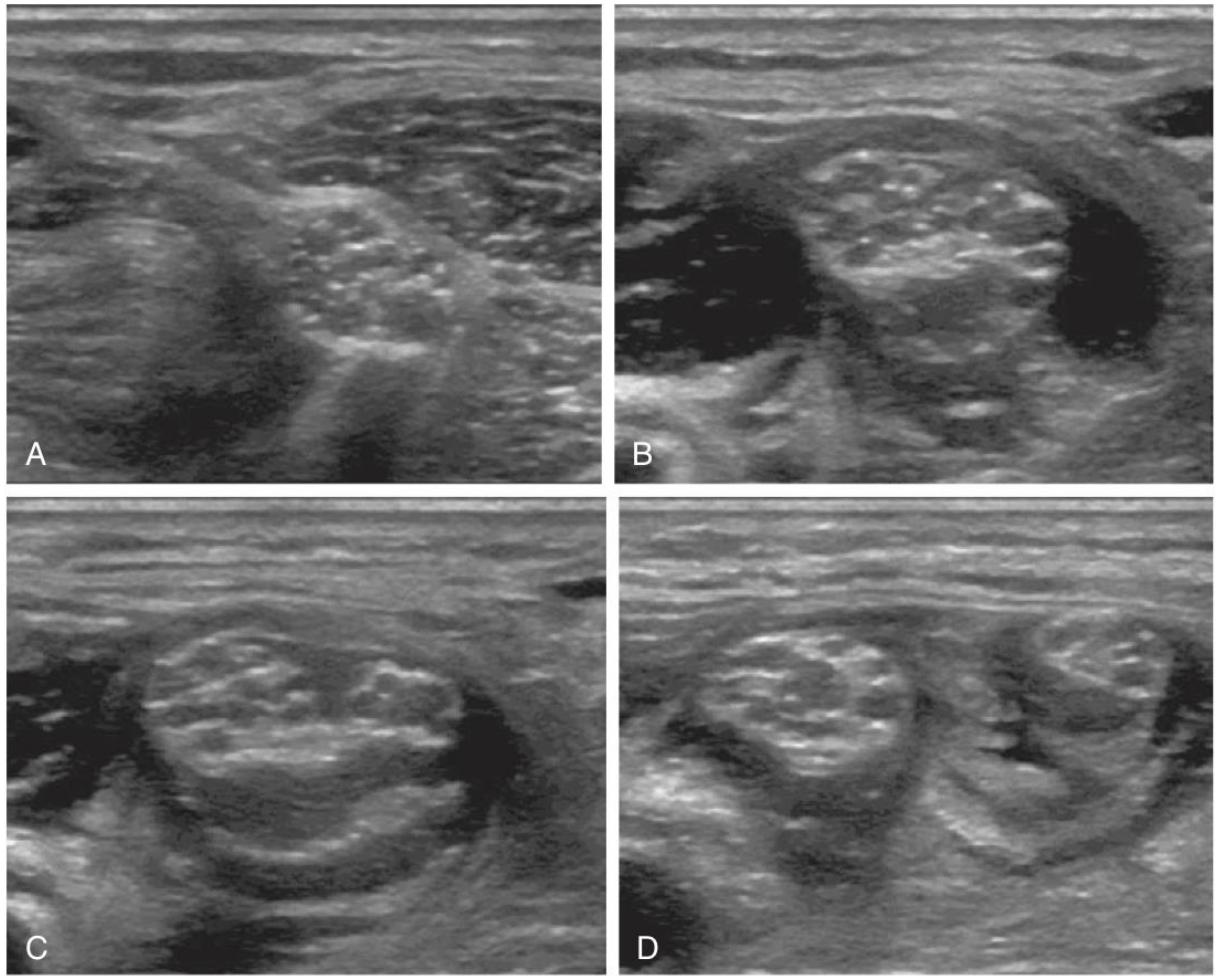

Fig. 46.31 Sciatic nerve imaging in the popliteal fossa before (A), during (B and C), and after (D) division into the tibial and common peroneal nerves. Local anesthetic tracks with both individual nerves, thereby confirming a successful block.

