BRA

Burton Regional Anaesthesia course booklet 2017

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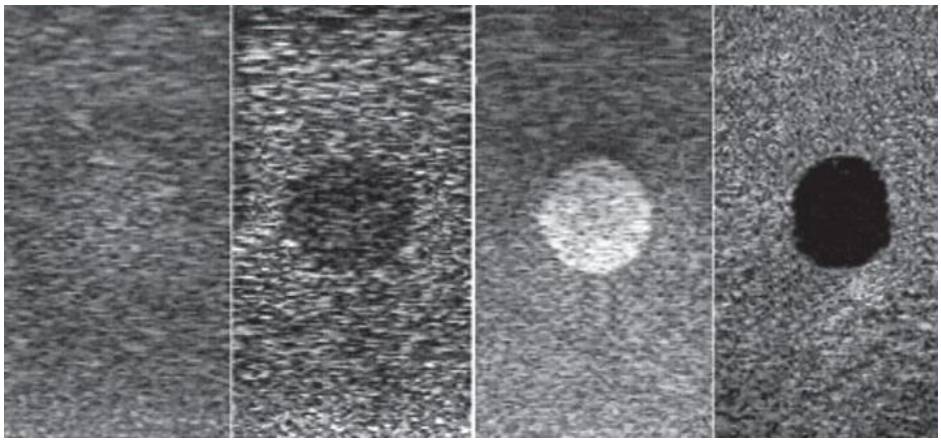
CONTENTS

Echogenicity:

Echogenicity of a tissue refers to its ability to transmit or reflect ultrasound waves in the context of the surrounding tissues. A structure can be either, Hyperechoic (white), Hypoechoic (grey) or Anechoic) black. (Fig 1)



isoechoic Hypoechoic Hyperechoic Anechoic
Fig 1 Different echogenicity

Choose the Probe:

Select the most appropriate probe for the scan required, depending on the following variables;

Frequency range: higher ultrasound frequencies provide better discrimination of fine details but have lower penetration because of increased attenuation by tissues.
Physical size: the smaller the probe, the smaller its footprint when placed on the patient.
The width of the tissue field scanned: an ultrasound probe scans a slice of tissue, usually 1-3 mm thick, with a width dependent on the size of the probe.

Common types of available probes are (fig 2):
Linear (general purpose probe)
Flat surface, parallel sided scan field, about 1 mm thick
Frequency 5-13 MHz,
Width 20-40 mm (depending on the probe footprint)

Hockey-stick
Small probe for small patients or paediatrics or awkward positions; around clavicle, ankle.
Its narrow field makes it difficult to identify the anatomy.

Curvilinear
Curved surface giving fan-shaped diverging scan field with curvilinear distortion in the horizontal field, like fish eye lens photography)
Frequency 2-5 MHz
Panoramic view; easy anatomy identification, greater depth, but coarse discrimination.

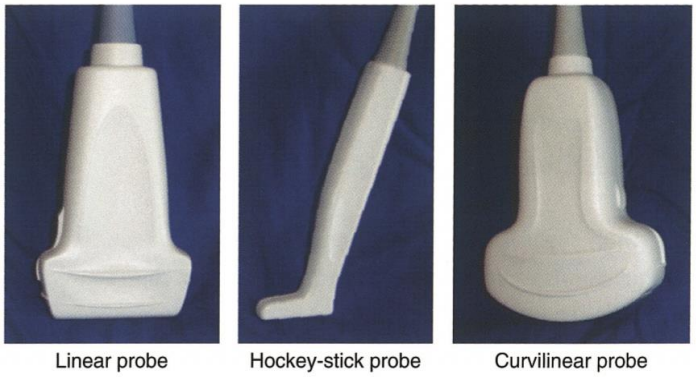
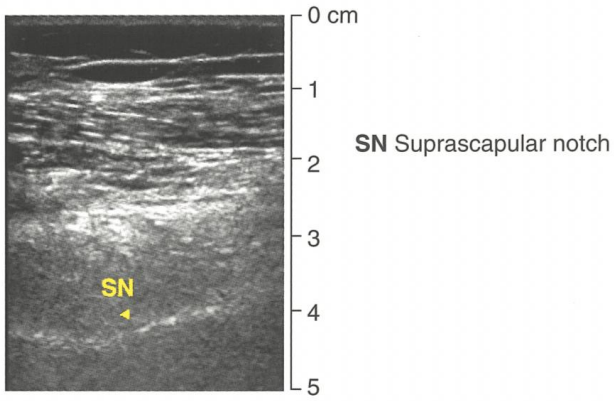


Fig 2 The common tupes of ultrasound probes

Choose the frequency:

The frequency determines both the depth of the penetration and the discrimination of details.
Unfortunately, we have to sacrifice one for the other. (Fig 3)
Higher frequencies = lower penetration and better discrimination
Lower frequencies = higher penetration but poorer discrimination.

Linear probe (10MHz) 2-3 cm Fig 2
Curvilinear probe (2-5 MHz) 4-10 cm Fig 4



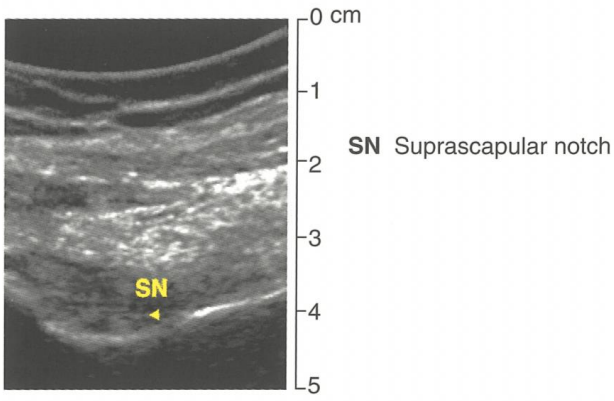


Fig 3 A) high resolution but low penetration
Using a linear probe at 10 MHz

B) Low resolution but high penetration
Using a curvilinear probe at 4 MHz

Choose the gain:

This is equal to brightness. (Fig 4) It does not necessarily mean the target will be easier to identify.
Some complex machines can increase the gain at a selected depth known as time gain compensation (TGC), a useful feature to visualise deeper structures. (Fig 5)

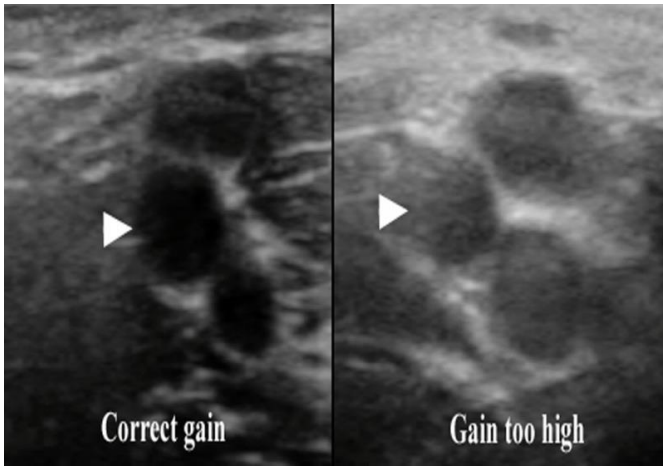


Fig 4 too high gain on the right compared to adjusted gain on the left.

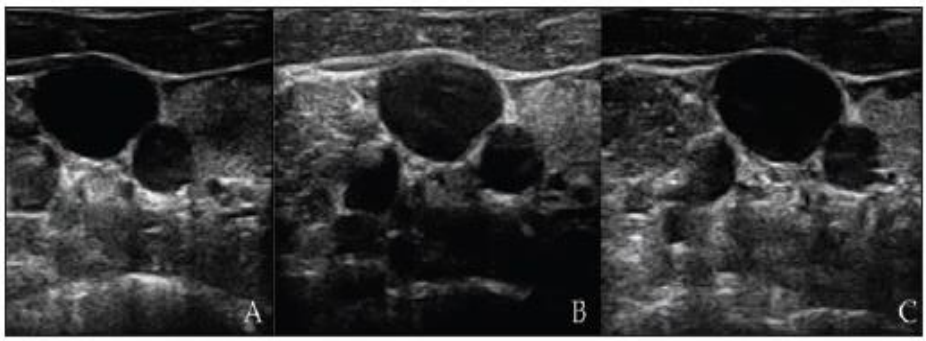


Fig 5 Images of IJV showing various time gain compensation settings. A, near field too dark, B, far field too dark, C, optimum setting.

Choose the depth:

Use the depth control to place the desired target at about two-thirds of the total depth of the scan.

Focus:

If you are using a machine that has a focus adjustment, this enhances the image quality at a chosen depth. Adjust the depth to just below the target area.

Recognize different tissues:

NERVES
Peripheral nerves have a granular appearance in cross section due to echogenicity of the endoneurium. (Fig 6). Nerves appear less echogenic when viewed more centrally due to the thinner surrounding sheath.

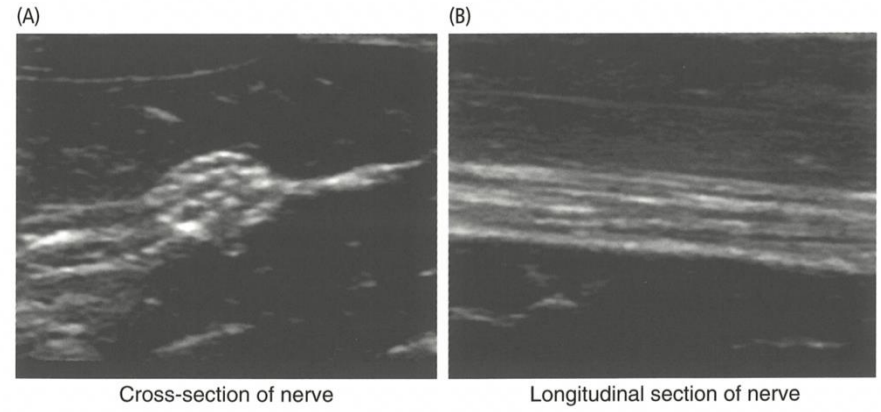


Fig 6 Ultrasound appearance of nerve fascicular pattern.

Anisotropy: slight adjustment of the probe around its long axis (tilting) can improve the view of the target, or even make it visible, when it was not previously. This is because of altering the angle at which the US waves strike the target. (Fig 7). Anisotropy can also help distinguish nerves from tendons. (Fig 8)

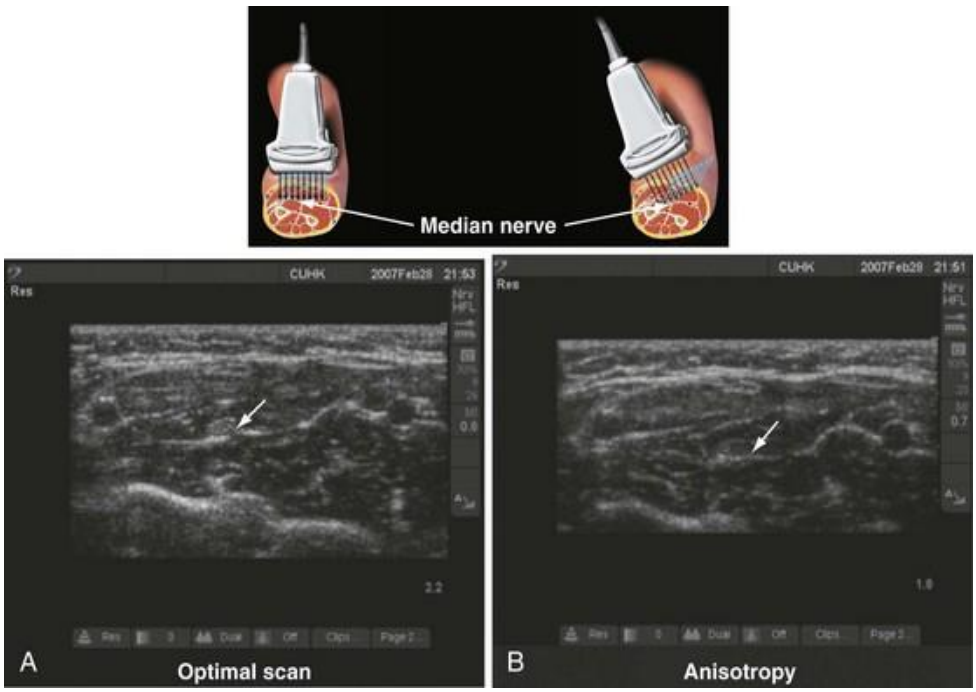


Fig 7 Tilting the probe to minimize anisotropy to optimise view of the median nerve.

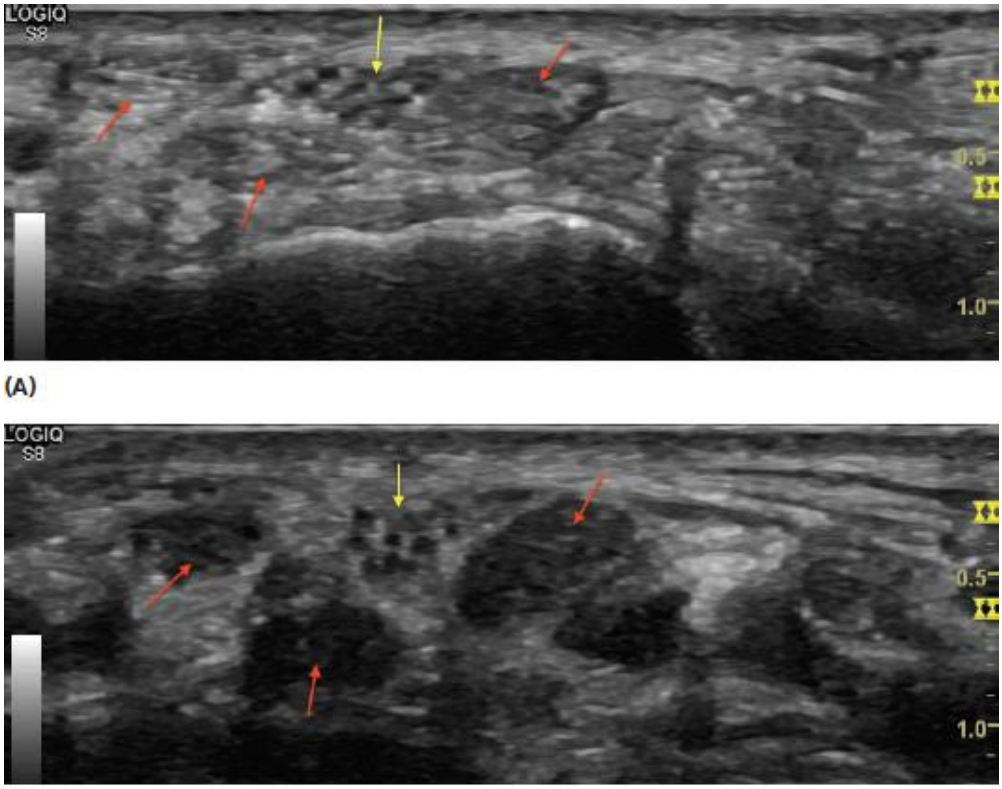


Fig 8 A) poor discrimination between nerve (yellow arrow) and tendons (red arrows), B) adjusted anisotropy.

BLOOD VESSELS

Blood vessels are easily recognised because of the low echogenicity of the blood they contain.
Arteries retain they circular shape and pulsatile nature even with pressure.
Veins are compressible with an irregular cross section. (Fig 9)

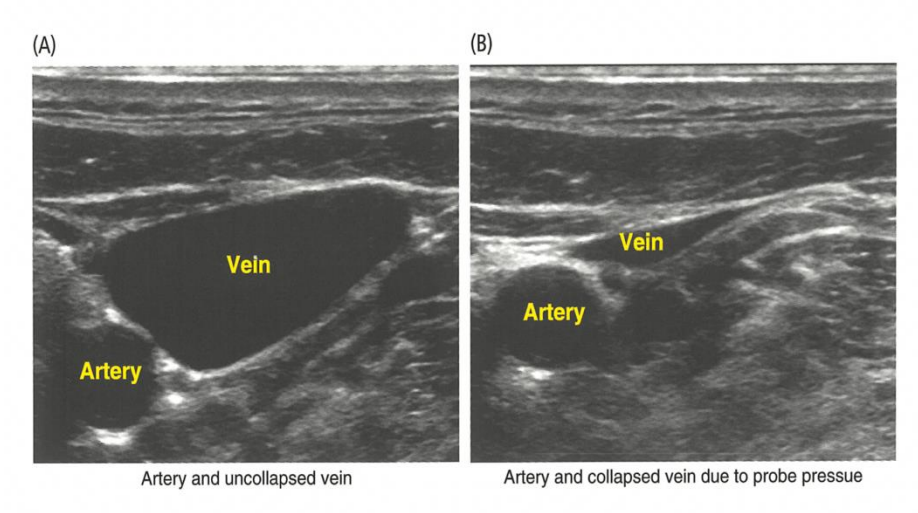


Fig 9 scan of ICA and IJV

Colour Doppler:
helps identification of structures with movement, a very useful to identify blood vessels especially from proximal hypoechoic nerves. It also determines the direction of blood flow when needed.

Post-cystic enhancement:
Often a bright area can be seen distal to a fluid-filled cyst or vessel. (Fig 10). This has many reasons. A) low attenuation of ultrasound waves as they pass through the vessel. B) Refraction C) Edge shadow, that is caused by scattering ultrasound waves from the edges of the vessel.

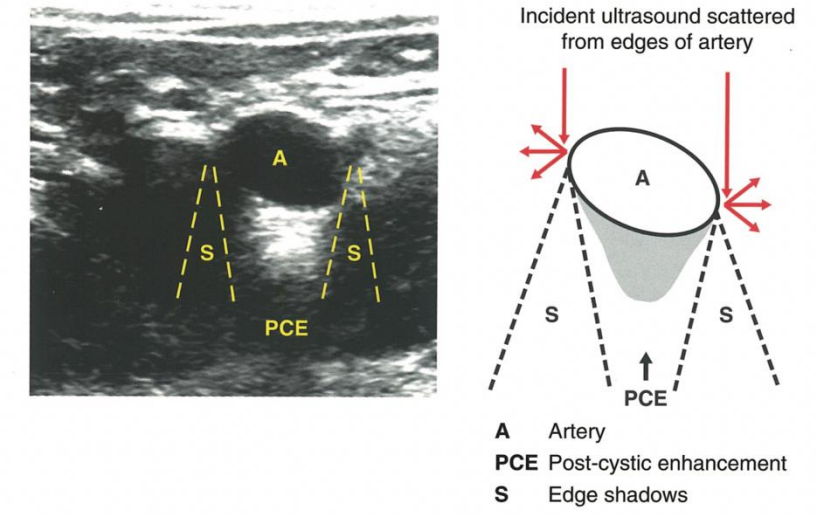


Fig 10 Post cystic enhancement.

Needling Techniques:

The ultrasound beam is only 1 mm thick. It is necessary to obtain the best possible view of the needle and needle tip.

Obtaining a good needle view has two prerequisites;

A The needle to be in plane of the ultrasound beam.
B The angle between the needle and the face of the probe should be as small as possible in order to maximize the reflection of the ultrasound waves back to the probe. (Fig 11)

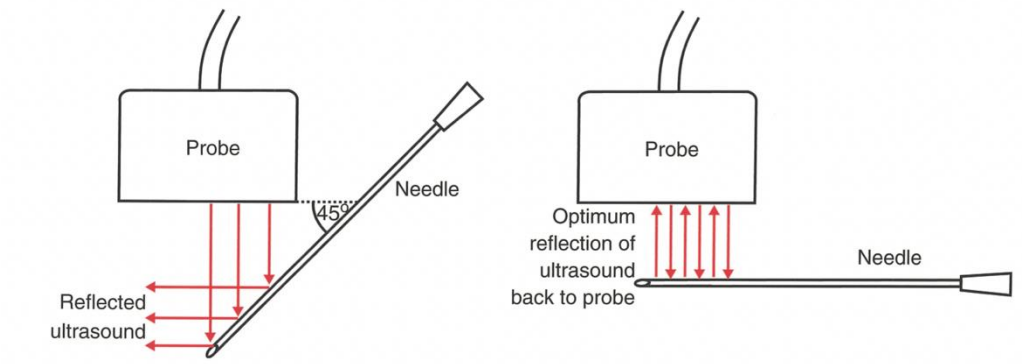


Fig 11 The effect of different angles between needle and probe.

IN-PLANE needling: This means needle insertion parallel to the ultrasound beam. The whole needle, including its tip, must lie in the plane of the ultrasound beam. The whole needle is thus visualized completely (Fig 12), however, because the ultrasound beam is only 1-2mm thick, it is easy to only obtains a partial view of the needle. Leaving the needle invisible as it lies outside the plane of the ultrasound beam. (Fig 13)

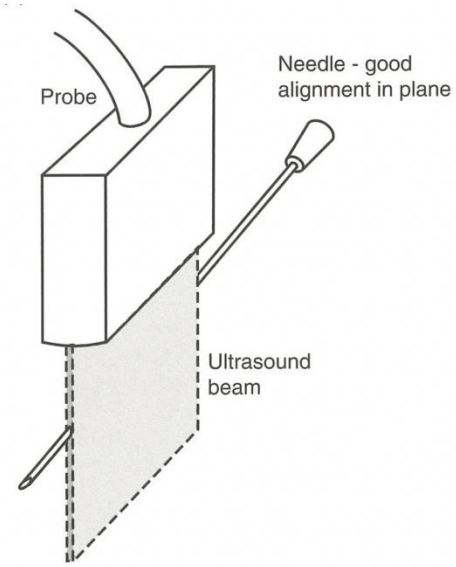


Fig 12 Proper in-plane needle technique.