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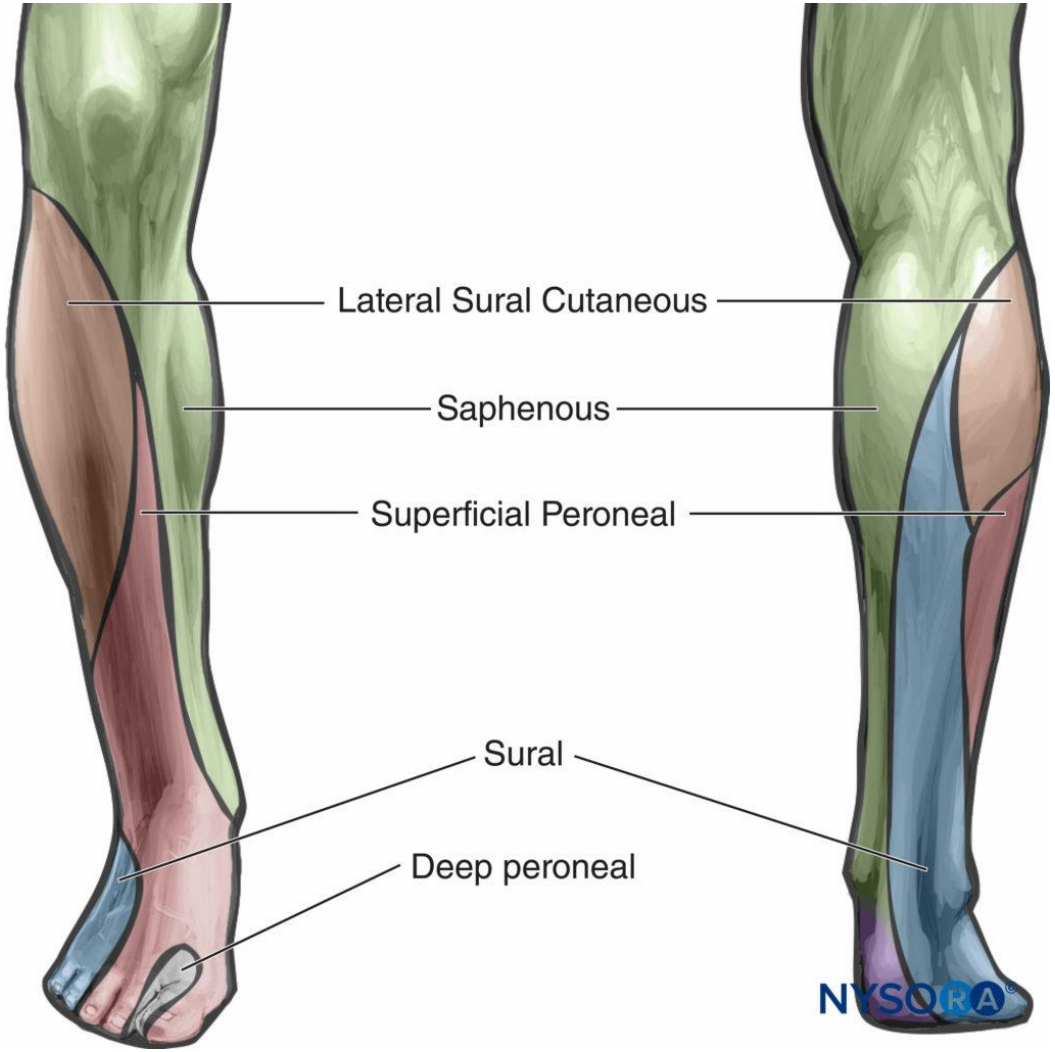
Sensory distribution of anesthesia after popliteal blockade.



Popliteal block results in anesthesia of all shaded areas except that of the saphenous nerve (femoral)

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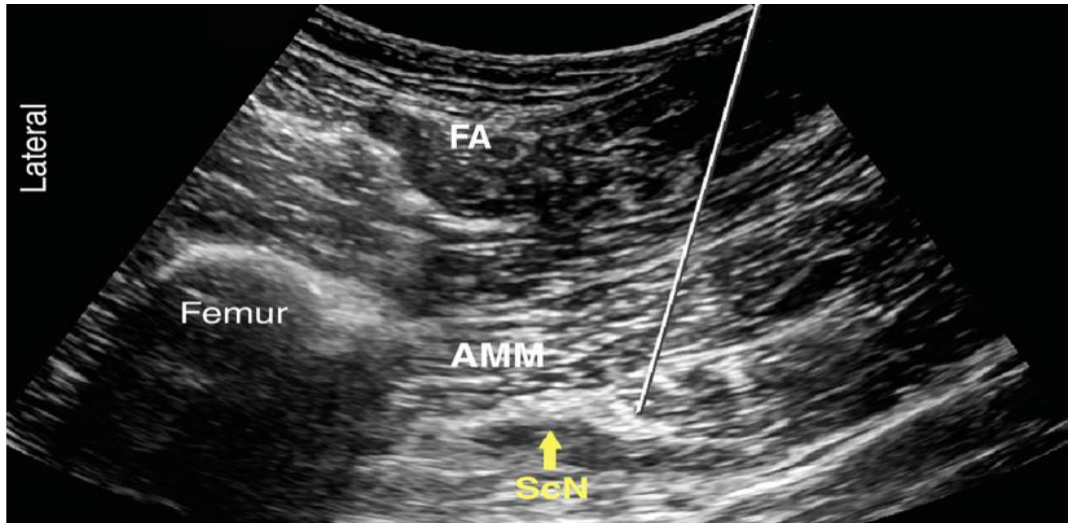
Sciatic nerve block (anterior approach)



Position : supine position & hip is abducted

Landmark : needle tips adjacent to the sciatic nerve between the adductor magnus muscle and biceps femoris muscle

Advantage : useful when the patient can't be positioned for other approaches due to pain or leg traction

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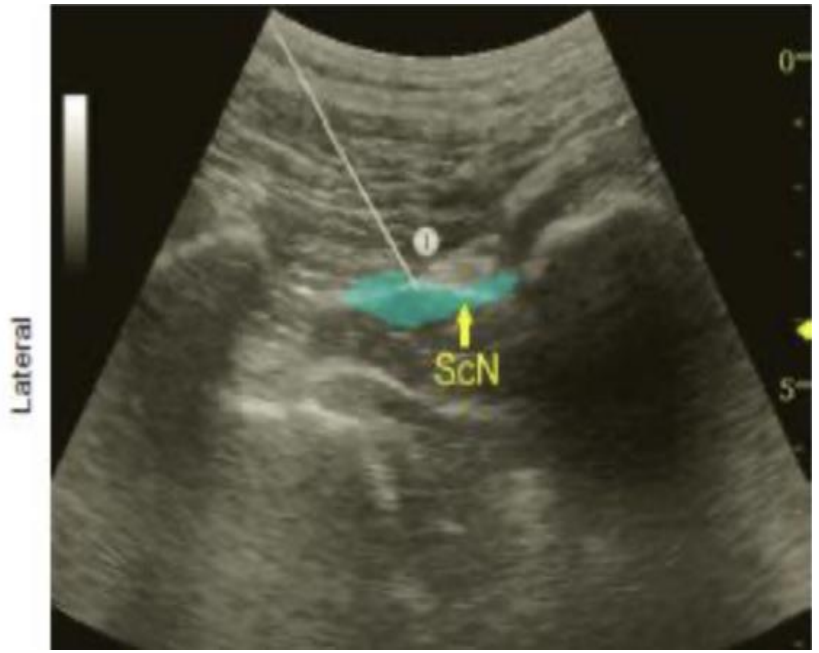
Sciatic nerve block (Transgluteal approach)

FIGURE 10. *Transgluteal approach to sciatic block: patient position, transducer (curved) placement, and needle insertion. (Reproduced with permission from Hadzic A: Hadzic's Peripheral Nerve Blocks and Anatomy for Ultrasound-Guided Regional Anesthesia, 2nd ed. New York McGraw-Hill, 2011.)*



Landmark : deep to gluteus maximus muscle (*ischial tuberosity and greater trochanter)*

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Sciatic nerve block (Subgluteal approach)

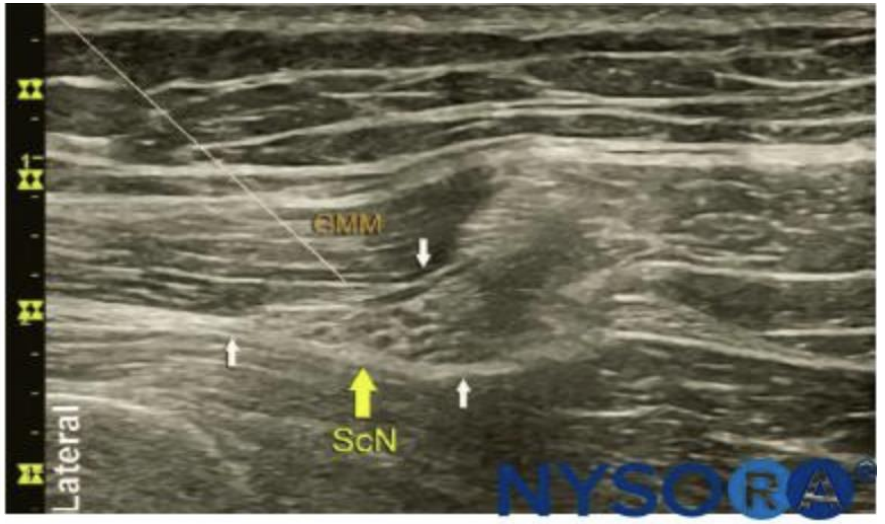

FIGURE 11. *The sciatic nerve (ScN) as seen in the subgluteal positio (using a linear transducer) and simulated needle path to the interfacia plane (white arrows) between the gluteus maximus muscle (GMM) and the adductor magnus. (Reproduced with permission from Hadzic A: Hadzic's Peripheral Nerve Blocks and Anatomy for Ultrasound-Guided Regional Anesthesia, 2nd ed. New York: McGraw-Hill, 2011.)*

- **Landmark :** sciatic nerve between biceps femoris muscle and posterior surface of adductor magnus muscle
- **useful :** provide motor blockade of hamstring muscles, obesity patient