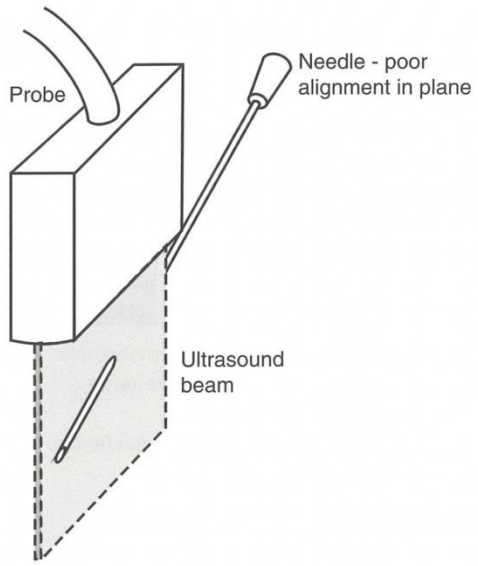


Fig 13 Poor in-plane needle technique.

OUT-OF-PLANE needling: This means the needle is perpendicular to the ultrasound beam. The needle is only visualised as a hyperechoic spot as it traverses the ultrasound beam. (Fig 14)

It makes it easier to identify surrounding anatomy, but it increases the risk of puncturing unwanted structures as thee needle tip is not always visualised.

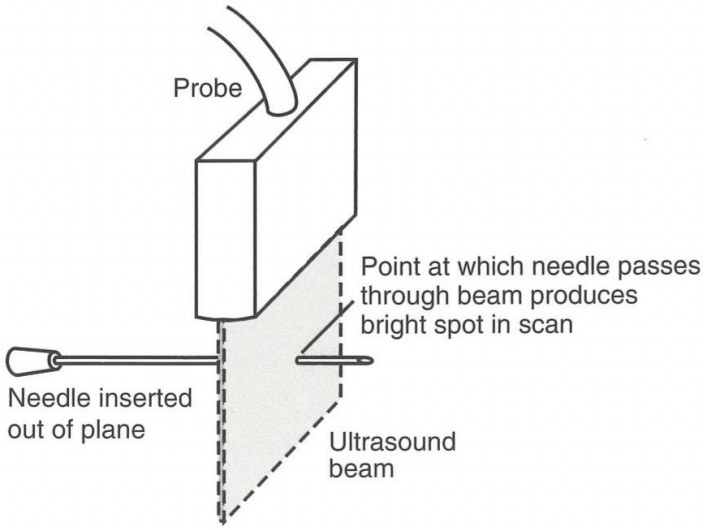


Fig 14 out of plane needling

Ergonomics of Ultrasound procedures:

The ultrasound machine must be positioned on the contralateral side of the patient, with the operator standing on the ipsilateral side. The transducer is usually held in the operator's non-dominant hand, with the needle in the dominant hand. The transducer should be held gently quite low on the probe near to the scanned surface.

STOP BEFORE YOU BLOCK

A stop moment is mandatory before performing a regional anaesthetic block. It must be done immediately before performing the block with both the anaesthetist and the ODP (operating department practitioner)

This includes checking patient identity (name, hospital number, DOB), consent, site and mark.

PROBE MANIPULATION

When dealing with ultrasound probe manipulation, the mnemonic PARRTS is useful.

P Pressure
A Alignment (sliding)
R Rotation
R Rocking
T Tilt

PRESSURE

Correct pressure application can considerably improve the image quality. It affects tissue echogenicity and shortens the distance to the structure of interest. It can also be applied to compress a vein. However, excessive pressure can cause discomfort to the patient and underestimation of depth when taking measurements. (Fig 15)

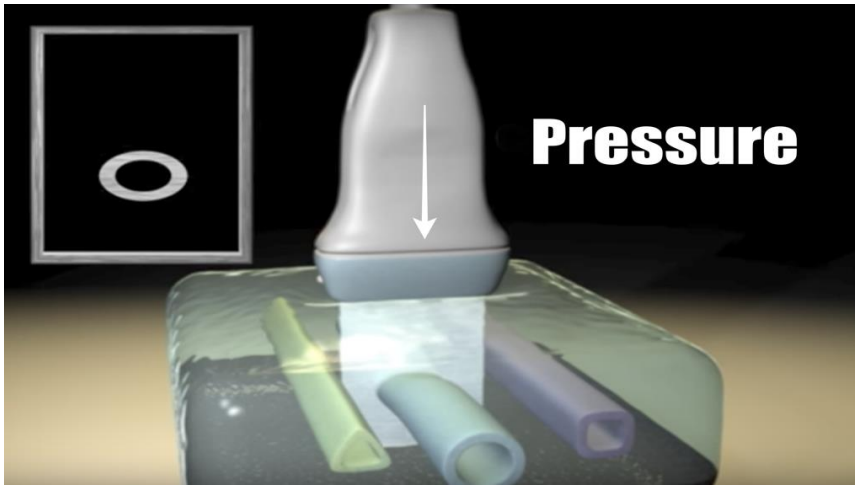


Fig 15 Pressure.

ALIGNMENT (Sliding)

Alignment means sliding the probe horizontally or longitudinally in order to find the structure of interest and position it optimally on the screen; in the middle of the screen for out of plane approach and somewhat on the opposite side for in plane approach. (Fig 16)

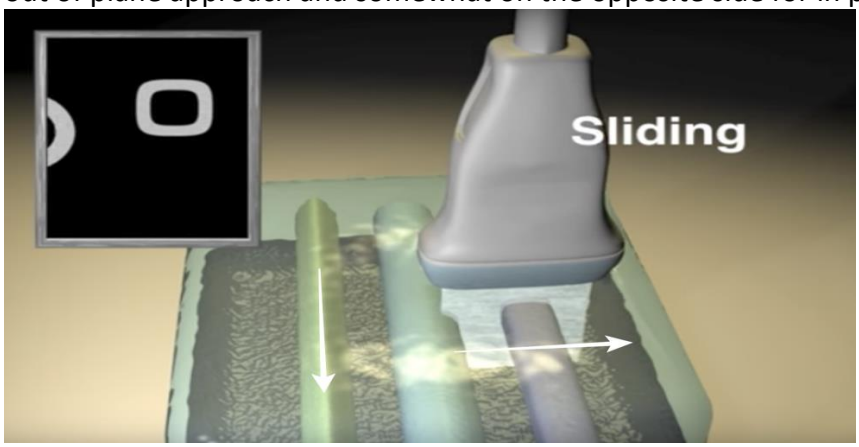


Fig 16 Sliding.

ROTATION

Rotation has several goals; A) helps attain a true axial view of the target B) can align the target into a more favourable trajectory for needle pass, away from blood vessels or pleura, and C) 90-degree rotation changes the view from short to long axis view and vice versa. (Fig 17)

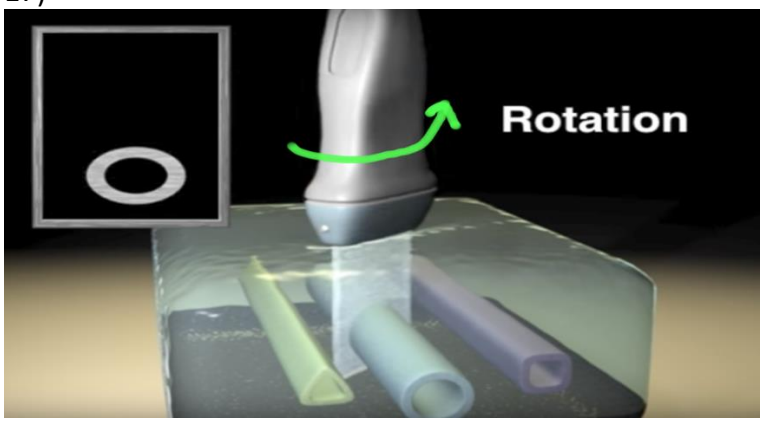


Fig 17 Rotation.

ROCKING

Rocking can be looked into as differential pressure. It helps extend the plane of imaging when working in a narrow acoustic window. (Fig 18)

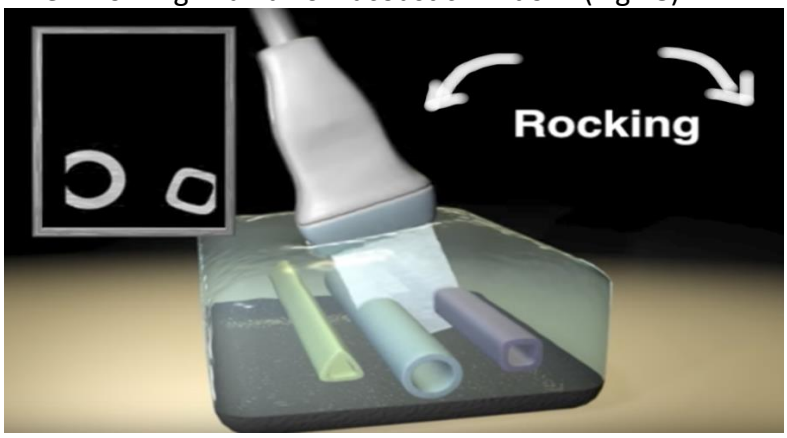


Fig 18 Rocking.

TILT

In nerve imaging, it is critical to optimize tilt in order to properly visualise nerve fascicles. Nerves are seen best when the scan plane is orthogonal to the course of the nerve. (Fig 19)

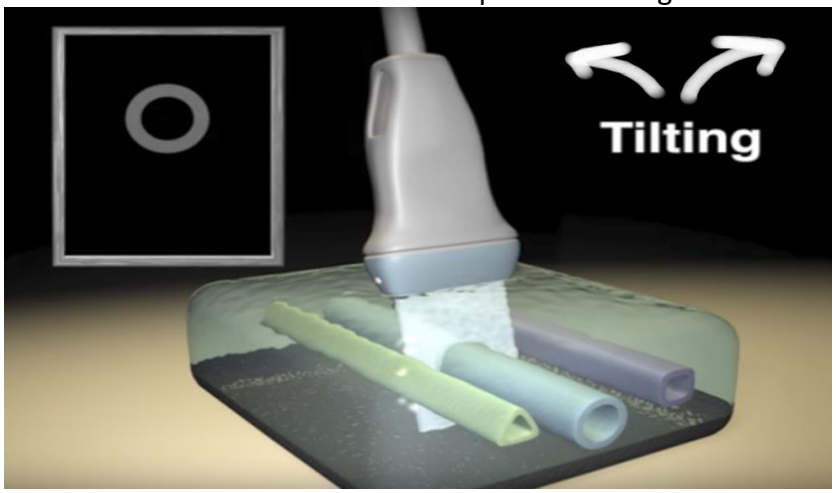


Fig 19 Tilting

Care of the ultrasound machine and probe

Care for your ultrasound machine is vital in its maintenance. The following are some recommendation by the S nerve machine company. Please Check with your company if you are using different machines.

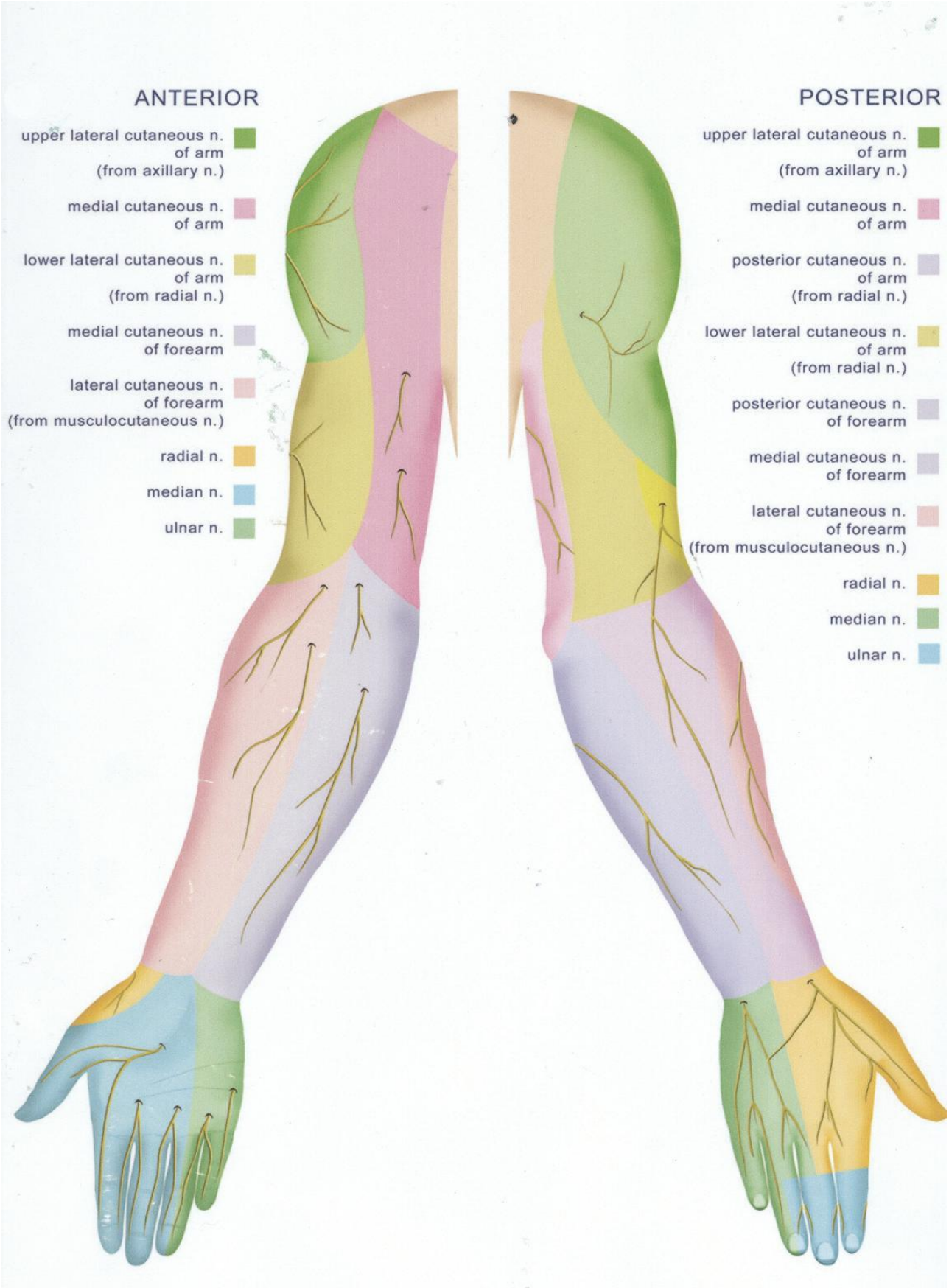
1- Do not use tegaderm on probe lens (it is very sticky and causes delamination and damage to the edges of probe)

2- Use Optilube (the gel we use for airway gadgets) only on the probe. It is sterile and doesn't leave any flakes on the probe

3- Do not use the chlorehexidine pink spray (Hydrex) on probe. It contains alcohol which is absolutely not to be used either to clean or as coupling agent.

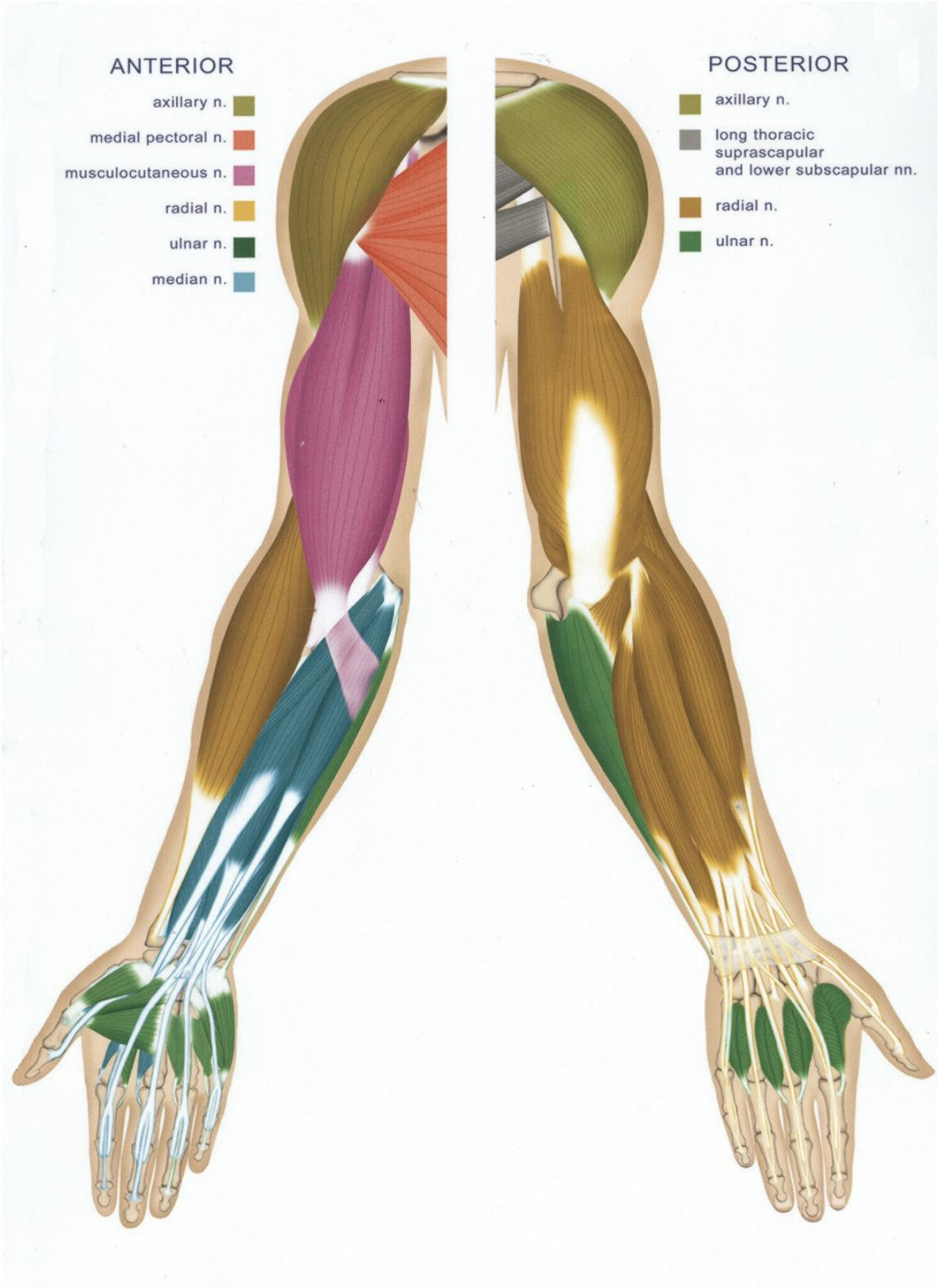
4- Clean the probe using Clinell wipes (available in all theatres) or wash the probe in the sink under running water

5- Probe should not be cleaned by alcohol swab, hyrax or any detergent.