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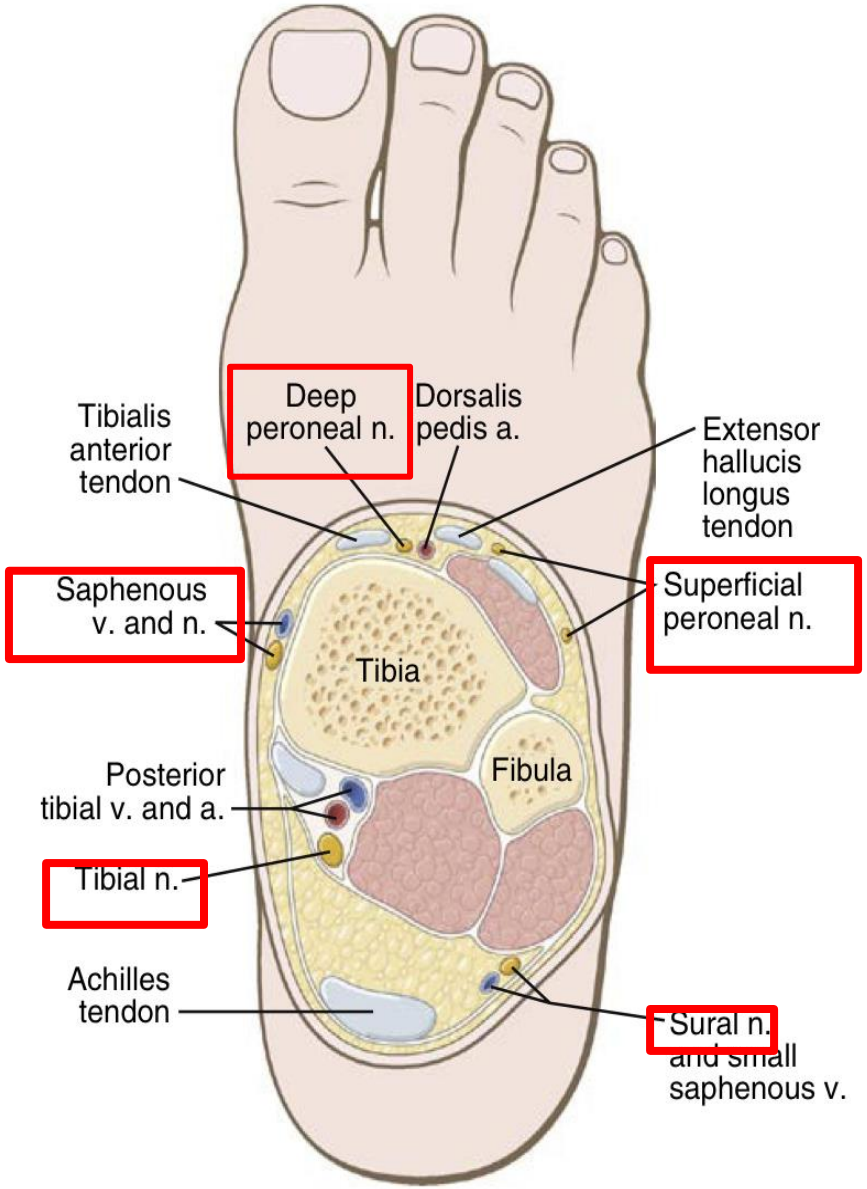
Nerve blocks at ankle



Relatively simple & performed at *the level of malleoli by surface landmark*

Common peroneal nerve divides superficial and deep peroneal nerve

Sural nerve forms both tibial and common peroneal nerve contribution

Saphenous nerve is major descending sensory branch of the femoral nerve

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Nerve blocks at ankle

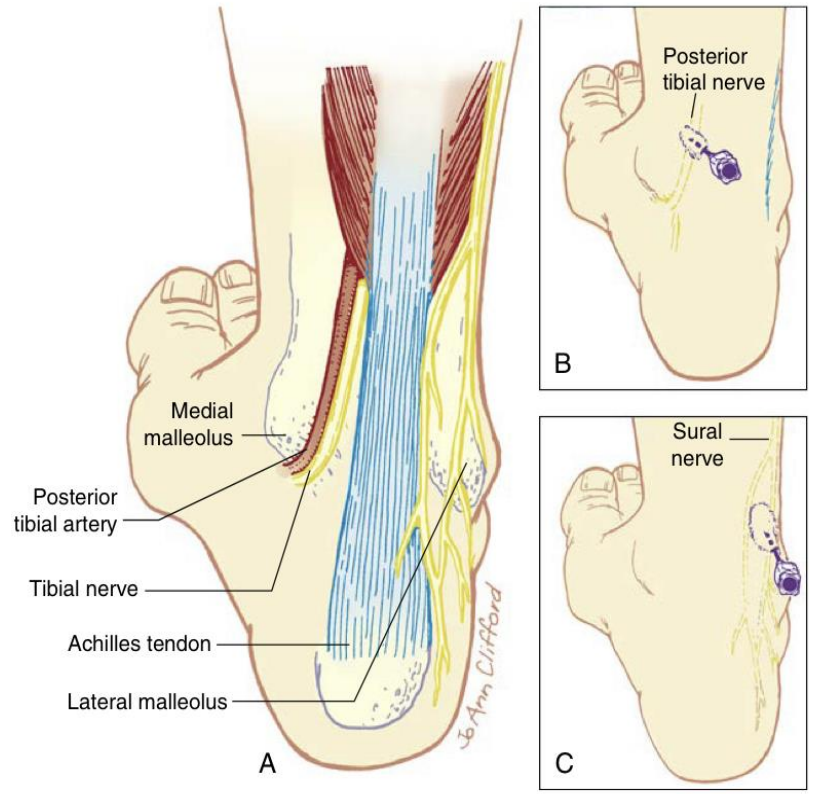

Fig. 46.33 (A) Anatomic landmarks for a block of the posterior tibial and sural nerves at the ankle. (B) Posterior tibial nerve and method of needle placement for a block at the ankle. (C) Sural nerve and method of needle placement for a block at the ankle.