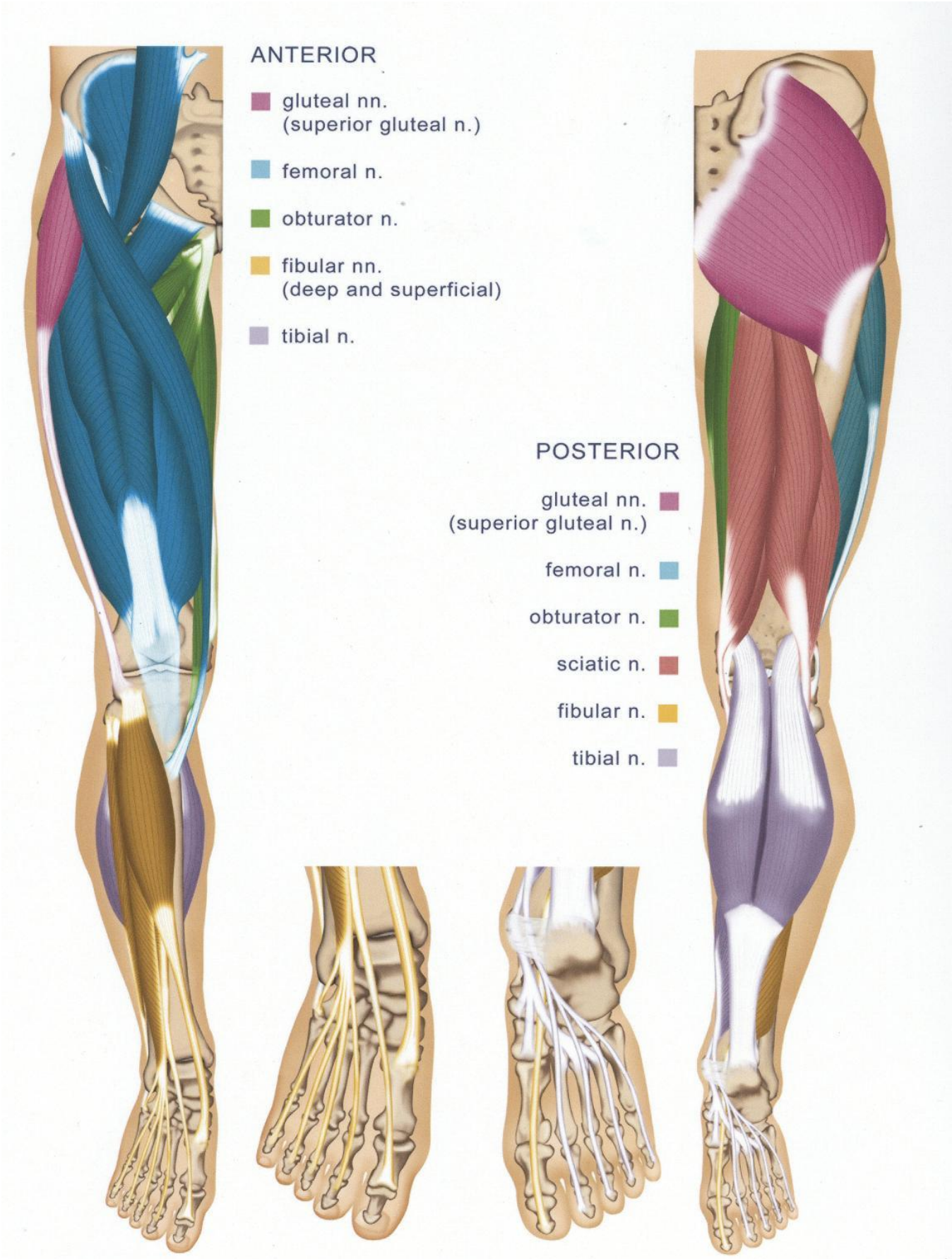


UPPER LIMB DERMATOMES

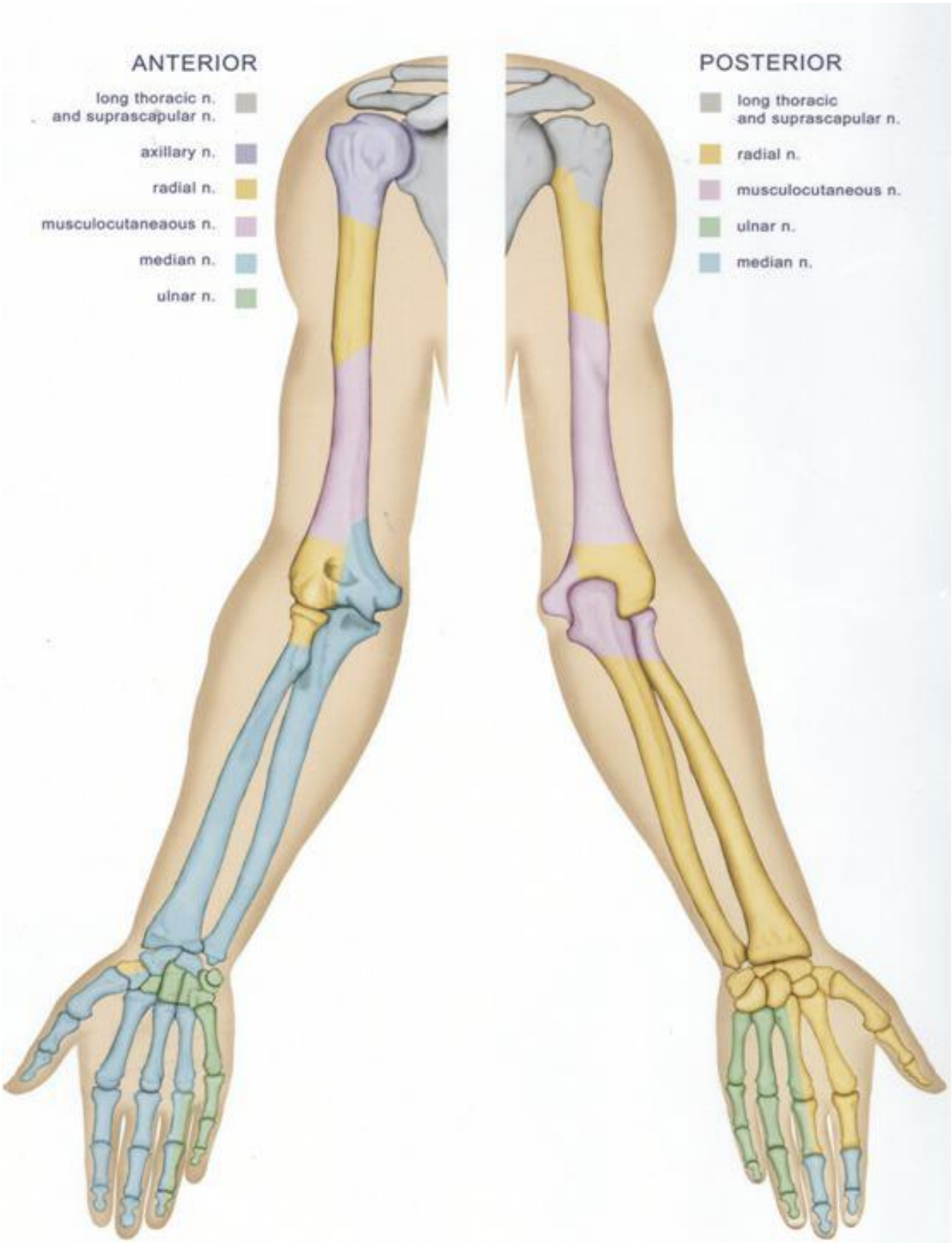
LOWER LIMB DERMATOMES



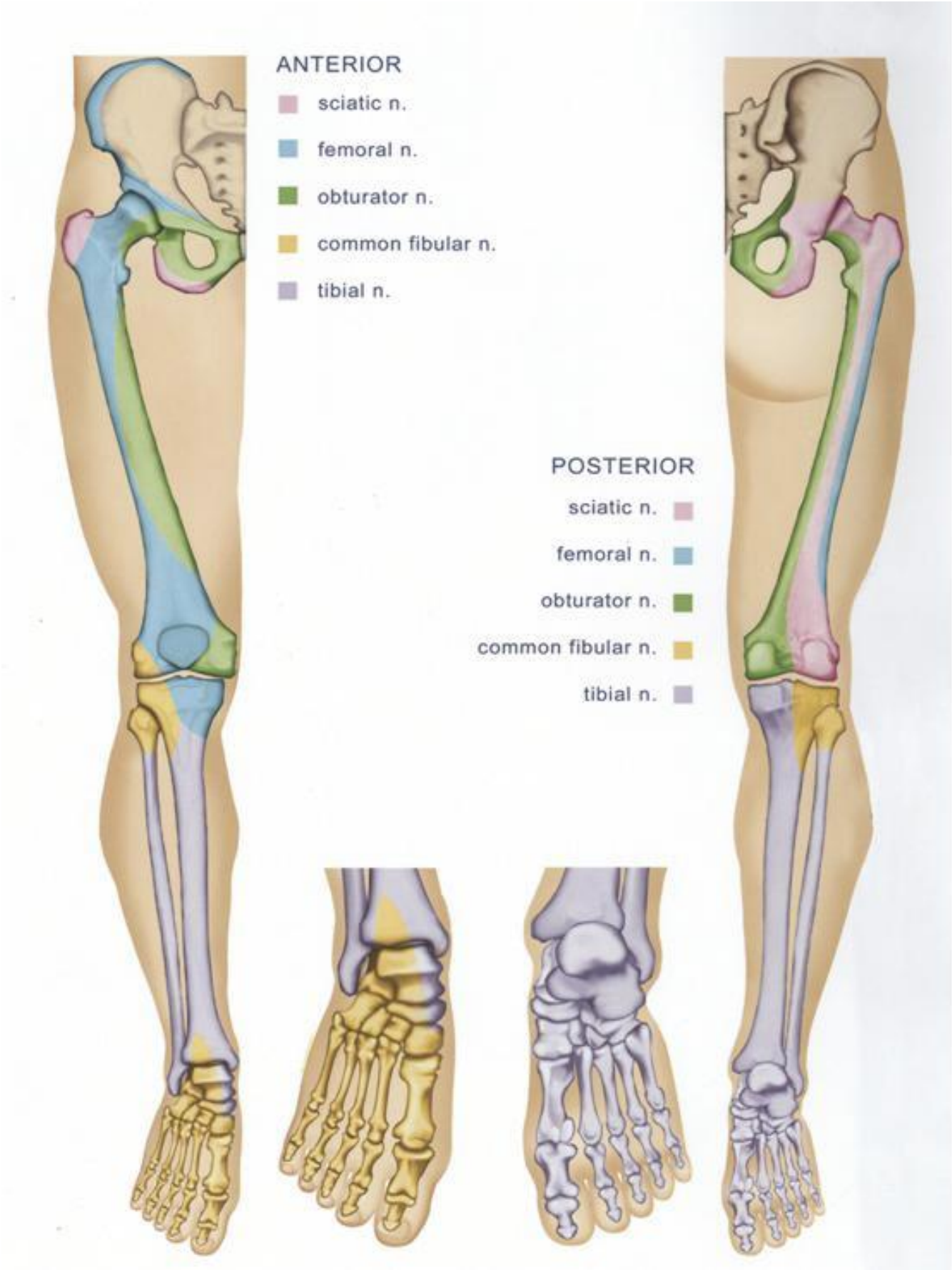
UPPER LIMB MYOTOMES



LOWER LIMB MYOTOMES



UPPER LIMB OSTETOMES



LOWER LIMB OSTEOTOMES

Recommendations for Choice of Local Anaesthetic & Doses

Superficial Cervical Plexus Block:

L-Bupivacaine 0.25%--10 mls. In our settings it is only used for analgesia i.e. surgery on clavicle, there is no need for higher concentration of LA

Interscalene Block:

Analgesic Block:

L-Bupivacaine 0.25%--20 mls

Anaesthetic Block:

Prilocaine 1% with/without adrenaline, 20-25 mls depending on the duration of surgery. Adrenalin may prolong the block up to extra 60 minutes (manipulation, diagnostic arthroscopy, SAD, ACJ resection)

OR

L-Bupivacaine 0.5%, 20-25mls (cuff repair, replacement) may take up to 30 minutes to be effective

Supraclavicular Block:

Analgesic Block:

L-Bupivacaine 0.25%, 25 mls

Anaesthetic Block:

shoulder

Prilocaine 1% with/without adrenaline, 25 mls for shorter procedures

OR

L-Bupivacaine 05%, 25 mls for longer procedures/analgesia (may take up to 30 min. to be effective)

Infraclavicular Block:

Analgesic Block:

L-Bupivacaine 0.25%, 30 mls

Anaesthetic Block:

Prilocaine 1% with or without adrenaline, 30 mls

OR

L-Bupivacaine 0.5%, 30mls for longer procedures/analgesia (may take up to 30 min to be effective)

Axillary Block:

Analgesic Block:

L-Bupivacaine 0.25%, 6 mls/nerve (total 25mls)

Anaesthetic Block:

Prilocaine 1% with/without adrenaline 6ml/nerve (total 25mls) for shorter procedures

OR

L-Bupivacaine 0.5%, 6ml/nerve to maximum 25 mls, for longer procedures/analgesia.

Rescue Blocks of Upper Limb:

Suprascapular Nerve:

L-Bupivacaine 0.25%, 10 mls

Axillary Nerve:

L-Bupivacaine 0.25%, 10 mls

Median/Ulnar/Radial & Musculocutaneous Nerves:

L-Bupivacaine 0.25%, 5mls/nerve

Lumbar Plexus Block:

L-Bupivacaine 0.25/0.375%, 30 mls. Higher concentration of the same volume will provide dense block of longer duration

Fascia Iliaca Compartment Block:

L-Bupivacaine 0.25/0.375%, 30-40mls.Higher concentration of the same volume will provide dense block of longer duration

Femoral Nerve Block:

L-Bupivacaine 0.25/0.375%, 20mls.Higher concentration of the same volume will provide dense block of longer duration

Obturator Nerve Block:

L-Bupivacaine 0.25%, 5mls for each branch to total 10mls.

Lateral Femoral Cutaneous Nerve Block:

L-Bupivacaine 0.25%, 10mls

Adductor Canal (Saphenous Nerve) Block:

L-Bupivacaine 0.25-.375%, 10mls

Sciatic Nerve Block (Para sacral/anterior/sub gluteal):

L-Bupivacaine 0.25-0.375%, 20-25mls. Higher concentration will provide denser and prolonged block

Popliteal Block:

L-Bupivacaine 0.25-0.375%, 20mls (10ml for each branch)

Ankle Block:

L-Bupivacaine 0.25-0.375%, 5mls/nerve

Maximum Safe Doses of Local Anaesthetics

Lidocaine

… … Plain …… ……. . . 3mg/kg

…… With Adrenaline ……. 7mg/kg

Prilocaine:

. … Plain…. .. . 6mg/kg

…… With Adrenaline ….. .. 9mg/kg

Bupivacaine:

… Plain ….. 2mg/kg

… . With Adrenaline .. …. 2.5mg/kg

Levobupivacaine:

…. Plain .. ….. . 2.5mg/kg

… . With Adrenaline ……. . ? 3mg/kg

Ropivacaine:

….. Plain… … . 3-4mg/kg

. . . With Adrenaline ….. 3-4mg/kg

Local Anaesthetic Drug Information

DRUG	Lidocaine	Prilocaine	Bupivacaine	L-Bupivac	Prilocaine
Description	Amide	Amide	Amide	Amide	Amide
Potency	2	2	8	8	6
pKa	7.7	7.9	8.1	8.1	8.1
Onset	5-10 min	5-10 min	10-15 min	10-15 min	10-15 min
Duration Plain	1-2 h	1-2 h	3-12 h	3-12 h	3-12 h
Duration + Adrenaline	2-3 h	2-3 h	4-12 h	4-12 h	4-12 h
Max Dose Plain	3mg/kg	6mg/kg	2mg/kg	2.5mg/kg	3mg/kg
Max Dose + Adrenaline	7mg/kg	0mg/kg	2.5mg/kg	3mg/kg*	4mg/kg*

* Probably max.safe dose (insufficient data)

PRINCIPLES & RATIONAL SELECTION OF LOCAL ANAESTHEICS

- For rapid onset of blockade, use Lidocaine1-2% or Prilocaine 1-2%

- For prolonged analgesia, use L-Bupivacaine/Bupivacaine 0.25-0.5% or Ropivacaine 0.5-0.75%
- For short surgical anaesthesia, use Lidocaine/Prilocaine 1- 2% & long surgical anaesthesia use L-Bupivacaine/Bupivacaine 0.5% or Ropivacaine 0.75%
- Prilocaine 0.5% is drug of choice for Bier's block
- Larger nerves (Sciatic) are thicker and myelinated. LA takes longer time to diffuse into the nerve, hence the onset is delayed
- LA agents with low pKa are less ionized and produce rapid onset of block
- **There is little clinical advantage in mixing local anaesthetics** (it increases risk of drug error. Toxicity is additive and not just related to individual drug)
- Bupivacaine binds tightly to tissues and hence produces the longest duration of block.
- Bupivacaine produces refractory VF, which is difficult to reverse.
- Addition of Adrenaline to Bupivacaine/L-Bupivacaine does not prolong the block but reduces the risk of toxicity due to reduced absorption
- L-Bupivacaine has greater vasoconstrictor property than Bupivacaine. Hence less cardio toxic (slow absorption). It also produces less motor block as compared to Bupivacaine
- A 1:200,000 Adrenaline solution of LA contains 5 micrograms of Adrenalin/ml
- Addition of 8.4% Sod Bicarbonate to LA increases the PH, resulting in increased proportion of unionized component in LA. This increases the onset time and block duration. Add one ml of 8.4% Sod Bicarb to 10 mls of LA.
- The relationship between concentration and block onset is logarithmic and not linear, I, e doubling the concentration will only marginally speed up the onset of block but it will produce dense and prolonged block

Procedure Specific Nerve Blocks

Upper Limb Procedures:

Shoulder operations:
Interscalene block
Supraclavicular BP + Suprascapular N block (patients with COPD)
Surgery on clavicle:
Interscalene + superficial cervical plexus (Supraclavicular N)

ORIF humerus:

Supraclavicular BP block Axillary N block

Elbow operations:
Supraclavicular / Infraclavicular BP block + Intercostobrachial N

Surgery on forearm & hand:
Supraclavicular / Infraclavicular or Axillary block

Lower Limb Procedures:

Hip Arthroplasty (THR*):*

Lumber plexus+ Para sacral (Trans-gluteal) sciatic nerve blocks Fascia Iliaca Compartment Block (FICB) **(only partially effective**)

Femur fracture surgery:
FICB Femoral & Lateral femoral cutaneous nerve of thigh

Knee Arthroplasty (TKR):
Femoral + Sciatic + Obturator nerves block
Anterior Cruciate Ligament Reconstruction Surgery:
Femoral or Saphenous N + Obturator N blocks

Leg surgery:
Popliteal block + Saphenous N block
Foot Surgery:
Ankle block. Selection of specific nerves to be blocked depends upon the site of surgery
Popliteal block

Surgery on Trunk:

Upper Abdominal Surgery (T6-T10):

Oblique subcostal TAP block

Umbilical/Para umbilical Surgery:

Rectus sheath block

Lower Abdominal Surgery (T10-L1):

Bilateral TAP Block (**posterior/classical**)

Hernia/Groin Surgery:

Ilio-inguinal & Ilio-hypo gastric N block (**anterior TAP block**)

Appendicectomy:

Unilateral TAP block

Breast surgery:

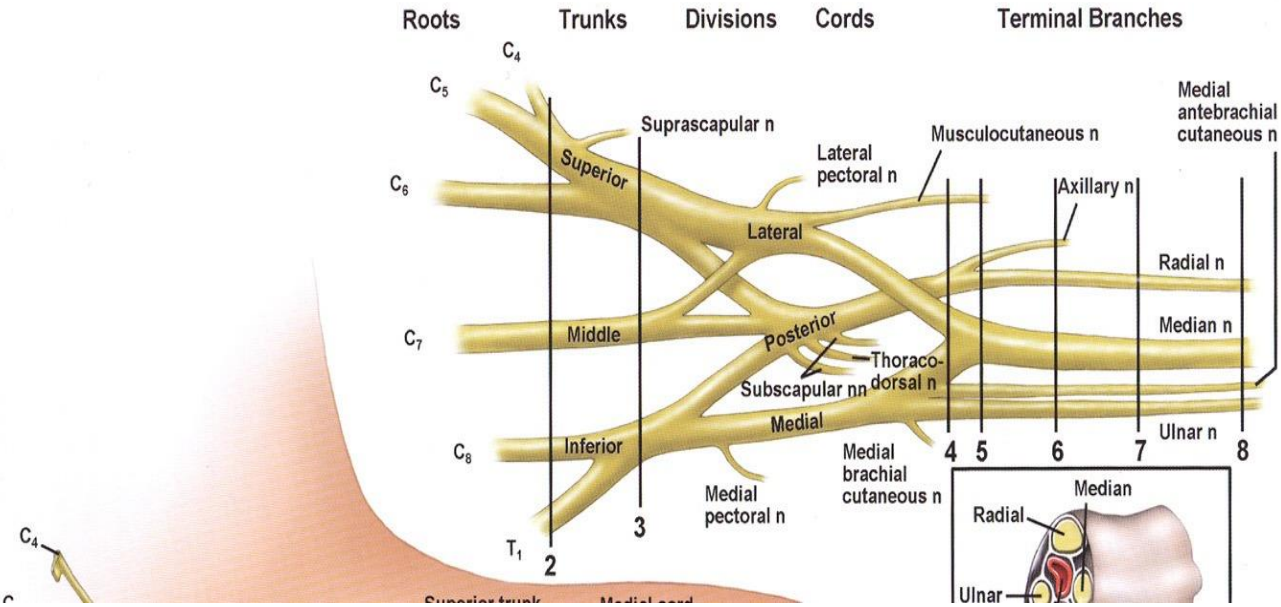
Para vertebral block

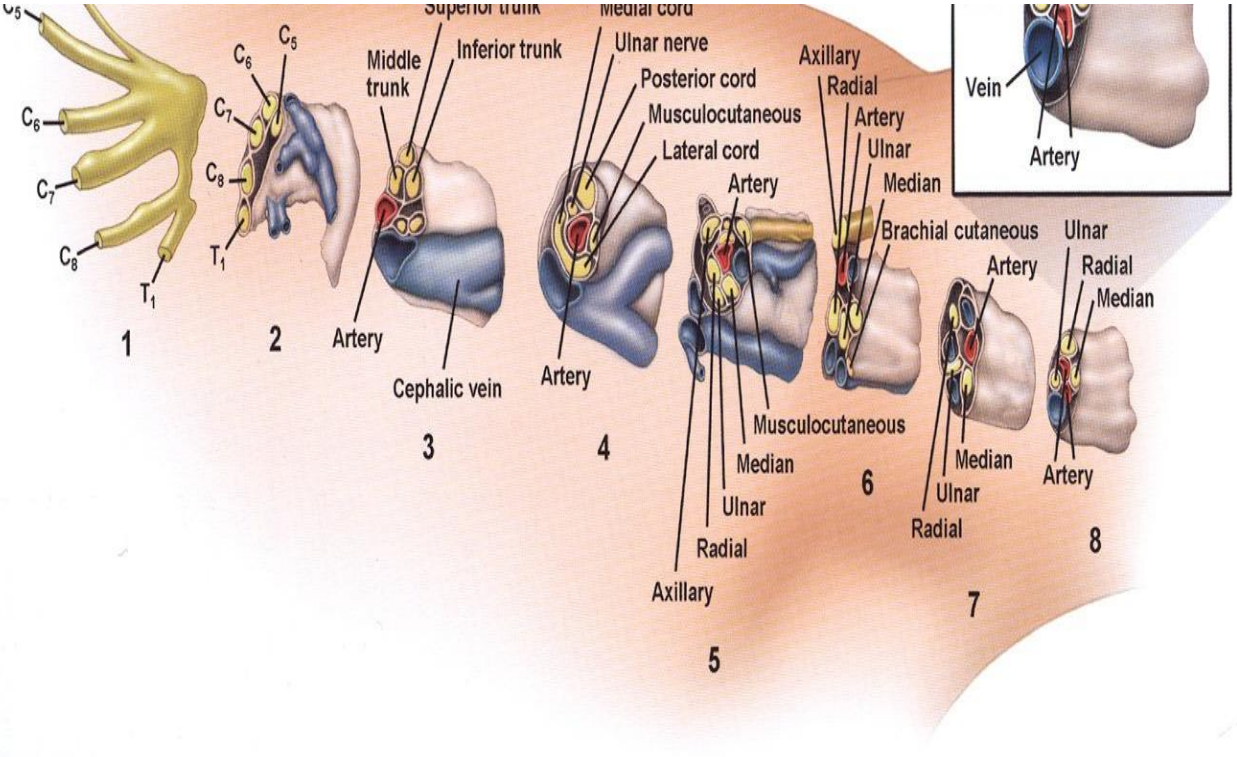
PEC/s block

Serratus anterior plane block

UPPER LIMB BLOCKS

BRACHIAL PLEXUS

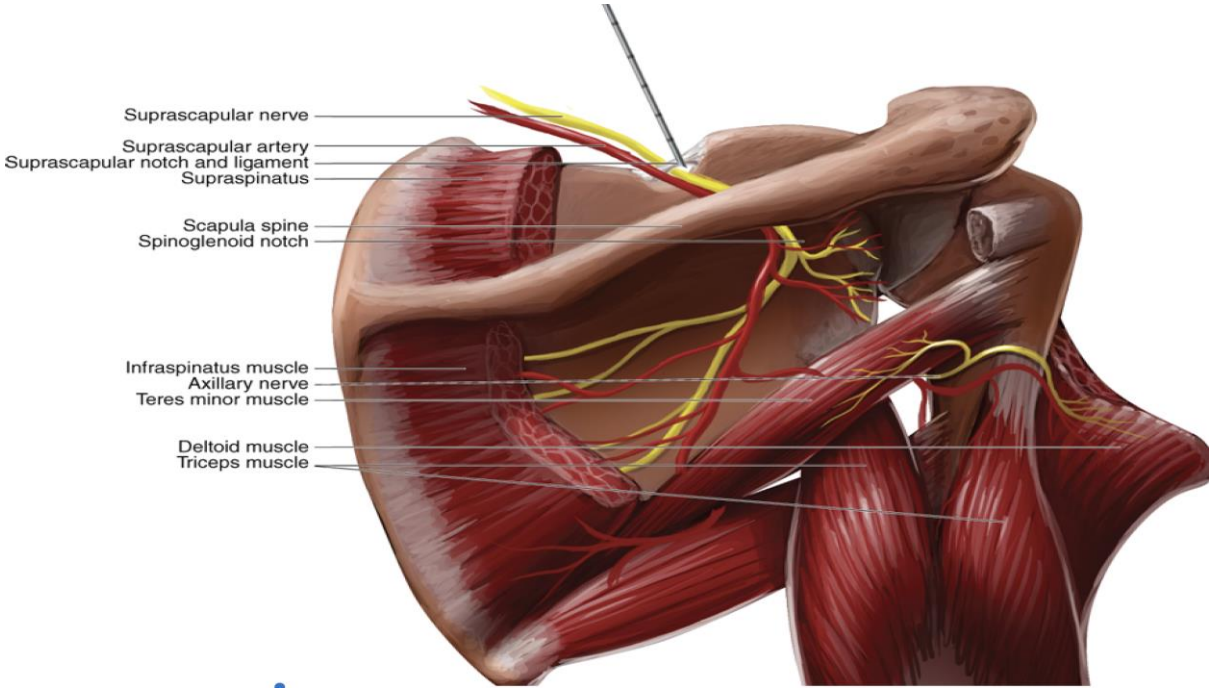




SUPRASCAPULAR NERVE BLOCK

Anatomy

Origin: upper trunk of brachial plexus C5,6
It is a mixed motor and sensory nerve.
Motor: Supraspinatus m., Infraspinatus m.
Sensory: Glenohumeral joint and shoulder joint.
Course: It passes across the upper part of the posterior triangle of the neck and through the suprascapular notch under the suprascapular ligament. (Suprascapular artery passes above the ligament.)

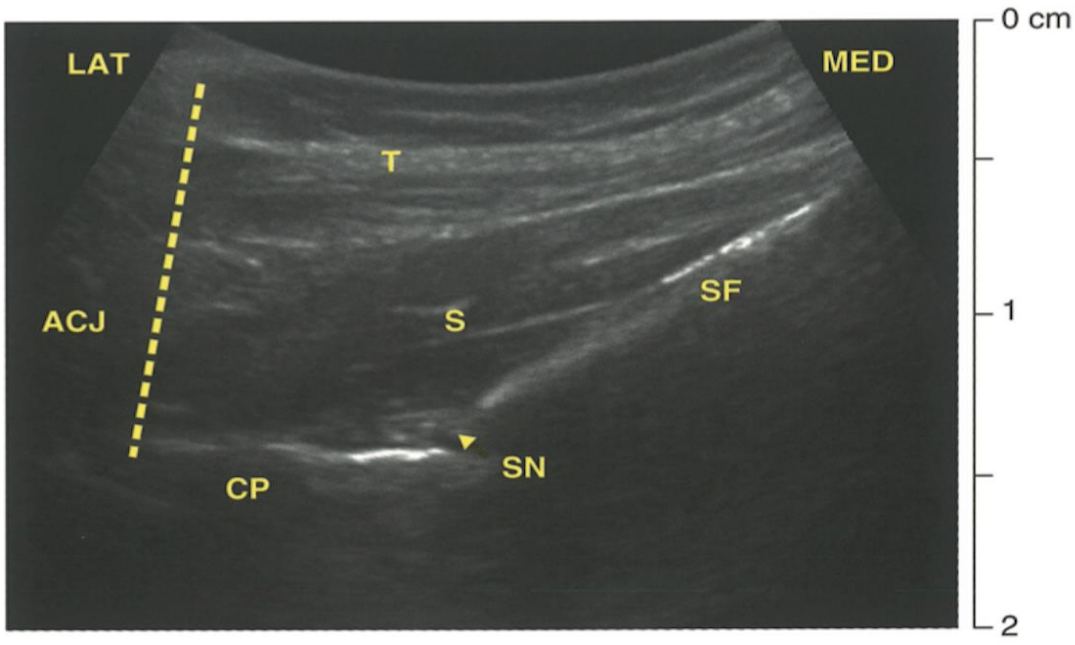


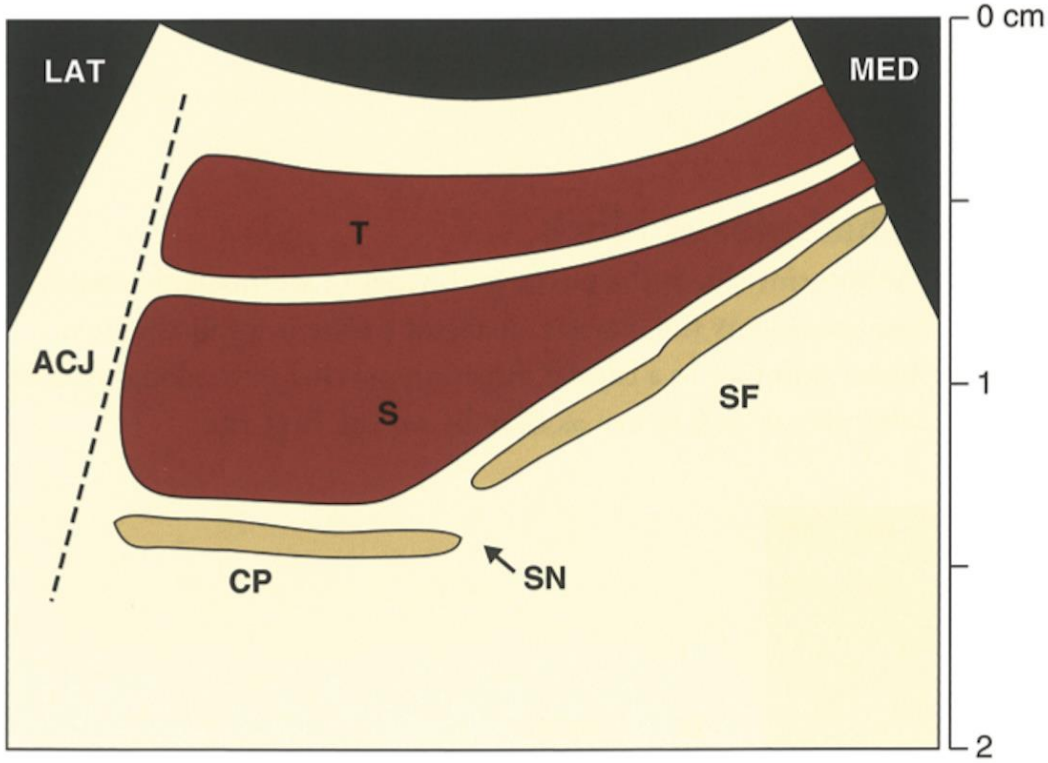
Indications:

Shoulder surgery; intra/post-operative pain control
Chronic shoulder pain

Technique:

Patient position: sitting
Probe: Curvilinear
Position the probe just medial to the acromioclavicular joint and parallel to the scapular spine. Direct the beam caudally towards the floor of the supraspinatus fossa and scan forward by tilting the probe until the beam reaches the anterior wall of the fossa, where the suprascapular notch comes into view. It appears as a break/step of the continuous bony profile. The nerve is not usually seen, but the artery may be seen above and lateral to the nerve.
100 mm needle is inserted in plane from the medial side of the probe.
Inject 8-10 ml of local anaesthetic.



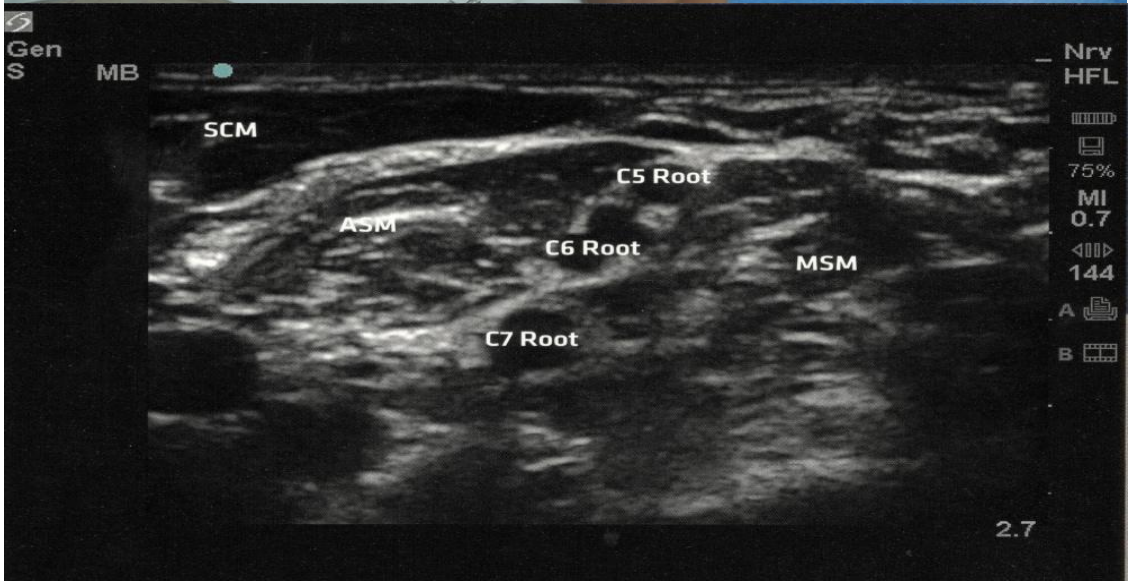


CP Coracoid process
SF Floor of supraspinatus fossa
T trapezius muscle
S Supraspinatus muscle
SN suprascapular notch
ACJ drop-out shadow from acromioclavicular joint

INTERSCALENE BRACHIAL PLEXUS BLOCK:

BLOCK AT A GLANCE:

- **Indications:** Shoulder & upper arm surgery up to mid humerus
- **Transducer type & position:** 25 or 38 mm, high frequency linear
- **Patient position:** Supine with head turned away or lateral decubitus
- **Needle:** 50 mm, 22G blunt
- **Goal:** LA spread around the trunks of brachial plexus between anterior and middle scalene muscles
- **LA volume**: 15-25 mls



CLINICAL PEARLS:

- Keep patient's head steady & immobile during procedure as slight movement of the head may change the image of plexus
- Move the pillow towards opposite side, under contralateral shoulder, to maximize area for needle placement when block is performed in supine position.
- When scanning slim patients, place a pillow or folded blanket beneath the ipsilateral shoulder to improve needle access
- When visualization of brachial plexus is difficult at cricoid level, lower the transducer to clavicle level and identify the plexus at supraclavicular level. Trace back (cranially) the brachial plexus at the desired level
- A small dip in cervical fascia covering scalene muscles often corresponds to Interscalene groove
- The neck is very vascular area. Use colour Doppler before injecting to identify any vessel in the path of the needle. Be extremely vigilant about vertebral artery
- In 5% of cases the brachial plexus may be split and all the roots/trunks may not be in interscalene groove and may be found within the anterior scalene muscle. In this situation, all the roots need to be blocked individually to have complete block
- Interscalene block almost always results in phrenic nerve blockade (care in COPD). "Phrenic sparing" block with lower volume of LA produces inconsistent results.
- For patients with COPD, alternative and relatively safer technique is to either block Axillary and Suprascapular nerves individually or Supraclavicular block plus Suprascapular nerve block
- Interscalene block plus superficial cervical plexus produces effective analgesia for surgery on clavicle
- Small dose of LA in carotid or vertebral arteries will result in seizures. Apart from frequent aspiration during injection, ensure to see the spread of LA. Absence of spread may be due to IV injection

SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK:

BLOCK AT A GLANCE:

Indications: arm, elbow, forearm & hand surgery

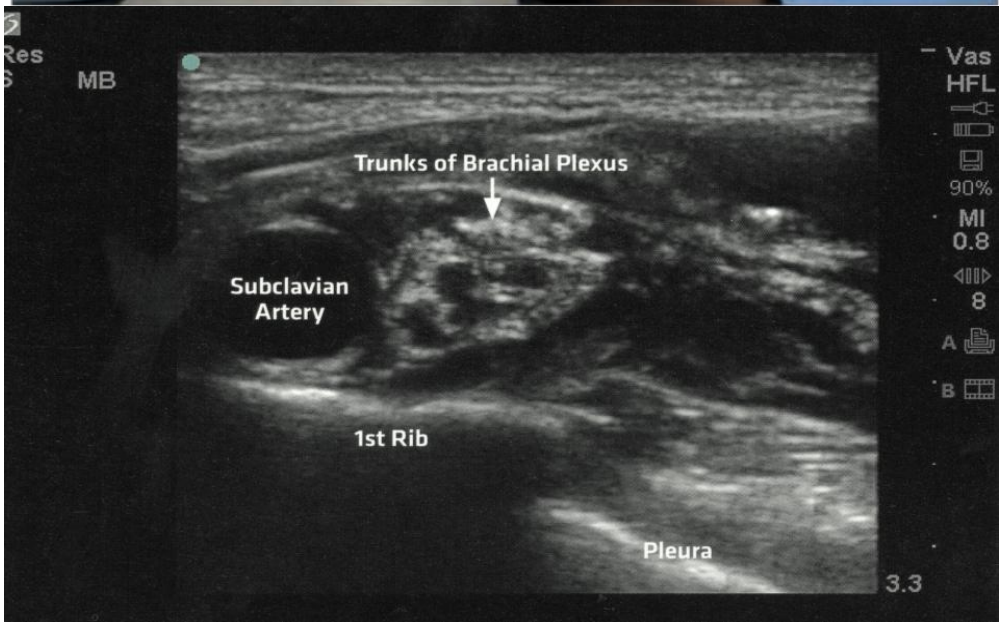
Transducer & its orientation: 25 or 38 mm linear or 11 mm curvilinear. Probe position transverse, just superior to mid point of clavicle, parallel to clavicle or coronal oblique

Patient position: supine with head turned away or lateral decubitus

Needle: 50-85 mm, 22G blunt

Goal: LA spread around brachial plexus supero-lateral to Subclavian artery

LA volume: 20-25 mls



CLINICAL PEARLS:

- To achieve the best possible results, the transducer must be tilted inferiorly rather than perpendicular to the skin. The artery should look rounded structure rather than oval or linear
- If the nerve structures are not clearly visible, slowly angle the probe more obliquely by moving the lateral end of probe posteriorly. This will bring the nerve structures into view more clearly
- Move the pillow towards opposite side to maximize area for needle placement
- In slim patients, place a pillow or folded blanket beneath the ipsilateral shoulder to improve needle access.
- When using IP technique, lateral to medial insertion of needle is recommended
- During an IP technique, if needle is not visible, move the probe to seek the needle rather than the opposite
- Multiple injection technique increases spread of LA and success rate, reduces required dose of LA for block BUT increases risk of nerve injury
- When needle approaches the brachial plexus, extra force is required to penetrate the brachial plexus “sheath” and is always associated with a distinct “pop”
- Anaesthesia of the lower trunk is required for hand surgery. Inject the LA close to inferior portion of verves cluster and as close to the first rib as possible
- Neck is a very vascular area. Of particular interest in this area are internal jugular vein, Subclavian artery, inferior carotid artery & dorsal scapular artery. Use colour Doppler to identify the vessels before insertion of needle.

INFRACLAVICULAR BRACHIAL PLEXUS BLOCK:

BLOCK AT A GLANCE:

Indications: arm, elbow, forearm and hand surgery. It is particularly a useful block in a fractured arm where arm positioning may be difficult.

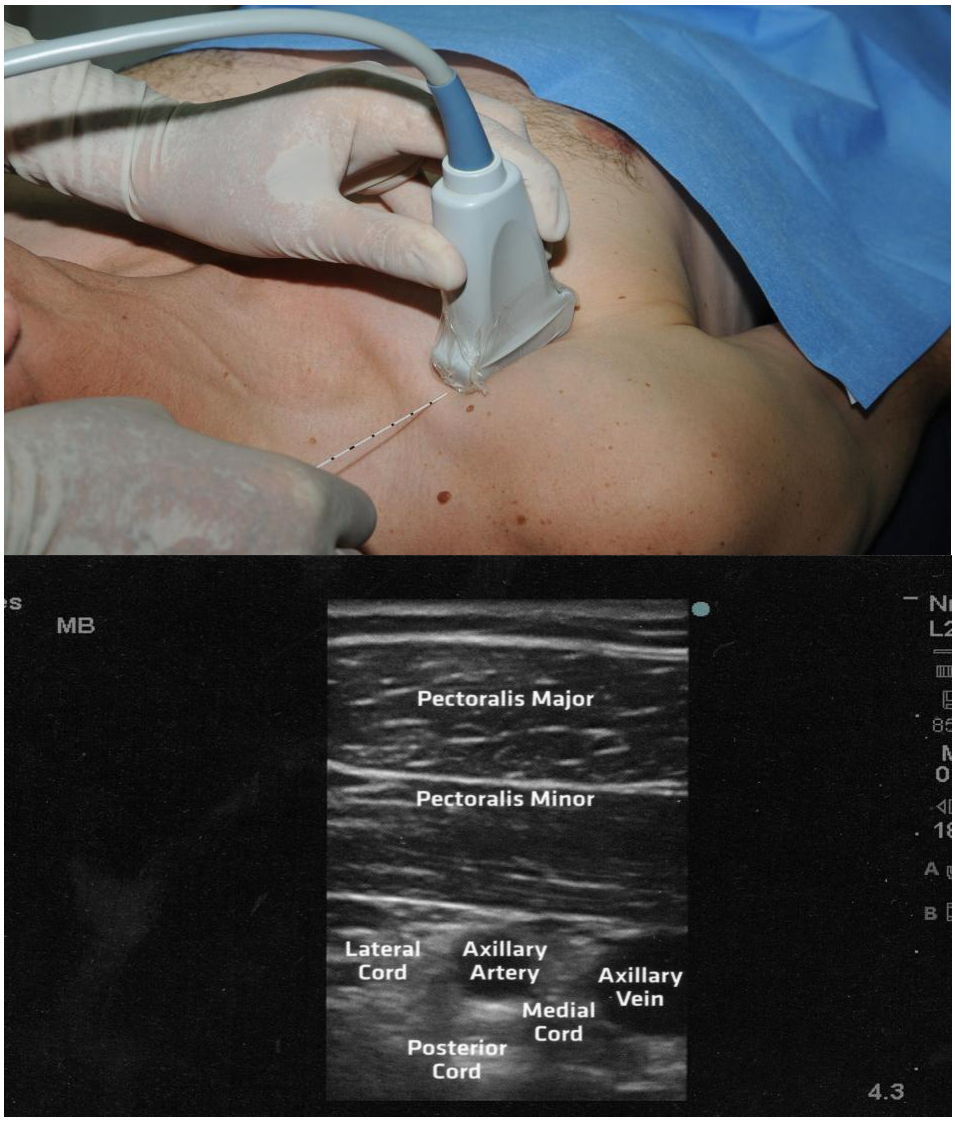
Transducer & its position: 25 or 38 mm linear or 11 mm curvilinear, parasagittal, just medial to coracoid process below the clavicle