Tibial nerve technique

Position : supine or prone

Landmark : posterolateral to the posterior tibial artery

Anesthesia : heel, plantar portion of toes, soles of the foot

Sural nerve technique

Landmark : superficially between the lateral malleolus and Achilles tendon

Anesthesia : lateral foot, lateral aspects of proximal sole of the foot

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Nerve blocks at ankle

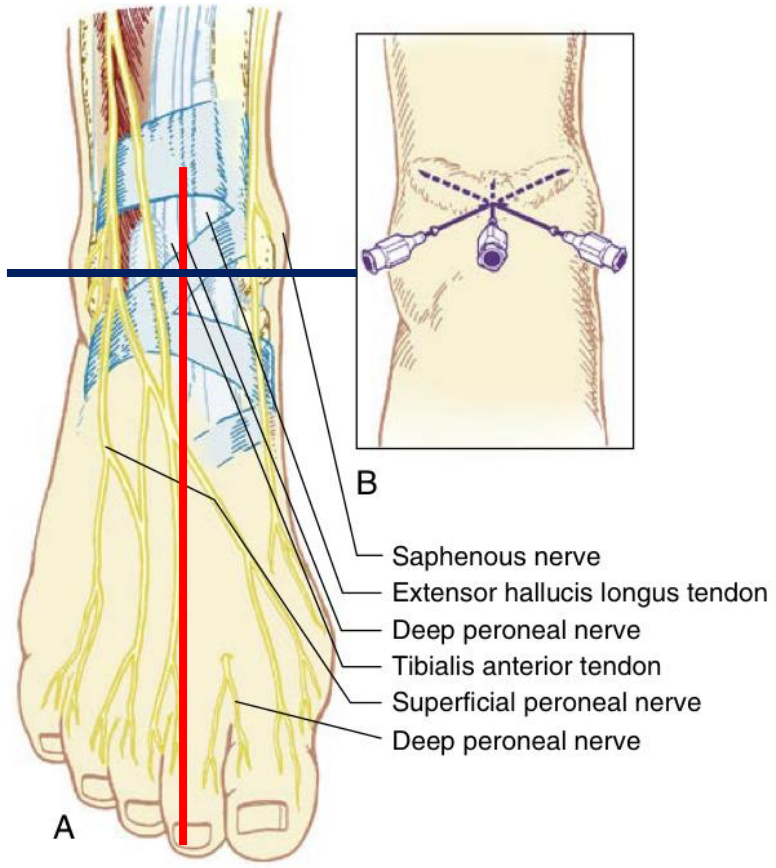

Fig. 46.35 (A) Anatomic landmarks for a block of the deep peroneal, superficial peroneal, and saphenous nerves at the ankle. (B) Method of needle placement for a block of the deep peroneal, superficial peroneal, and saphenous nerves through a single needle entry site.

The deep peroneal , superficial peroneal, saphenous nerve can be blocked through a *single needle entry site*

LA is injected deep to the extensor retinaculum to block the deep peroneal nerve
(skin between 1st,2nd toe and the short extensors of toes)

Lateral to block superficial peroneal nerve
(dorsum of foot except 1st interdigital cleft)

Medial direction to block saphenous nerve
(strip along the medial aspect of foot)

Side effect : patient discomfort, ankle edema
intravascular injection

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Continuous catheter technique

- **Advantages :** prolongation of surgical anesthesia, post operative pain relief, sympathectomy, decreased systemic toxicity due to lower incremental dose
- Although concern accurate catheter placement and maintenance still exists
- Ultrasound guidance produce more consistent times for catheter placement
- **Application :**
  - **upper extremities :** *digit replantation, total shoulder or elbow arthroplasty, reflex sympathetic dystrophies*
  - **lower extremities :** *psoas compartment, sciatic, femoral, adductor canal, popliteal fossa*

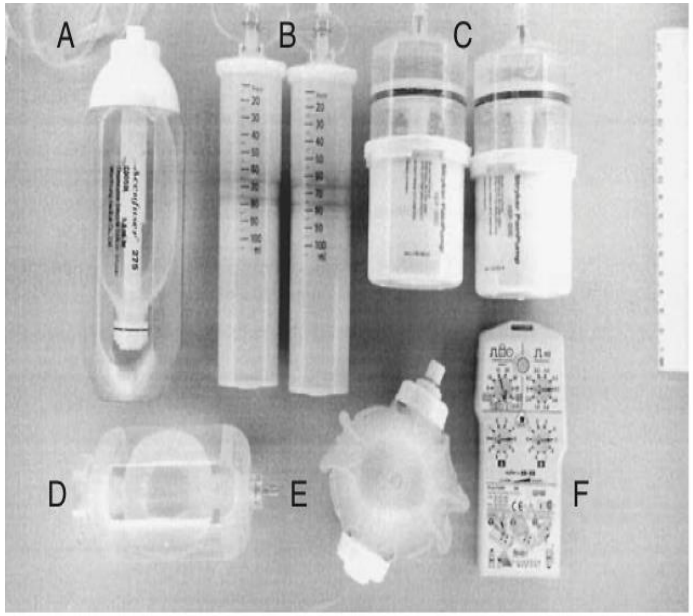

Fig. 46.37 Portable infusion pumps. (A) Accufuser (McKinley Medical, Wheat Ridge, Colo.). (B) Sgarlato (Sgarlato Labs, Los Gatos, Calif.). (C) Stryker PainPump (Stryker Instruments, Kalamazoo, Mich.). (D) MedFlo II (MPS Acacia, Brea, Calif.). (E) C-Bloc (I-Flow, Lake Forest, Calif.). (F) Microject PCA (Sorenson Medical, West Jordan, Utah). (From Ilfeld BM, Morey TE, Enneking FK. The delivery rate accuracy of portable infusion pumps used for continuous regional analgesia. *Anesth Analg.* 2002;95:1331–1336.)

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Choice of local anesthesia

- Depend on the duration of the surgical procedure

- **Long acting** : bupivacaine, ropivacaine
- **Short or medium acting** : lidocaine, mepivacaine

- **Highest concentration** – not appropriate for peripheral nerve blockade
  - 0.75% bupivacaine or ropivacaine, 2% lidocaine, 2% mepivacaine
- **Lowest concentration** – might not provide complete motor blockade
  - 0.25% bupivacaine or ropivacaine, 0.5% lidocaine/ mepivacaine
- Vasoconstrictor (epinephrine 1:200,000) : improve onset of action, to decrease drug uptake, prolong action (*avoid blocks of digits or penis can cause tissue ischemia)*

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Complications and safety

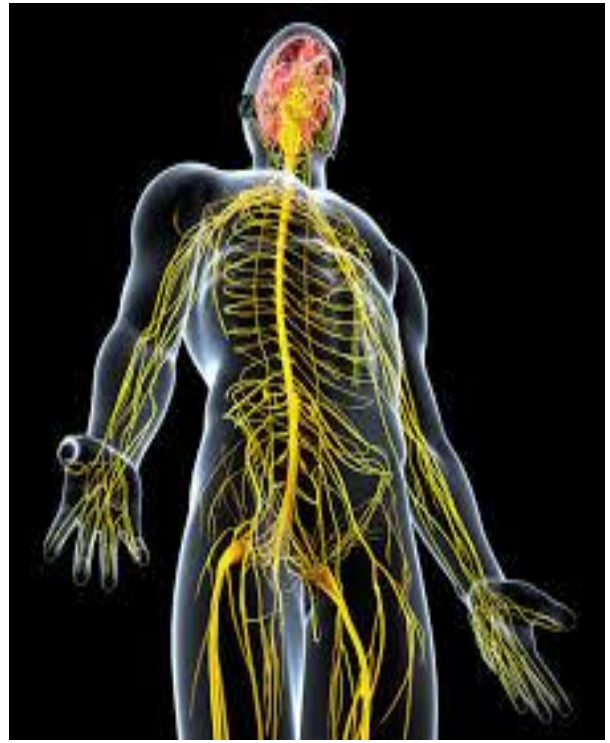
Nerve injury is a recognized complication of peripheral regional technique

Neurologic deficit after regional anesthesia : *neural ischemia, traumatic injury, infection, hemorrhagic*

Box 46.3 Recommendations: Needle Tip Location, Choice of Local Anesthetic, and Nerve Localization Techniques

Needle Tip Location, Choice of Local Anesthetic, and Paresthesia

- Intrafascicular needle insertion and injection should be avoided because it can cause histological and/or functional nerve injury.



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Complications and safety

Nerve Localization Techniques

- There are no human data to support the superiority of one nerve localization technique over another with regard to reducing the likelihood of peripheral nerve injury.
- Peripheral Nerve Stimulation
  - Presence of an evoked motor response at a current of <0.5 (0.1 ms) indicates intimate needle-nerve relationship, needle-nerve contact, or an intraneural needle placement.
- Injection Pressure Monitoring
  - Animal data have linked high injection pressures to subsequent fascicular injury, but there are no human data that confirm or refute the effectiveness of injection pressure monitoring for limiting PNI.
- Ultrasound
  - Ultrasound can detect intraneural injection.
  - Current ultrasound technology does not have adequate resolution to discern between an interfascicular and intrafascicular injection.
  - Adequate images of needle-nerve interface are not consistently obtained by all operators and in all patients.