Patient position: supine with arm by the side or abducted and elbow flexed

Needle: 50 mm, 22G blunt

Goal: Local anaesthetic spread around Axillary artery

LA volume: 20-30 mls



CLINICAL PEARLS:

- Abduct the shoulder 90 degrees and flex to gain more room for the needle between the clavicle and the probe
- Keep the needle as perpendicular to the US beam as possible
- Inject LA deep to the Axillary artery first. It pushes the other structures more superficial and improves needle visibility
- ICB should be placed laterally in the Infraclavicular region to avoid pneumothorax
- In the lateral Infraclavicular approach there is commonly an acoustic shadow, which is seen below the artery. To distinguish it from the nerve, either change the scanning angle or use the nerve stimulator
- Aspirate every 5 ml to avoid IV injection
- Do not change the transducer pressure throughout the injection (to avoid open and close veins which increases risk of IV injection)

AXILLARY BRACHIAL PLEXUS BLOCK:

BLOCK AT A GLANCE:

Indications: elbow, forearm and hand surgery

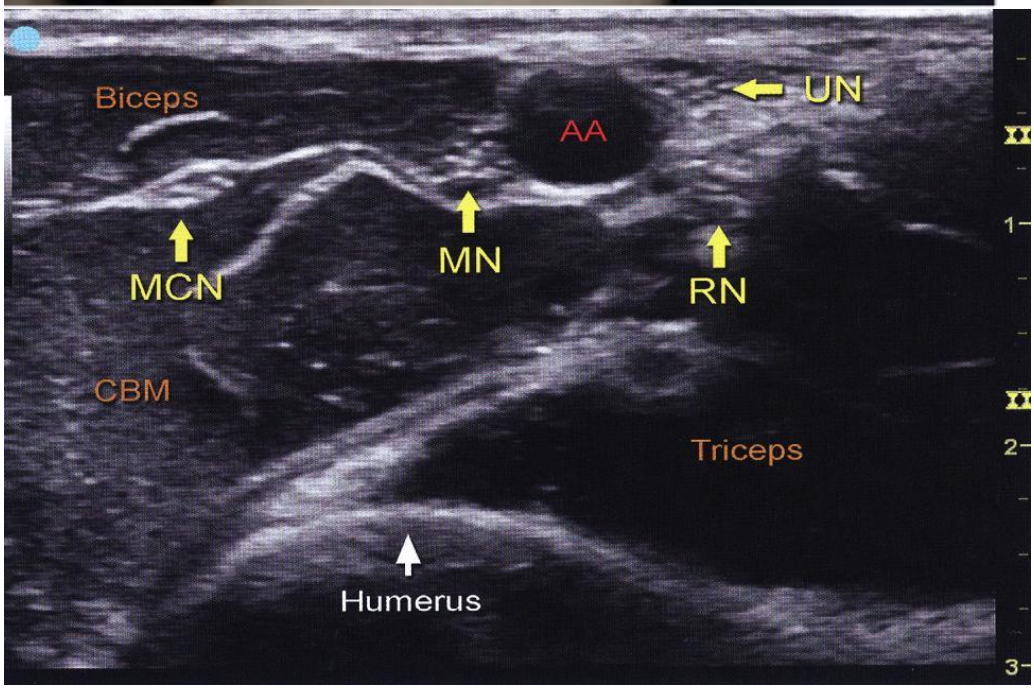
Transducer & its position: 25 or 38 mm linear, transverse just distal to pectoralis major insertion

Patient position: supine with arm abducted and externally rotated, elbow flexed

Needle: 50 mm, 22G blunt

Goal: LA spread around Axillary artery

LA volume: 20-30 ml



CLINICAL PEARLS:

- Because of the location of the nerves, successful block requires multiple injections
- The vessels lie in variable positions, use of Doppler is highly recommended to identify the vessels
- Slow injection & frequent aspiration are critical in this position to avoid IV injection
- During injection, the probe pressure should be partially reduced to visualize the axillary veins otherwise they may collapse
- Keep the transducer pressure steady to avoid opening and closing of veins which increases risk of IV injection
- There is significant variation in the location of nerves in this area. In case of difficulty in locating all the nerves & for reliable axillary block, inject half of LA above and half below the artery
- To identify the median nerve, follow the axillary artery down to elbow. The median nerve stays beside the artery all the way to elbow
- To identify the ulnar nerve, either trace back the nerve from ulnar groove at elbow till it joins the plexus.
- Personal recommendation of the sequence of block is radial- musculocutaneous-median and then ulnar nerve

RADIAL NERVE BLOCK

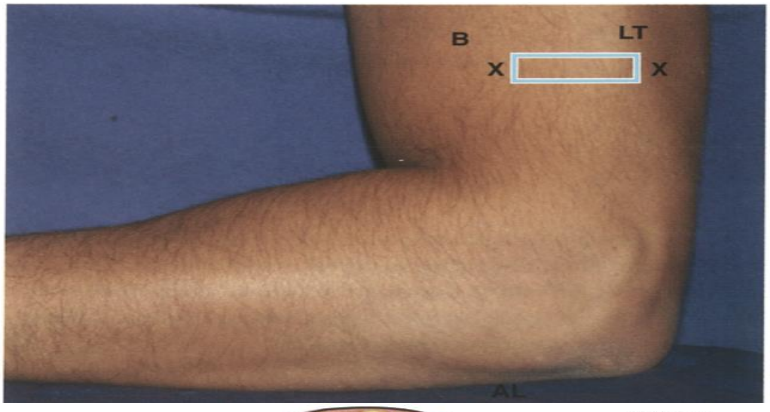
Anatomy: Largest terminal branch of the posterior cord of the brachial plexus. (C5-T1)
Motor: via its terminal motor branch, the posterior interosseous nerve of the forearm.
Supplies the muscles in the posterior forearm compartment.
Sensory: via its terminal sensory branch (superficial radial nerve)
Supplies the dorsolateral aspect of the wrist and the hand (lateral 3 ½ fingers)

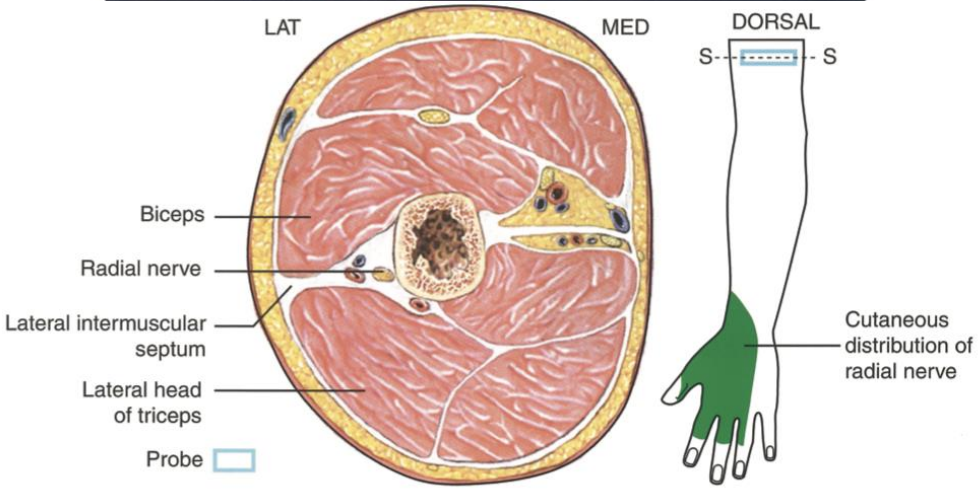
Technique:

Patient position: supine
Probe: high frequency linear probe
Needle: 50-mm needle

Block in the arm:

This blocks both its motor and sensory components.
A nerve stimulator is useful to confirm the needle placement.
Place the probe transversely in the lateral aspect of the arm at the junction of the middle and the lower thirds
Track the radial nerve as it passes distally in the radial groove, it will be seen to lift from the humerus as it approaches the lateral humeral epicondyle.
The needle is inserted from either side of the probe in an in-plane technique and 5 ml of local anaesthetic is deposited.





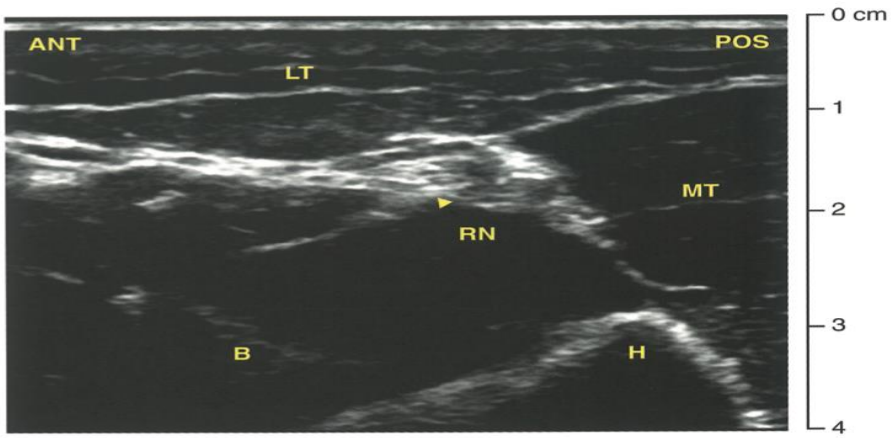
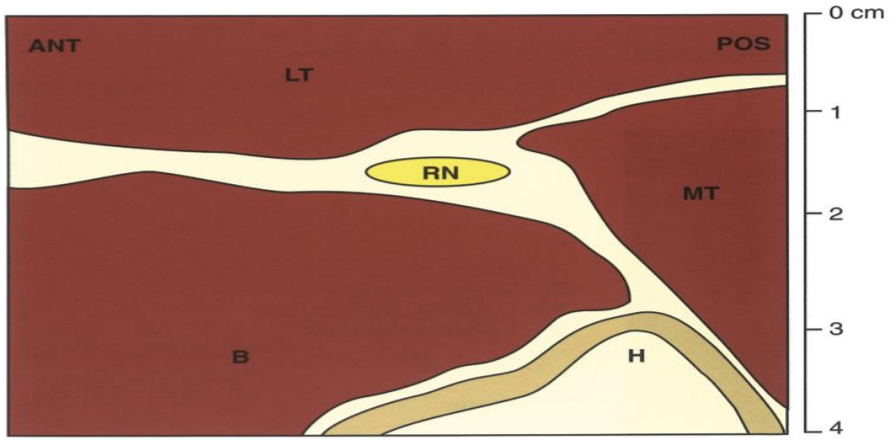


Diagram of scan



H Humerus, B brachialis LT lateral head of triceps, MT medial head triceps.

Block in the forearm:

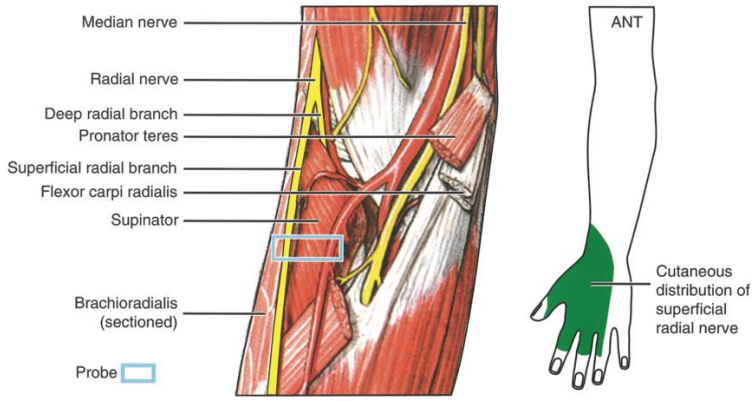
This only blocks the sensory component.

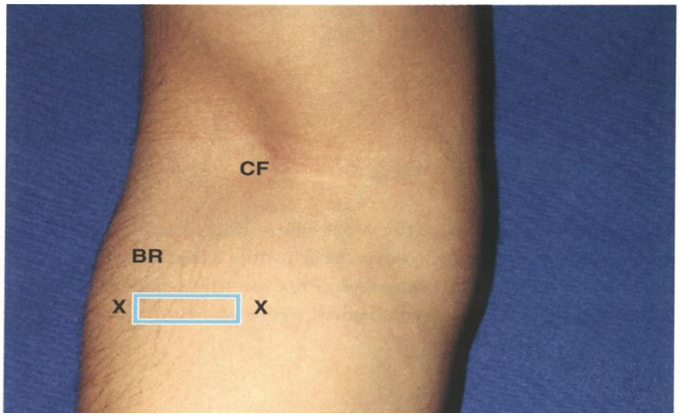
A nerve stimulator is useless at this level.

Place the probe transversely across the lateral aspect of the forearm over the brachioradialis muscle.

The radial nerve lies just lateral to the radial artery and can be tracked all way down to the wrist.

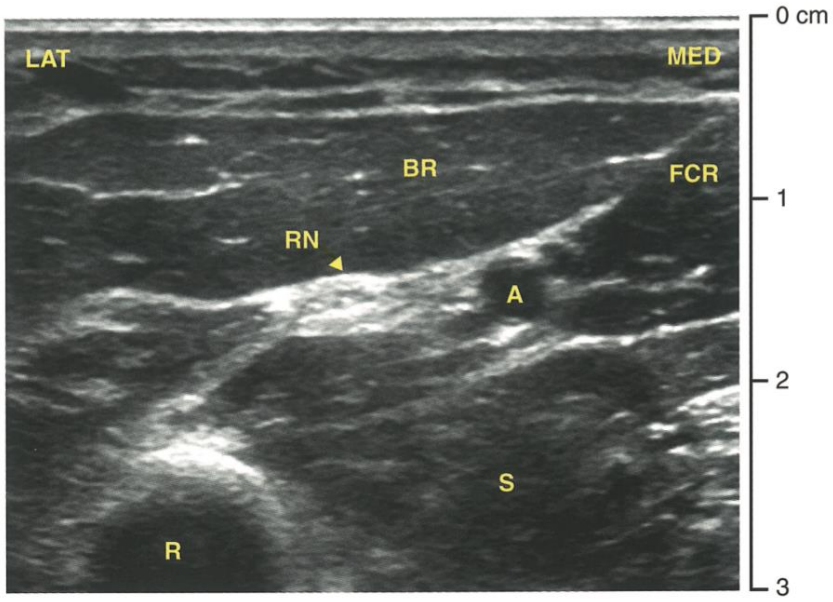
The needle is inserted from lateral to medial, to avoid radial artery, in an in-plane manner and 3-5 ml of local anaesthetic is injected.





BR Brachioradialis muscle
CF Cubital fossa
X Needle entry point

Probe



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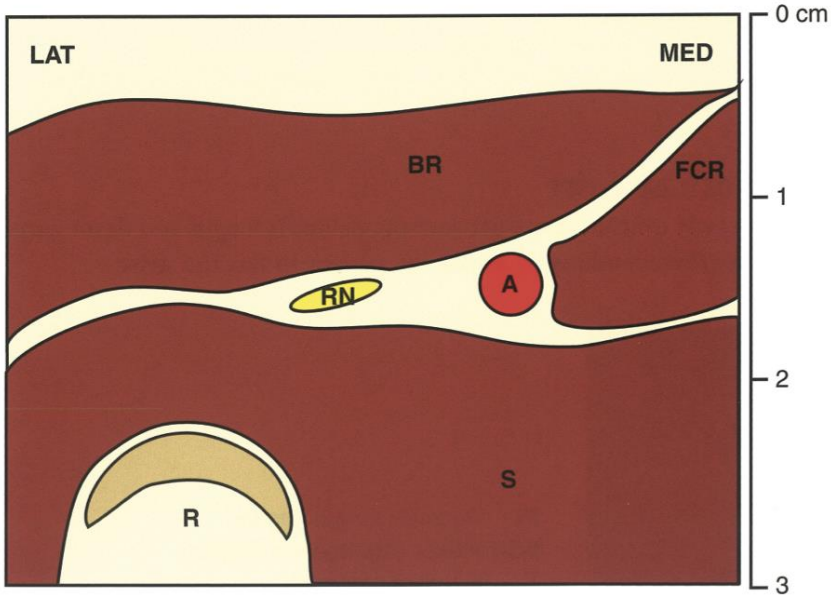


BR Brachioradialis, FCR Flexor carpi radialis, S supinator, RN Radial nerve, A radial artery, R, Radius

MEDIAN NERVE BLOCK

Anatomy: the median nerve is a branch of both the medial and lateral cord of the brachial plexus. (C5-T1)

It lies media to the brachial artery in the lower arm and in the cubital fossa, which it exits deep to bicipital aponeurosis.

Motor: flexor muscles of forearm, except the flexor carpi ulnaris and medial half of the flexor digitorum profundus.

It also supplies intrinsic muscles of the thumb.

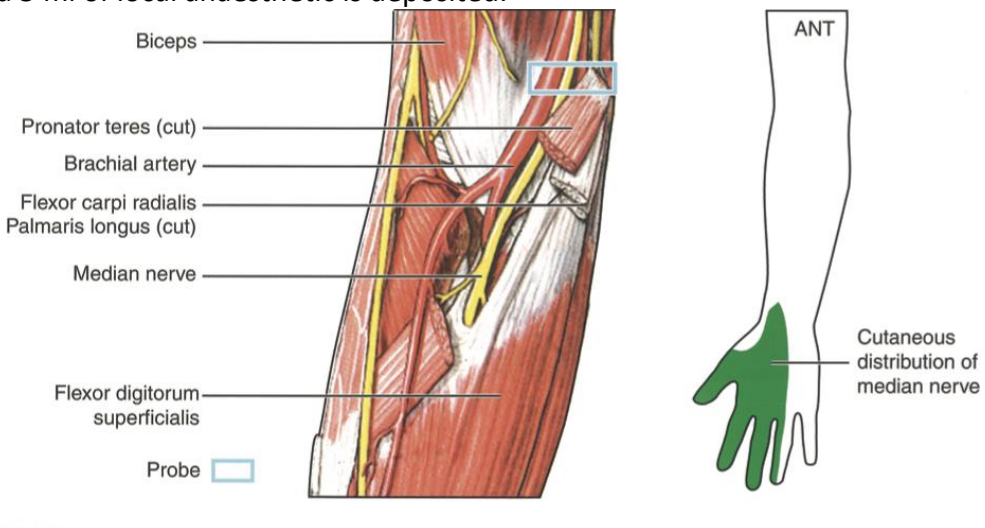
Sensory: lateral 2/3 of the palm and palmer side of lateral 3 ½ fingers.

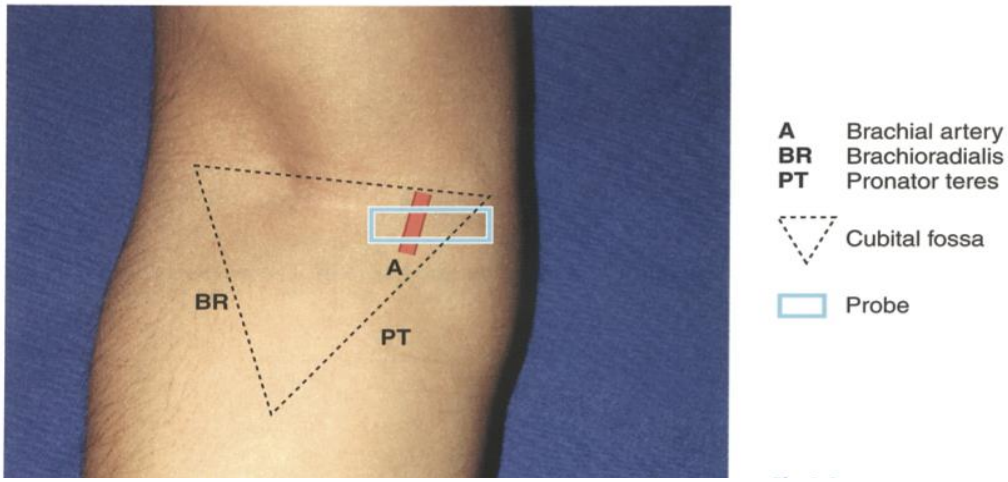
Technique:

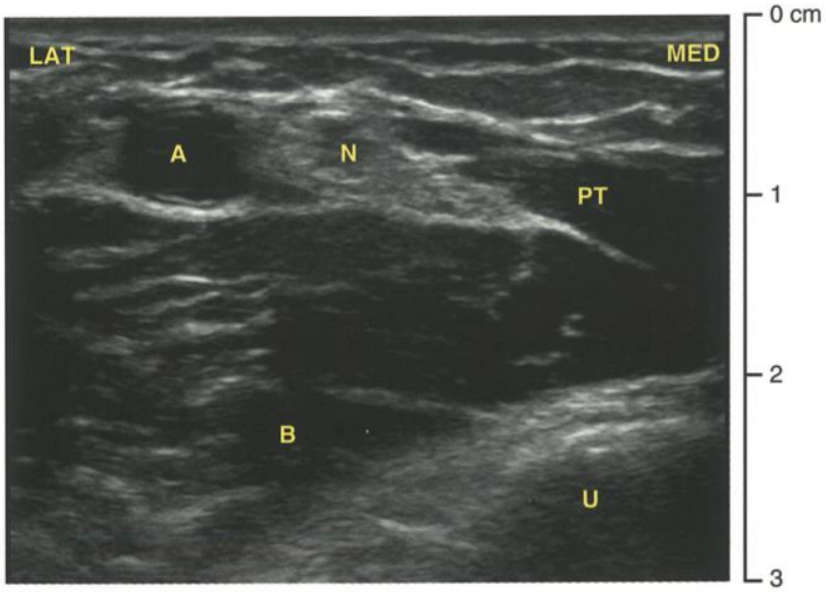
Patient position: supine
Probe: high frequency linear probe
Needle: 50-mm needle

Block at the cubital fossa:

This blocks both its motor and sensory components.
A nerve stimulator is useful to confirm the needle placement.
Place the probe transversely over the brachial artery in the cubital fossa.
The nerve lies immediately medial to the brachial artery.
The needle is inserted from the medial side an in-plane technique to avoid injury to brachial artery and 5 ml of local anaesthetic is deposited.







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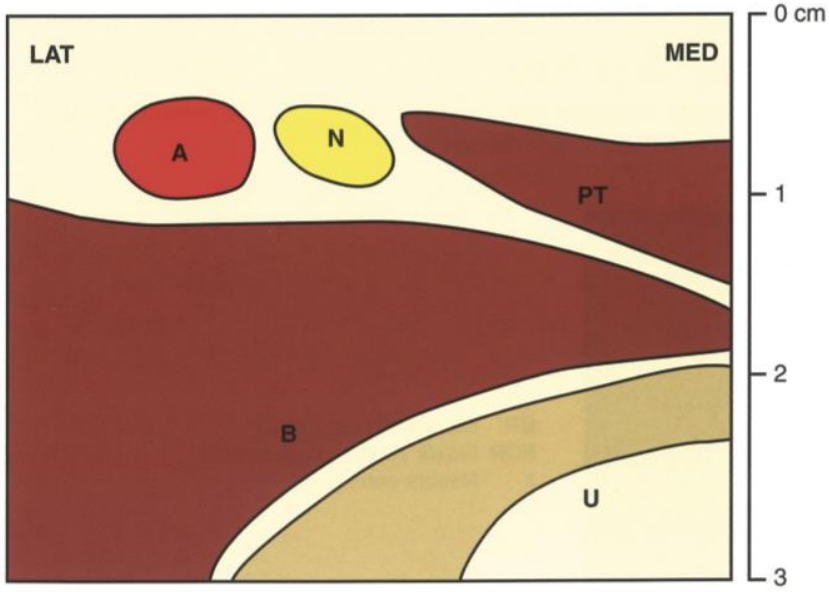
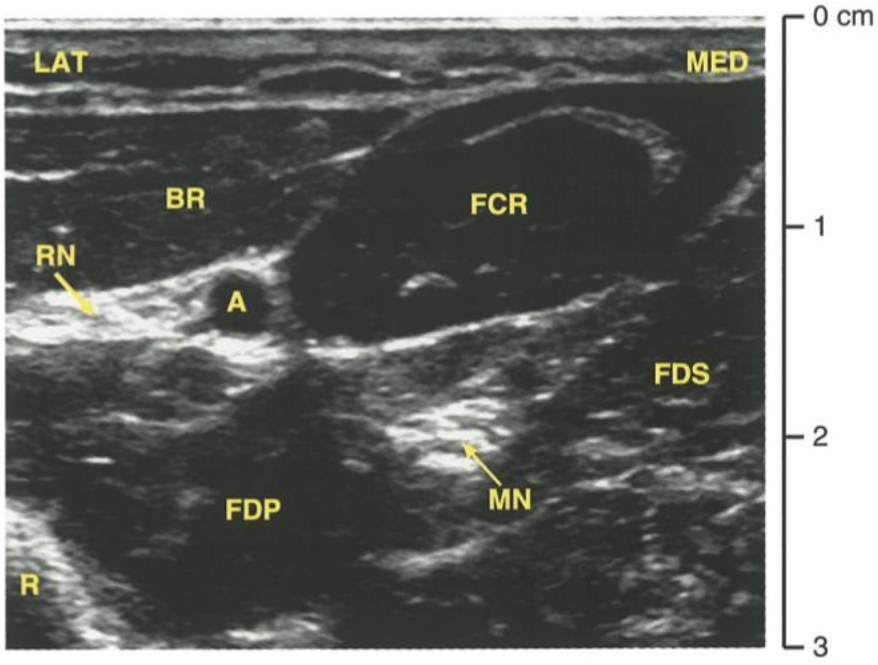


A brachial artery, B brachialis, N median nerve, P Pronator teres, U Ulna

Block in the forearm:

Place the probe transversely across the middle of the front of the forearm. It is not related to any bony or vascular markings, but readily visible as a hyperechoic structure between the muscles.

Insert the needle from either side of the probe in an in-plane manner and inject 3-5 ml of local anaesthetic.



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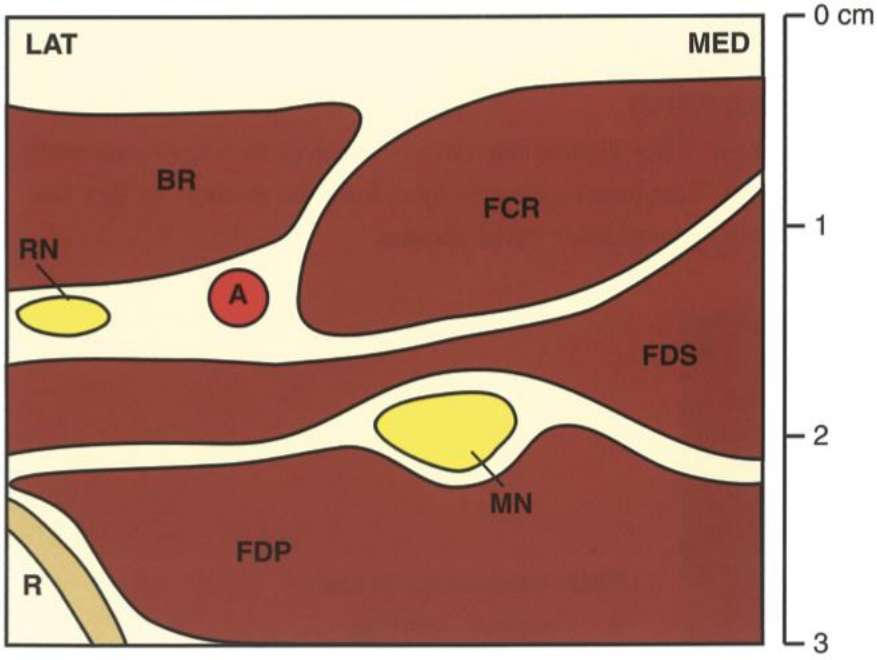


FCR flexor carpi radialis, BR Brachioradialis, FDP flexor digitorum profundus, FDS flexor digitorum superficialis, A Radial artery, RN radial nerve, MN median nerve, R radius.

ULNAR NERVE BLOCK

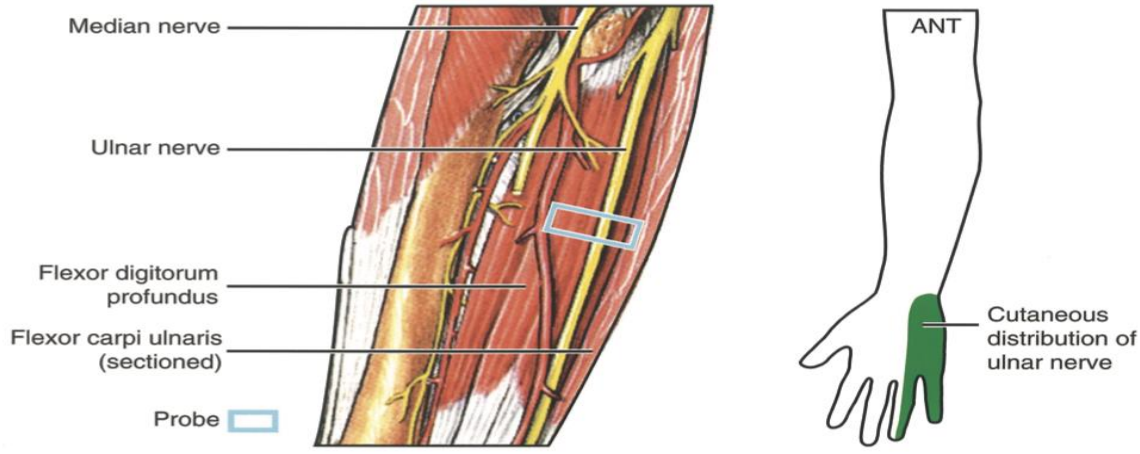
Anatomy: the ulnar nerve is the terminal branch of the medial cord of the brachial plexus. (C8-T1)
It enters the forearm from the ulnar groove posterior to the medial epicondyle. It descends in the forearm on the surface of the flexor digitorum profundus.
Motor: the flexor carpi ulnaris and medial half of the flexor digitorum profundus.
It also supplies intrinsic muscles of the hand.
Sensory: medial 1/3 of the palm and dorsum of hand and whole medial 1 ½ fingers.

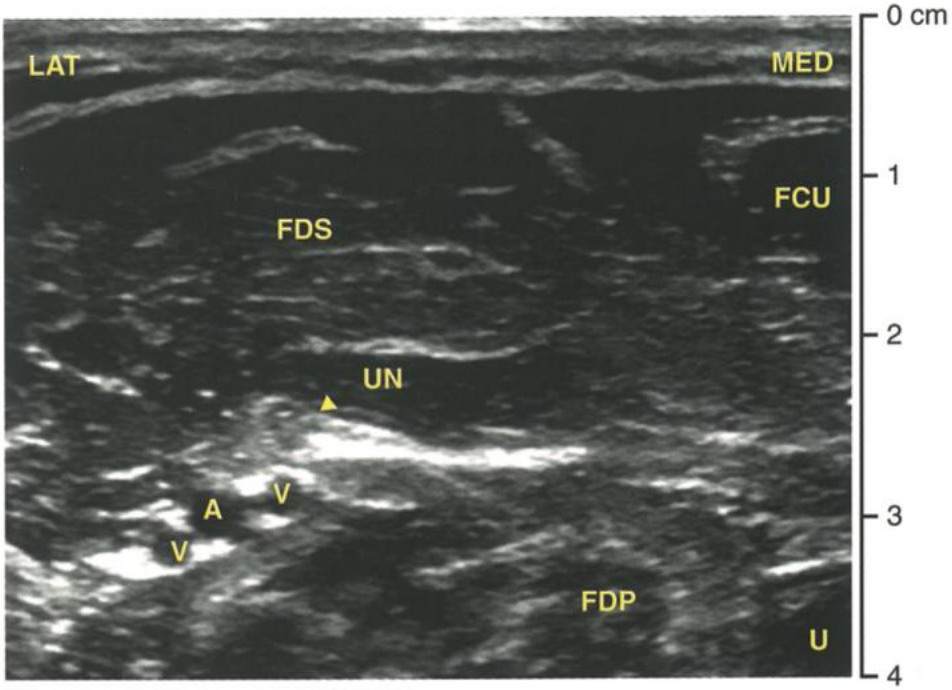
Technique:

Patient position: supine, with abduction of arm and elbow flexion.
Probe: high frequency linear probe
Needle: 50-mm needle
A nerve stimulator may be used.
Place the probe across the Flexor carpi ulnaris in the middle part of the forearm. The ulnar nerve is seen medial to the ulnar artery.

N.B. If the ulnar nerve is not readily seen, start scanning from just above the wrist where the ulnar nerve lies just medial to the artery and track it proximally until it just diverges from the artery.

Insert the needle from the medial side to avoid arterial puncture in an in-plane manner and inject 5 ml of local anaesthetics.





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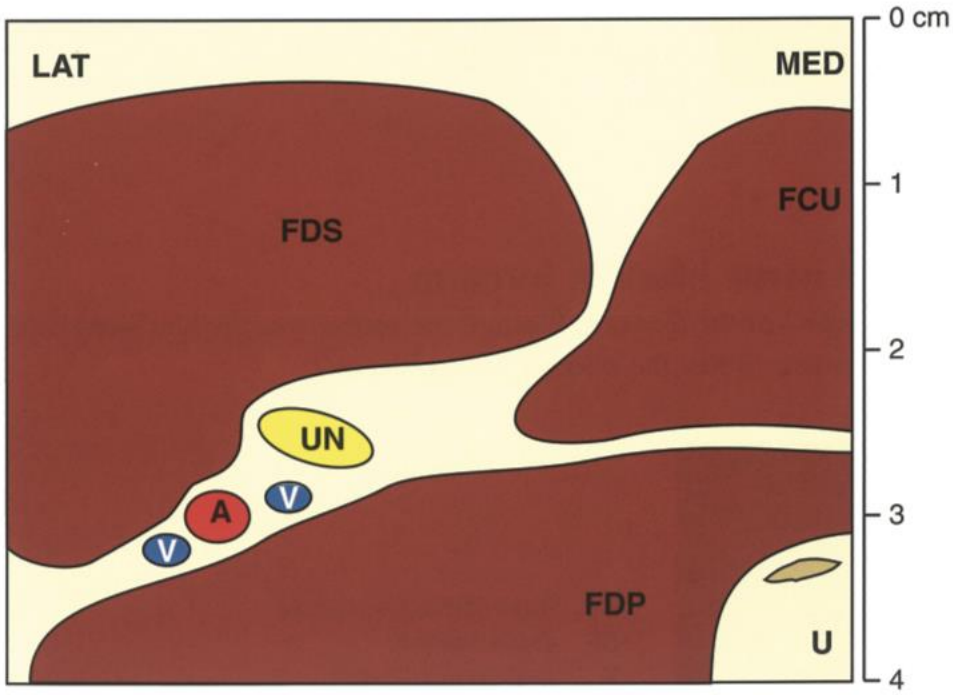


FSD flexor digitorum superficialis, FCU flexor carpi ulnaris, FDP Flexor digitorum profundus, UN Ulnar nerve, A ulnar artery, V accompanying veins, U Ulna

BLOCKS OF THE TRUNK

TRANSVERSE ABDOMINIS PLANE (TAP) BLOCK:

BLOCK AT A GLANCE:

Indications: Post op analgesia for laparotomy, Gynae, Obstetric, Urology, hernia & laparoscopic surgery. As an alternative to epidural analgesia for operation on abdominal wall

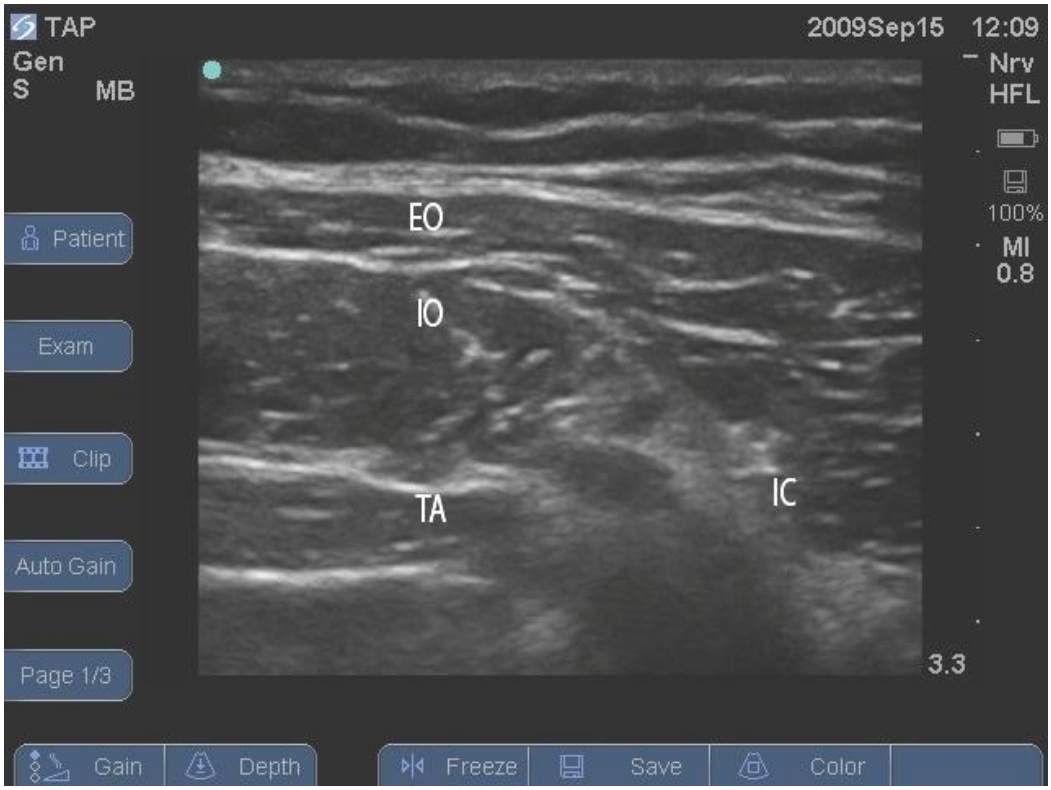
Transducer & position: 38 mm linear, transverse at middle/posterior axillary line, between costal margin and iliac crest

Patient position: supine or decubitus

Needle: 22G, 100 mm, blunt

Goal: LA spread between internal oblique & transversus abdominis muscle

LA volume: 15-30 mls of 0.25 % on each side to a maximum allowable dose of LA.



CLINICAL PEARLS:

- Internal oblique (IO) muscle is the thickest and prominent & transversus abdominis (TA) is the thinnest and the darkest muscle on US image
- An out of plane technique is more practical in obese patients
- T6-9 nerves enter TAP medial to anterior axillary line and T10-T12 enter lateral to anterior axillary line
- To block T6-9 (Upper abdominal surgery) oblique sub-costal TAP block is recommended, and to block T10-T12, injection is made at posterior axillary line (POSTERIOR/LATERAL OR CLASSICAL TAP) between iliac crest and costal margin
- For oblique subcostal block, the injection site is more medial than the classical approach, lateral to the lateral edge of rectus muscle
- In bilateral TAP block, be careful of the total dose, including the LA used by the surgeon
- It is a “volume” block; so reduce the concentration of LA rather than the volume to stay within the safe limit of LA dose. As this is an ‘analgesic” block, LA concentration of 0.25% is usually enough

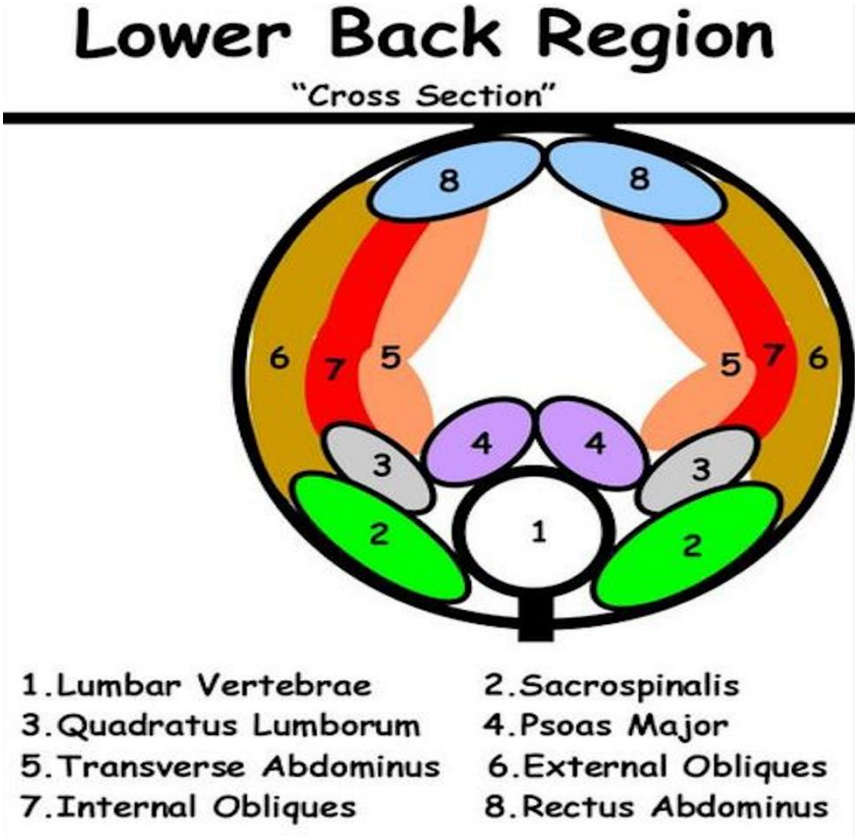
- Block success increases if the injection is made as posterior as possible, where the transversus abdominis muscle takes off.
- TAP block is an adjunctive technique for analgesia. It provides analgesia to anterior abdominal wall (skin, muscles & parietal
- peritoneum). It does not provide analgesia for visceral pain; hence
- supplemental analgesia with opioids is required.
- TAP block takes up to o 30 minutes to be effective. It should be given after induction of anaesthesia and before the incision, if possible
- It is recommended to palpate the edge of the liver, particular for ANTERIOR TAP.
- The optimal site for injection is in the superficial layer of transversus muscle, just below & adjacent to the facial plane between IO & TA In order to reach as many dermatomes as possible, the needle should be advanced in the length of TAP plane.
- Insert the needle 3-4 cm away from the probe in order to reduce the angle of insertion & keeping the needle in ultrasound beam
- There are 3 sites for scanning and injection. Use ANTERIOR TAP approach, just above the medial 1/3rd of iliac crest for hernia operation as Ilioinguinal & iliohypogastric nerves, L I, enter the TAP at or just medial to the middle third of iliac crest. POSTERIOR /CLASSICAL TAP, between iliac crest and costal margin for surgery through pfannenstiel incision and OBLIQUE SUB-COSTAL TAP injection for upper abdominal surgery.
- Incidence of transient femoral nerve palsy is 3.5-5%. This is due to tracking of LA along fascia iliaca.
- Success rate of TAP block is 85% due to variability of nerves location, technique & injection site.
- The blood supply to the abdominal wall is from superior & inferior epigastric arteries, deep circumflex artery and many perforators. Use of colour Doppler is recommended before inserting the block needle.