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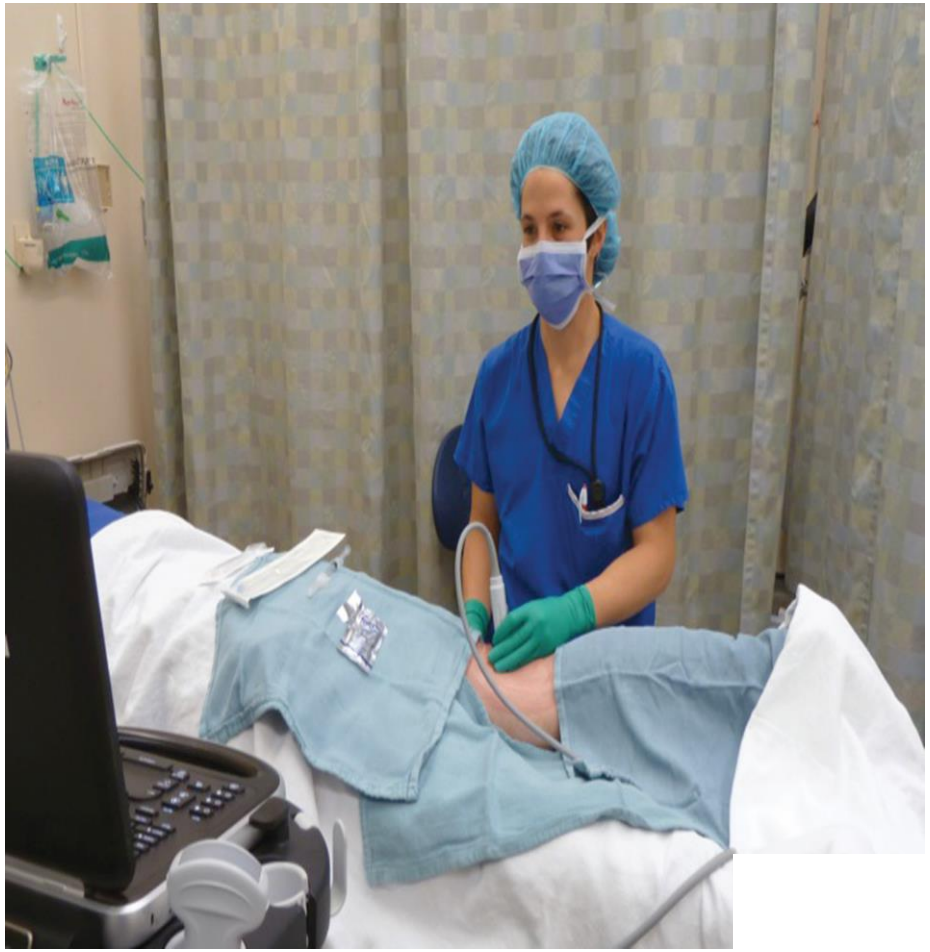