- According to the experts, block performed in the triangle of Petit (POSTERIOR TAP) provides better and prolonged analgesia than the block performed in mid-axillary line (ANTERIOR TAP)

QUADRATUS LUMBORUM BLOCKS

Anatomy

The abdomen wall is formed of different muscles.



While the conventional TAP block involves deposition of local anaesthetics between the internal oblique and the transversus abdominus.
The QL block, first described by Blanco as an ultrasound guided (POSTEROR) TAP block in 2007.

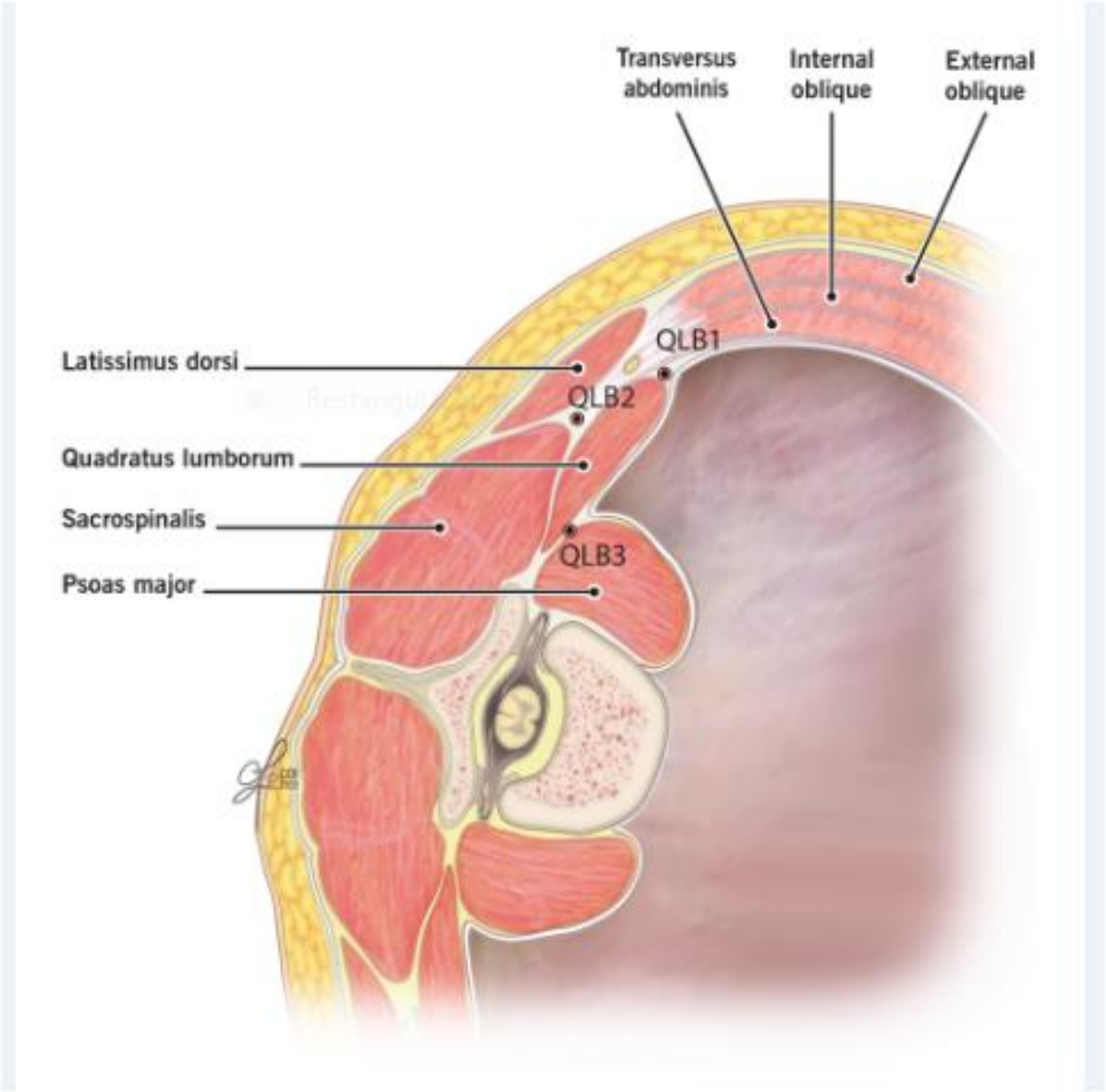
However, QL block is currently classified into 4 different types
QL (1,2,3,4) QL 4 is less commonly described.

QL1: deposition of local anaesthetics posterior to TAP and its aponeurosis.

QL2: deposition of local anaesthetics posterior to the QL muscle.

QL3: (trans muscular QL) deposition of local anaesthetics anteriorly between the psoas major (PM) muscle and the QL muscle

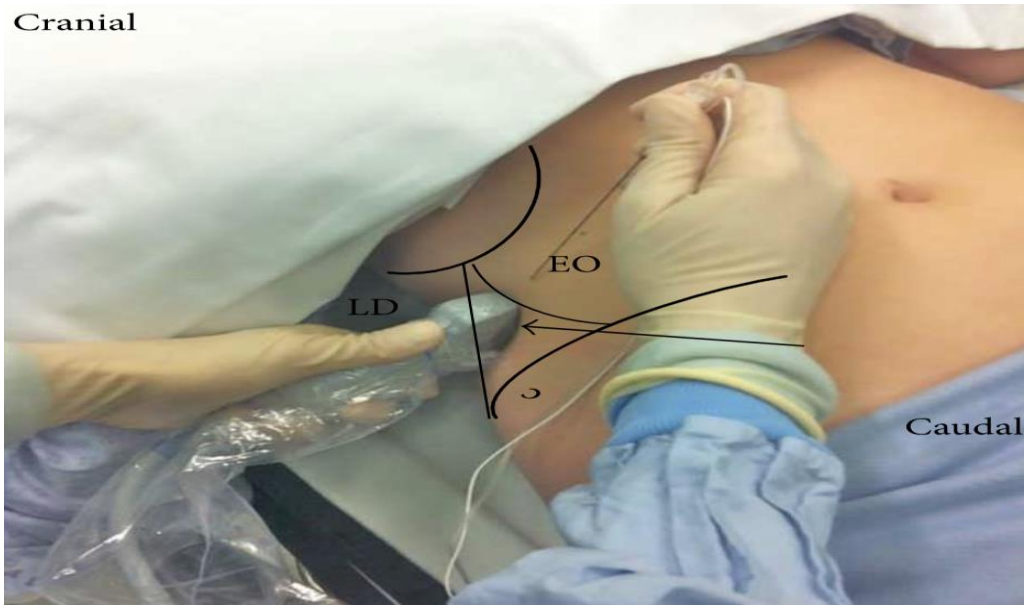
QL4: (intramuscular QL) deposition of local anaesthetic directly into the QL muscle

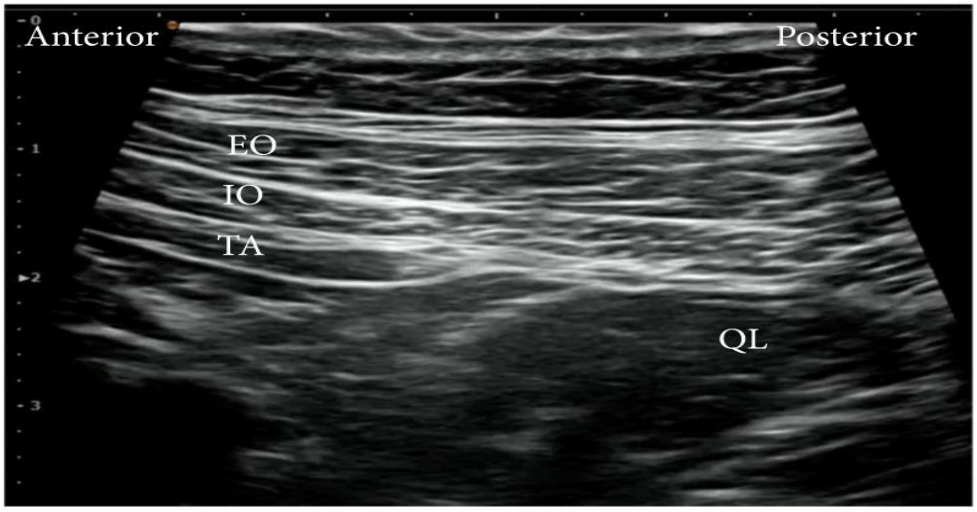


TECHNIQUE:

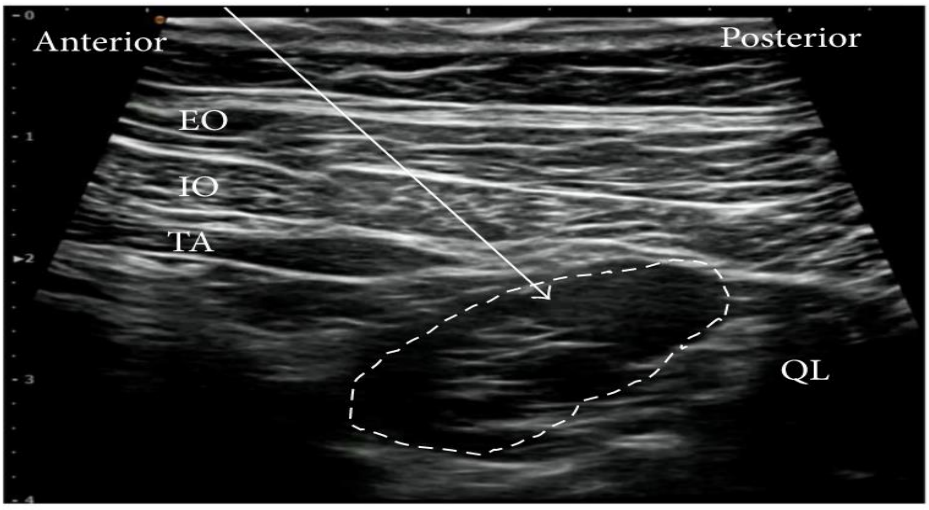
QL 1 (Lateral QL block)

It is called lateral as the local anaesthetic is deposited lateral to the QL muscle.
Patient position: supine.
Probe: Linear high frequency.
The probe is positioned transverse midway between the iliac crest and the costal margin above the posterior axillary line.
100 mm needle is inserted from anterior to posterior in-plane technique until it reaches posterior to TAP plane and anterior to QL muscle.
20 ml of local anaesthetics is injected in each side.


Cranial
EO
LD
Caudal


Anterior
Posterior
EO
IO
TA
QL

(a)


Anterior
Posterior
EO
IO
TA
QL

(b)

QL 2 (posterior QL block)

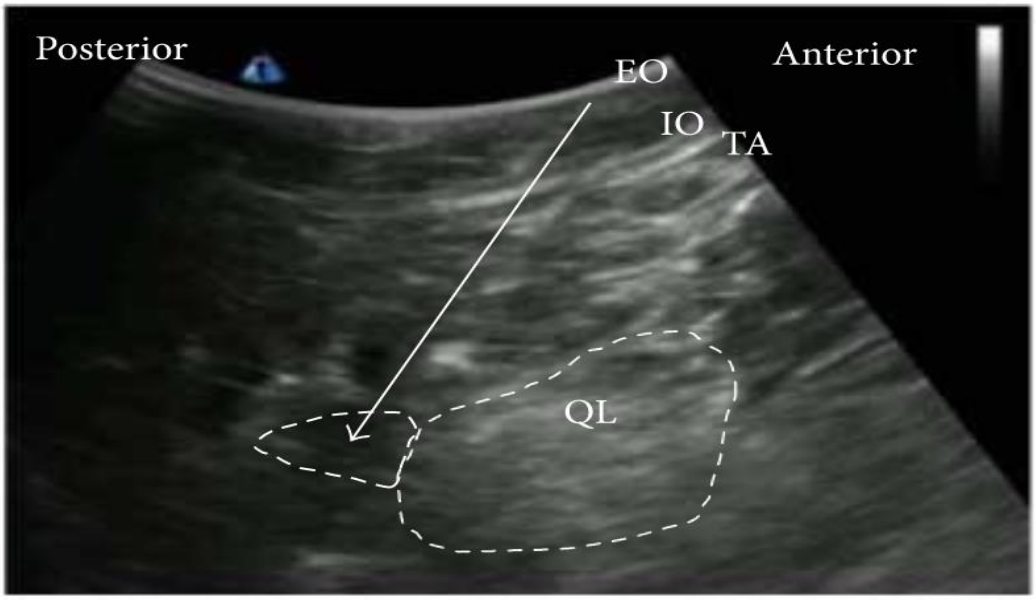
It is called posterior as the local anaesthetic is deposited posterior to the QL muscle.

Patient position: supine/ wedge under flank

Probe: low frequency curvilinear probe.

The posterior aspect of the QL muscle was confirmed, and the needle tip was inserted into this aspect of the QL muscle. The local anaesthetic was then injected into the LIFT behind the QL muscle

(a)



(b)

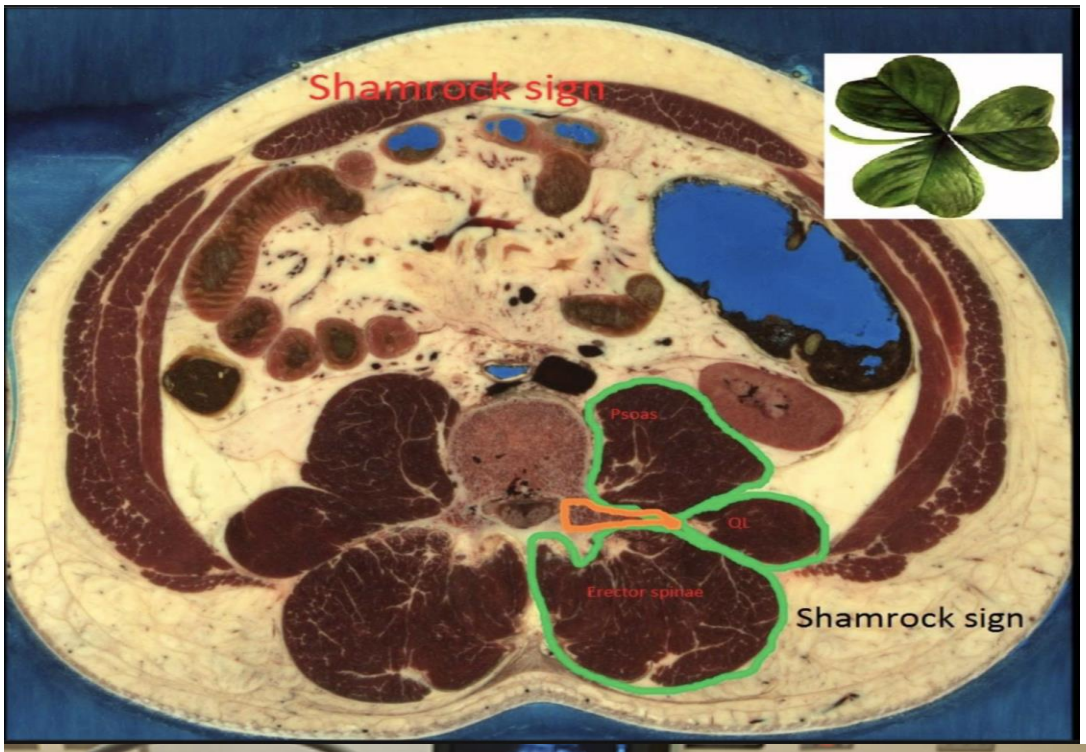
QL 3: (anterior / trans muscular QL block)

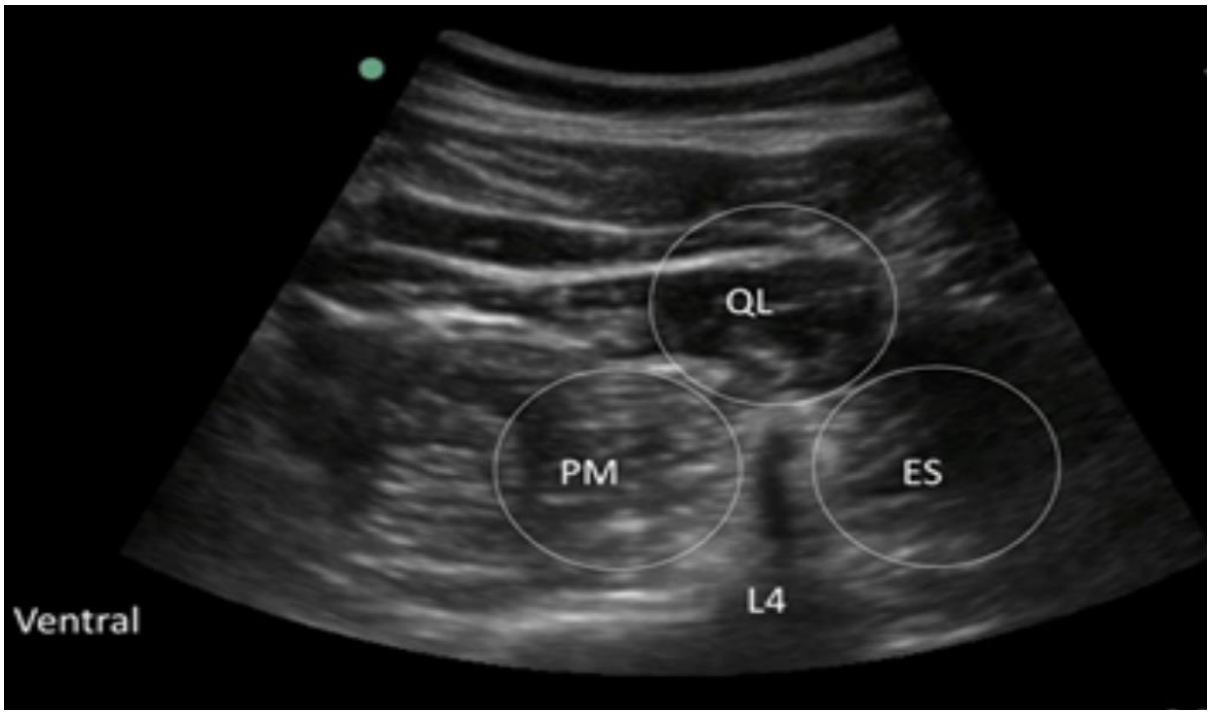
It is called anterior QL block as the local anaesthetic is deposited anterior to the QL muscle.

Patient position: lateral

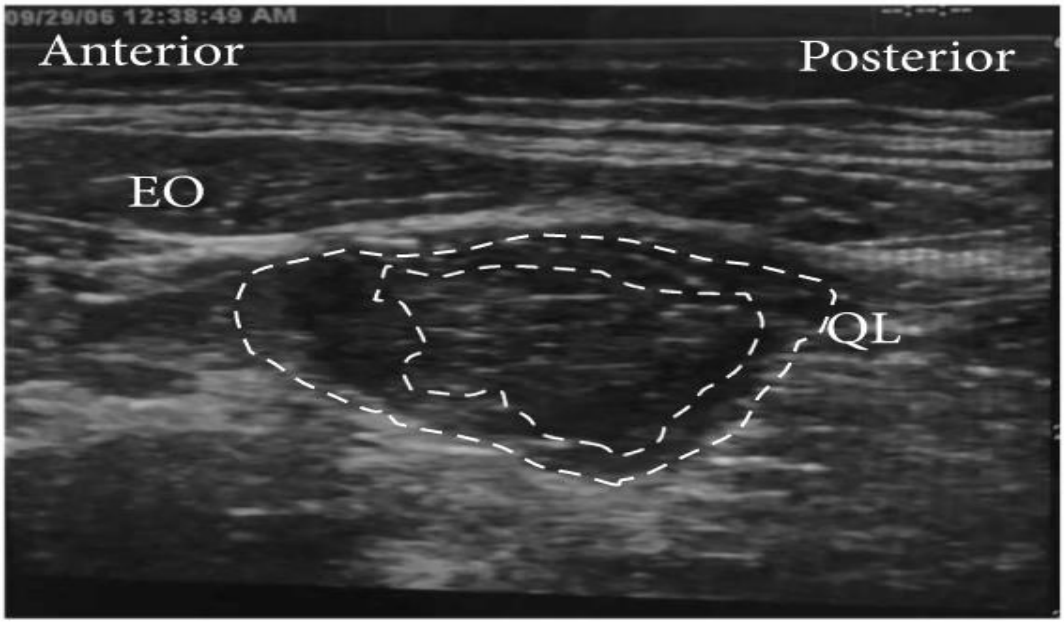
Probe: low frequency curvilinear probe

The probe is vertically attached above the iliac crest and a 100-mm needle is inserted in-plane from the posterior edge of the probe through the QL muscle in an anteromedial direction. The needle tip is placed between the PM muscle and the QL muscle and the local anaesthetic is injected into the fascial plane.





QL4: (intramuscular)
Patient position: Supine as QL1
Probe: Linear high frequency.
The probe is placed slightly cephalad to the iliac crest. The needle tip was advanced until it penetrated the fascia and is inserted into the QL. The local anaesthetic is injected into the Ql muscle.