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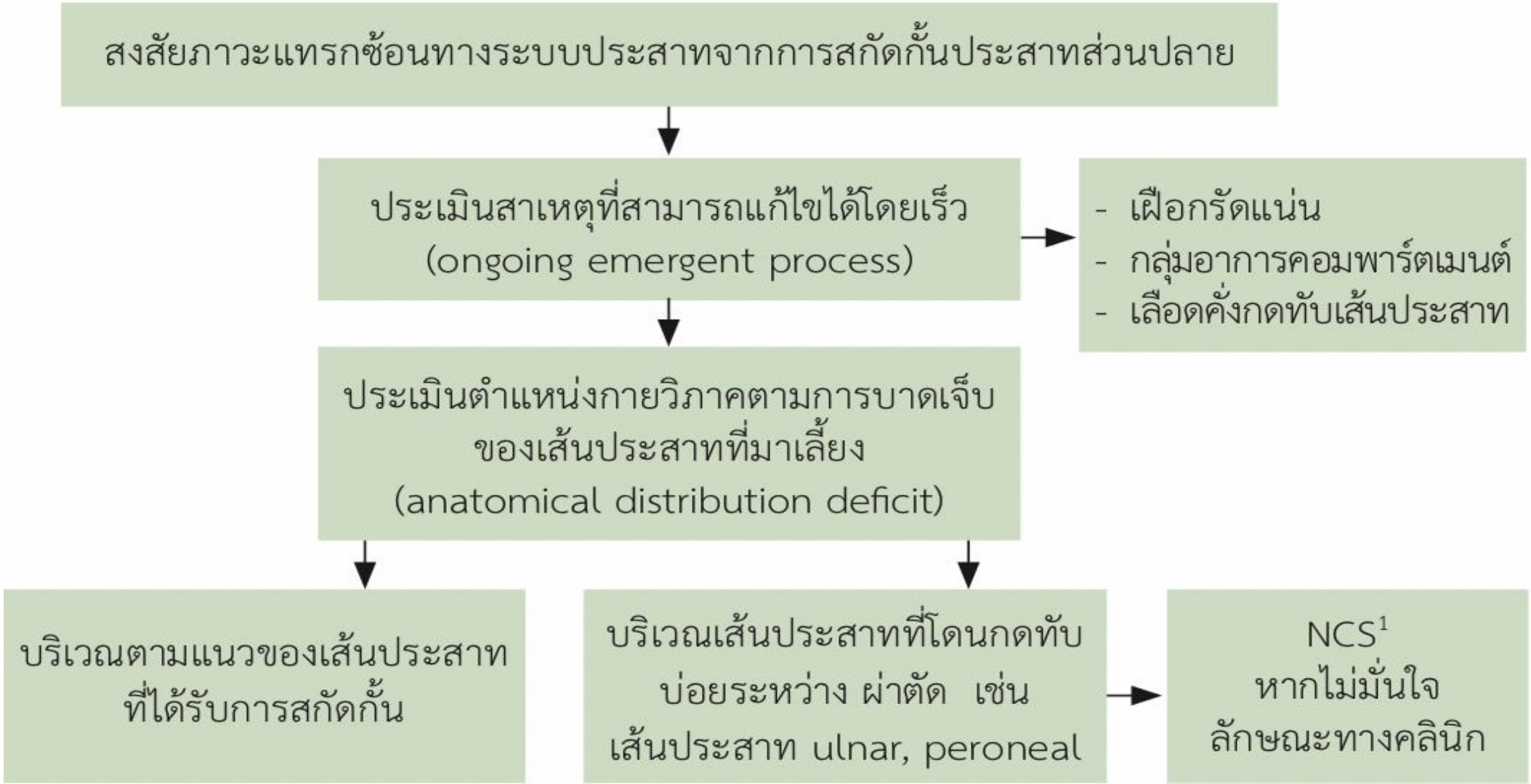
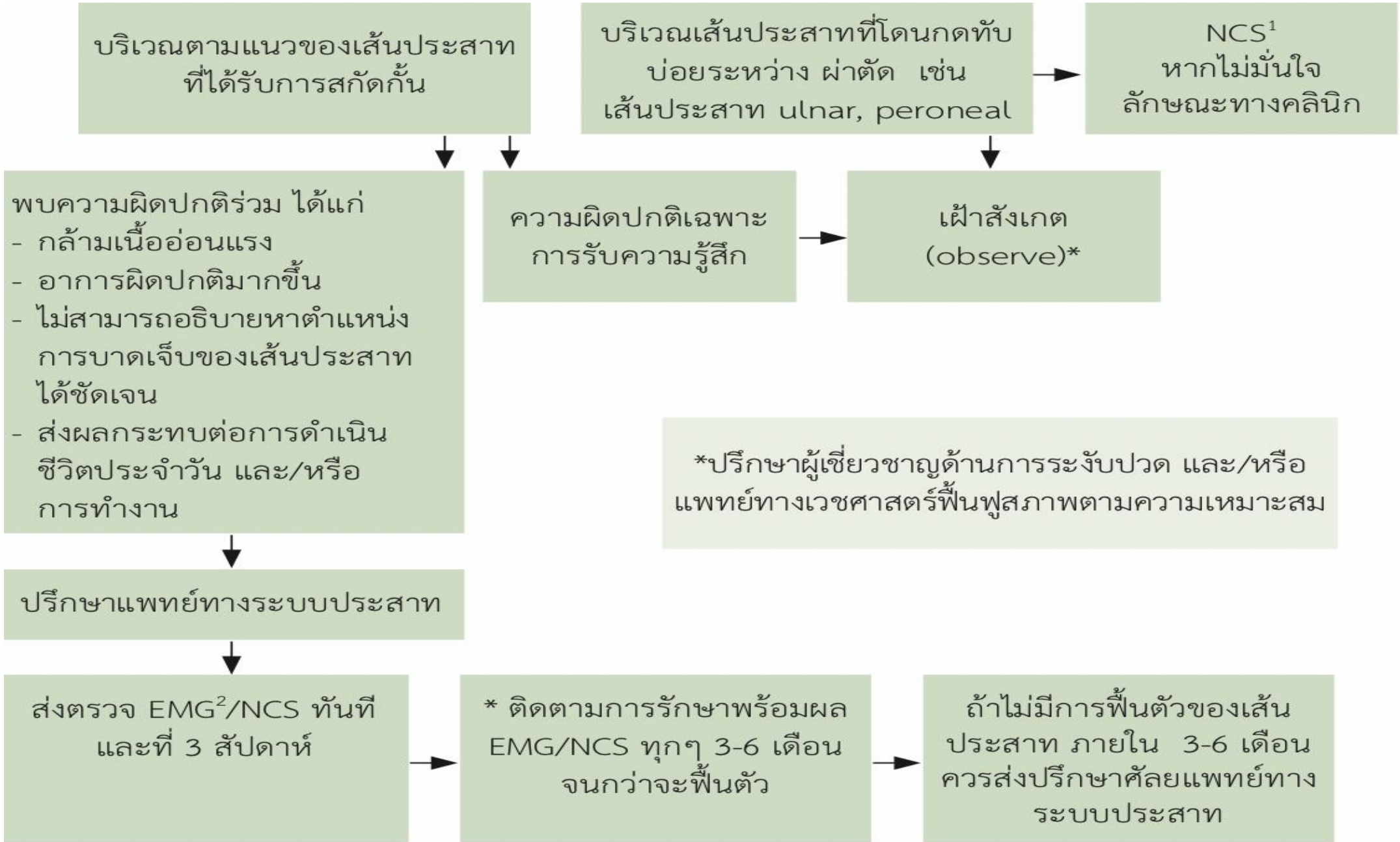
Guideline for peripheral nerve injury management





แนวทางพัฒนาการดูแลผู้ป่วยที่เข้ารับการระงับความรู้สึกเฉพาะส่วน

Take home message

- The peripheral nerve block techniques benefit the patient intraoperatively and postoperatively
- Knowledge of regional anesthesia and anatomy is essential for treatment
- Ultrasound guidance is major tool that choosing in regional anesthesia blocks
- Education and training play key roles in reducing adverse events