RECTUS SHEATH BLOCK:

BLOCK AT A GLANCE:

Indications: Post op pain for umbilical & incisional hernia and other umbilical surgery

Transducer& position: 38/25 mm linear, transverse just lateral to umbilicus

Patient position: Supine

Goal: LA spread between rectus muscle & posterior rectus sheath

Needle: 22 G, 50/100 mm, blunt

LA volume: 10 ml for each side (0.1ml /kg/side in children)

CLINICAL PEARLS:

- Rectus sheath block provides analgesia between T5 and T10 dermatomes
- Site of the surgery will determine at what level the LA should be placed
- One injection on each side of midline is required for effective block
- Rectus sheath block below the umbilicus produced inconsistent block
- Needle should be advanced from lateral to medial direction (IP technique). In OOP technique the LA should be placed at the lateral end between the rectus muscle & the posterior rectus sheath
- An out of plane injection is more useful in obese patients
- The needle tip should scratch the posterior rectus sheath and NOT pierce it
- Care about puncturing inferior epigastric artery. Use colour Doppler before insertion of needle

ILIOINGUINAL/ILIOHYPOGASTRIC NERVE BLOCK:

BLOCK AT A GLANCE:

Indications: Anaesthesia & analgesia for inguinal hernia surgery & other inguinal surgery. Analgesia following suprapubic incision

Transducer & position: 38/25 mm, linear, oblique on a line joining ASIS and umbilicus

Patient position: Supine

Goal: LA spread around the nerves between internal oblique & transversus abdominis muscle

Needle: 22G, 50/100 mm, blunt

LA volume: 10 ml/side. 0.15 ml/kg in children

IlioInguinal Nerve Block

CLINICAL PEARLS:

- IIN lies in TAP plane anterior to the iliac crest. Classical (posterior) TAP block will not consistently block IIN
- To identify IIN, identify the iliac crest on ultrasound and slide the probe anteriorly (medially) to identify the IIN between IO & TA
- The nerves are very close to the iliac crest. Keep some portion of iliac crest in the US image
- If there is lot of adipose tissue, adjust (reduce) the frequency of probe
- If muscles are still difficult to identify, slide to umbilicus, identify the rectus muscle and then slide the transducer laterally
- In slim patients, the transversus muscle is usually very thin. Care of peritoneal puncture
- An out of plane technique may be more successful in obese patients
- The block can result in quadriceps weakness from an injection deep to transversus muscles & underneath the fascia covering iliacus muscle (fascia Iliaca block)
- Aggressive infiltration by the surgeon can lead to femoral nerve block of its own. Must check the quadriceps strength before ambulating and discharge of patients to avoid post op falls
- The area can be very vascular. Use colour Doppler during scanning before inserting the needle

Chest wall Blocks:

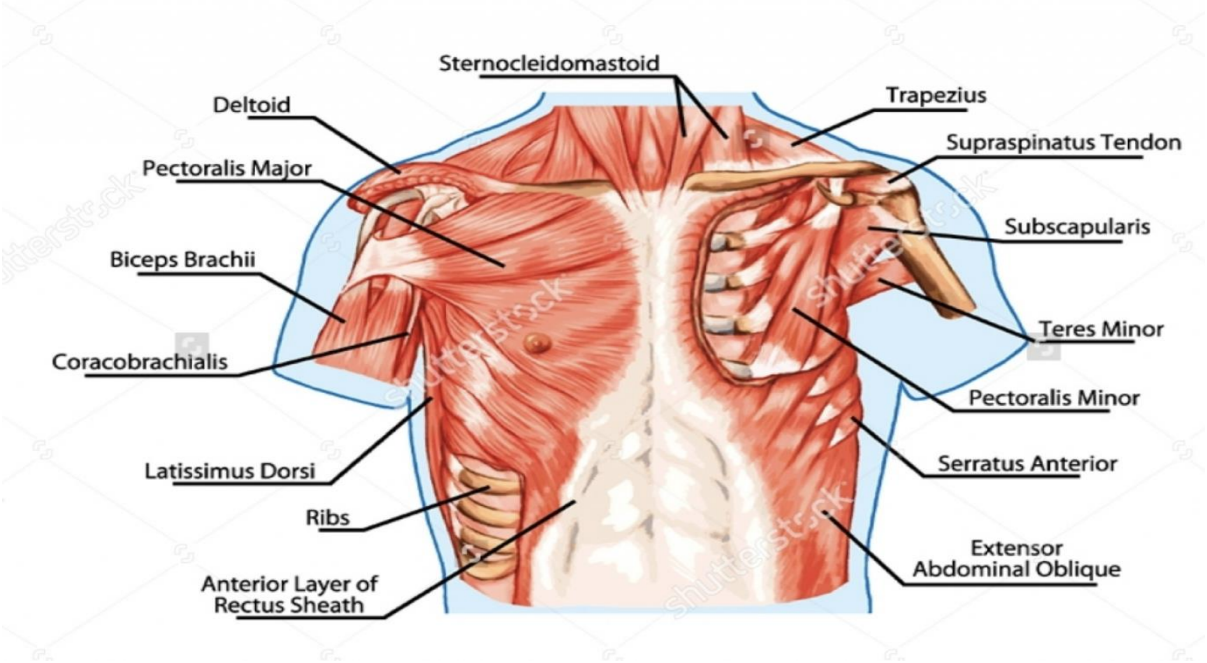
PEC1, PEC2 and Serratus plane block:

Anatomy:

PECTORALIS MAJOR:
ORIGIN: Medial half of clavicle, anterior surface of sternum, first six costal cartilages.
INSERTION: External oblique muscle, lip of bicipital groove of the humerus.
NERVE: Medial and lateral pectoral nerves.
ACTION: Adduction of the extended limb, medial rotation of arm, flexion of upper limb, depression of the arm and shoulder, elevation of the rib.

PECTORALIS MINOR:
ORIGIN:3rd– 5th ribs, fascia covering intercostal muscles.
INSERTION: Coracoid process of scapula
NERVE: Medial pectoral nerve
ACTION: Depression of the shoulder, draws scapula forward along with serratus anterior.

SERRATUS ANTERIOR:
ORIGIN: First 8 ribs.
INSERION: Inferior angle of scapula (first slip), medial border of scapula (next 3), inferior angle of scapula (Last 4).
NERVE: Long thoracic nerve
ACTION: Lateral rotation of scapula.

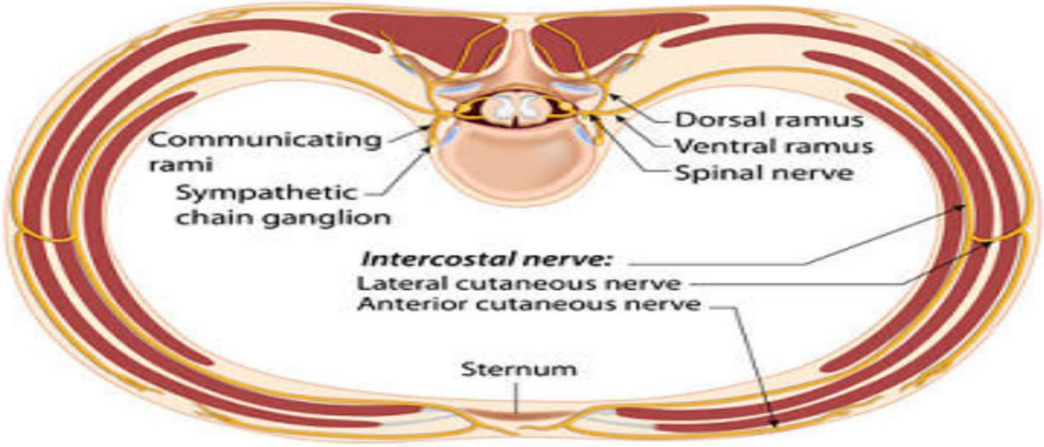


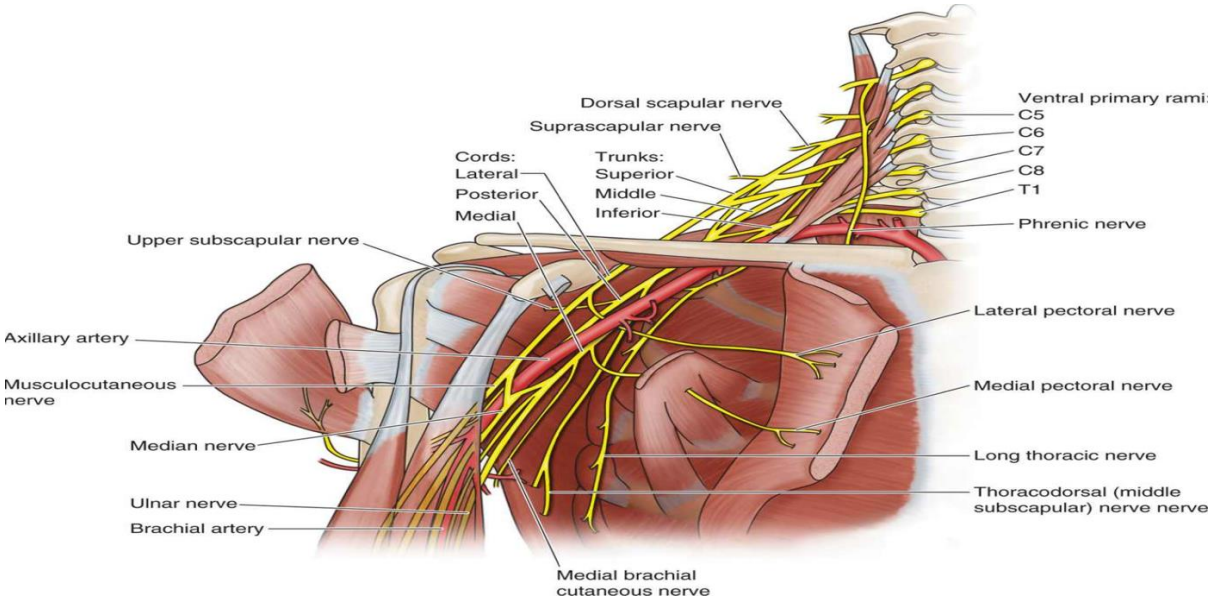
Nerve supply of the anterior chest wall and the breast:

1. Pectoral nerves: from the brachial plexus cords:
a. Lateral pectoral nerve: from C5-7, runs between pectoralis major and minor to supply pectoralis major.
b. Medial pectoral nerve: from C8-T1, runs deep to pectoralis minor to supply pectoralis major and minor.

2. T2-6 spinal nerves: run in a plane between the intercostal muscles and give off lateral and anterior branches:
a. Lateral: pierces the intercostal muscles/serratus anterior in the mid axillary line to give off anterior and posterior cutaneous branches (except T2 → intercostobrachial nerve)
b. Anterior: pierces the intercostal muscles and serratus anterior anteriorly to supply the medial breast.

3. Long thoracic nerve and thoracodorsal nerve:
a. Long thoracic nerve: from C5-7, runs on outer surface of serratus anterior to the axilla where it supplies serratus anterior.
b. Thoracodorsal nerve: from C6-8 via the posterior cord, runs deep in the posterior axillary wall to supply latissimus dorsi.





PECS I:

Aim: local anaesthetic is injected between the pectoralis major and pectoralis minor muscles.
Nerves blocked: Medial and lateral pectoral nerves.
Indications:

- Subpectoral prosthesis/breast expanders/implant insertion
- Subpectoral ICD, pacemaker insertion or Portacath insertion
- Adjunct to paravertebral block for mastectomy

Technique: Patient in supine position with arm neutral or abducted to 90 degrees. 6-13MHz, high frequency linear probe placed below the clavicle in the a superomedial to inferolateral position, probe moved inferolaterally to identify pectoralis major, pectoralis minor and the thoracoacromial vessels in the plane between these muscles. Move the probe laterally until pectoralis minor and serratus anterior are identified.
At the level of the 3rd rib, insert a 50mm long needle in-plane from medial to lateral in an oblique manner until you reach the fascial plane between the pectoralis major and minor.
Dose: 10 mls 0.25% levobupivacaine.
Helpful landmark: Thoracoacromial vessels help in delineating the plane between the two muscles.

PECS II:

Aim: local anaesthetic is injected in between the pectoralis minor and serratus anterior muscles.
Nerves blocked: T2-T4 spinal nerves (including intercostobrachial nerve) and the long thoracic nerve.
Indications:

- Mastectomy with or without reconstruction/subpectoral implant insertion
- Wide local excision of breast.
- Sentinel node biopsy.
- Axillary clearance.
- Shoulder surgeries (involving armpit)
- AV fistula formation high up in the arm/armpit

Technique: As PECS I block. A 6-13 MHz high frequency linear array probe is used and located on mid clavicular level. The probe is moved caudally after identifying the thoracoacromial vessels and located on the 3rd – 4th rib. At this point probe is moved inferolaterally to identify the pectoralis major, pectoralis minor and serratus muscles.
Insert a 50-80mm long needle in an in-plane medial to lateral oblique manner, until you reach the fascial layer between pectoralis minor and serratus anterior.
Dose: 20 mls 0.25% levobupivacaine.

Serratus anterior block:

Aim: local anaesthetic is injected in fascial plane between the latissimus dorsi and serratus anterior muscle at the level of 5th rib.
Nerves blocked: Lateral divisions of thoracic intercostal nerves (T2-T9), long thoracic and thoracodorsal nerve.

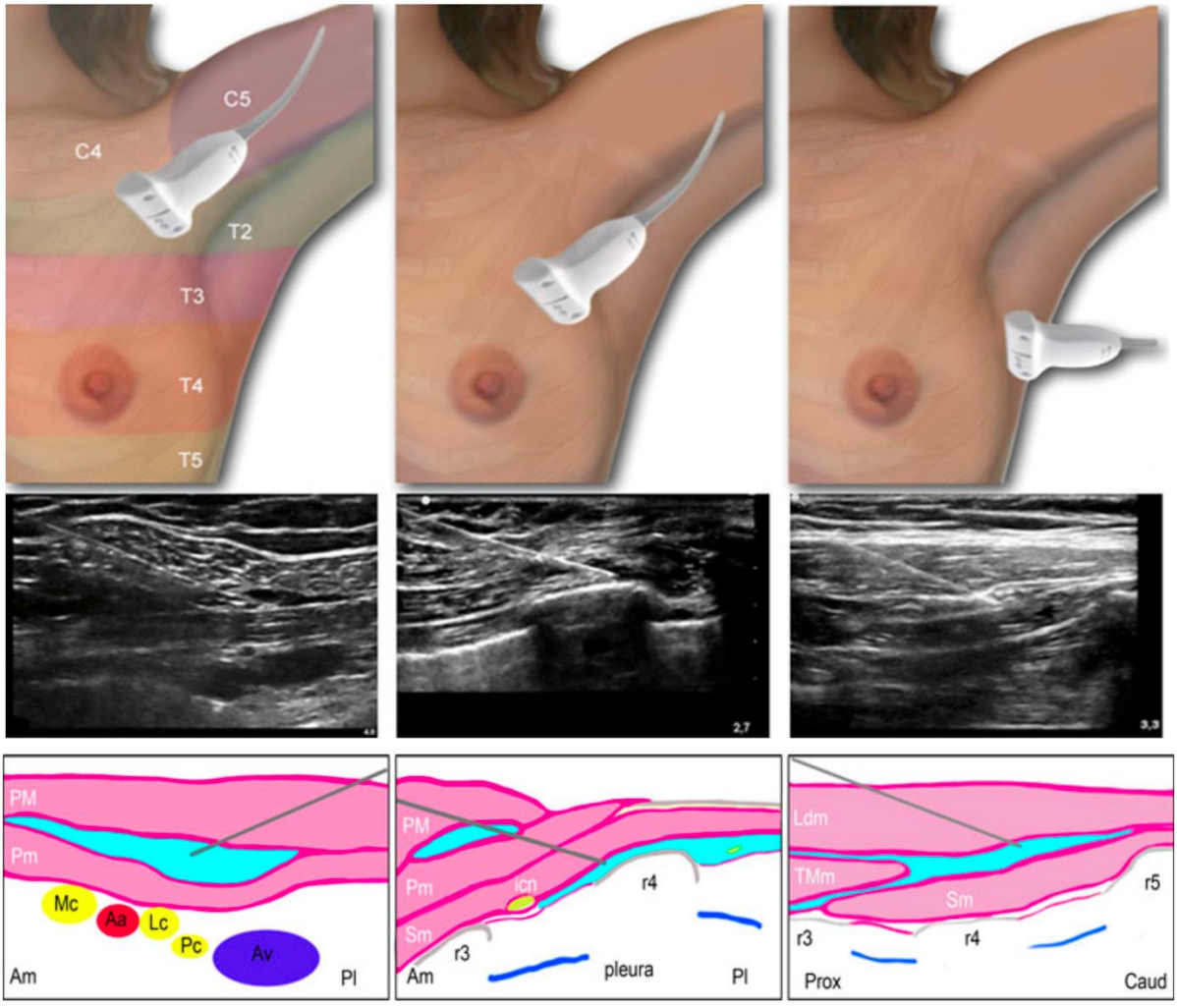
Indications:

- Breast surgeries- mainly wide local excisions
- Axillary clearance/sentinel node biopsy.
- Breast reconstruction surgery (Latissimus dorsi flap)
- AV fistula surgery
- Rib fractures.
- Esophagectomy and anastomosis.
- Thoracoscopy/ Thoracotomy.
- Shoulder surgery (involving armpit).

Technique: Patient in supine position or lateral position with the arm raised above the head. A high frequency linear transducer is placed at the level of nipple in an antero-posterior direction in the mid-axillary line. The serratus anterior muscle is identified lying close to the ribs and slide the transducer posteriorly until the longitudinal fibres of the latissimus dorsi muscle is identified. Local anaesthetic in injected in the plane between latissimus dorsi and the serratus anterior muscle so that it spreads up to the level of axilla. Thoracodorsal artery will be visualized in this plane. Insert a 50-80 mm long needle in an in-plane manner from anterior to posterior

Dose: 20 mls 0.25% levobupivacaine.

PEC 1 PEC 2 Serratus plane



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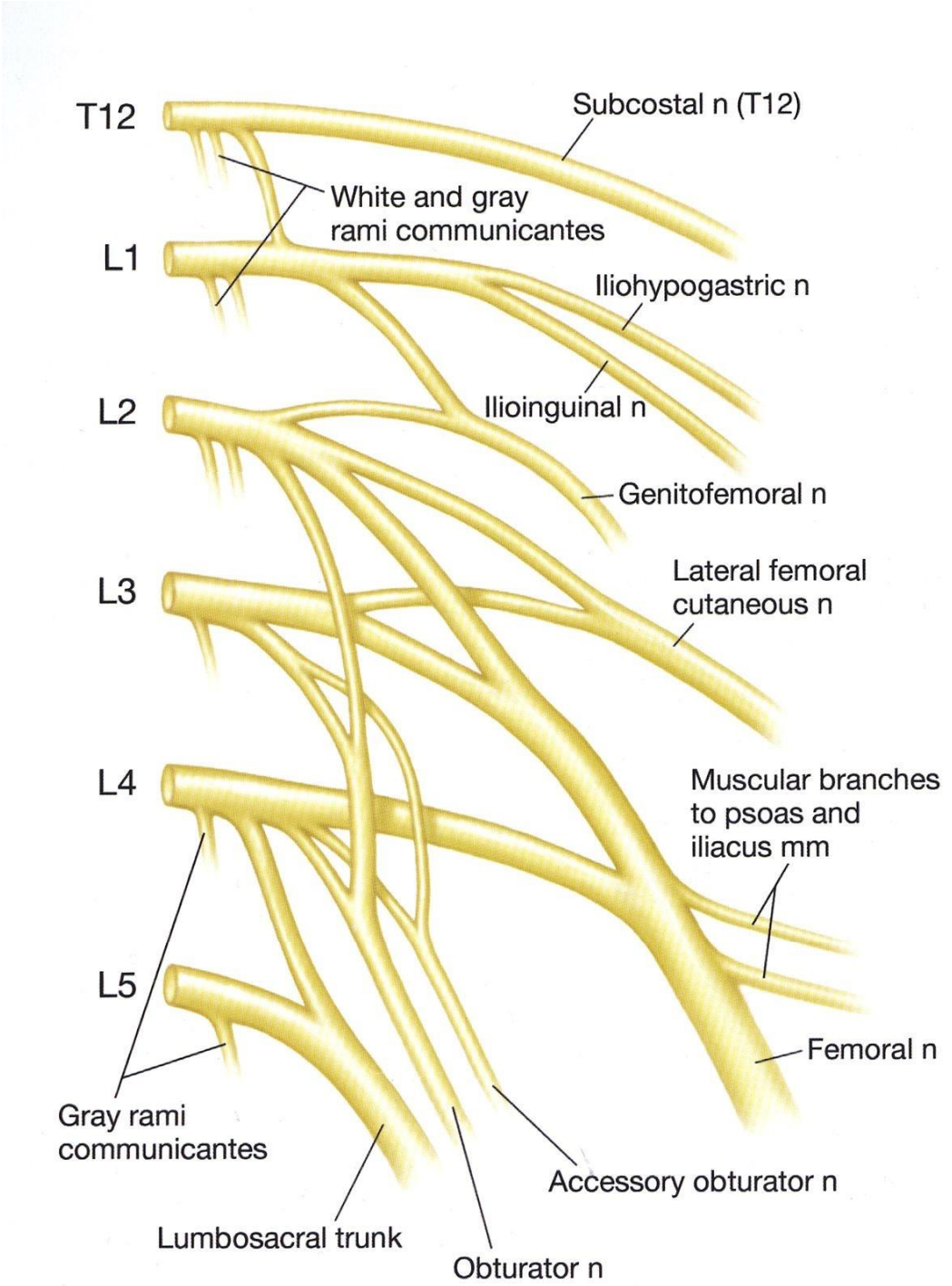
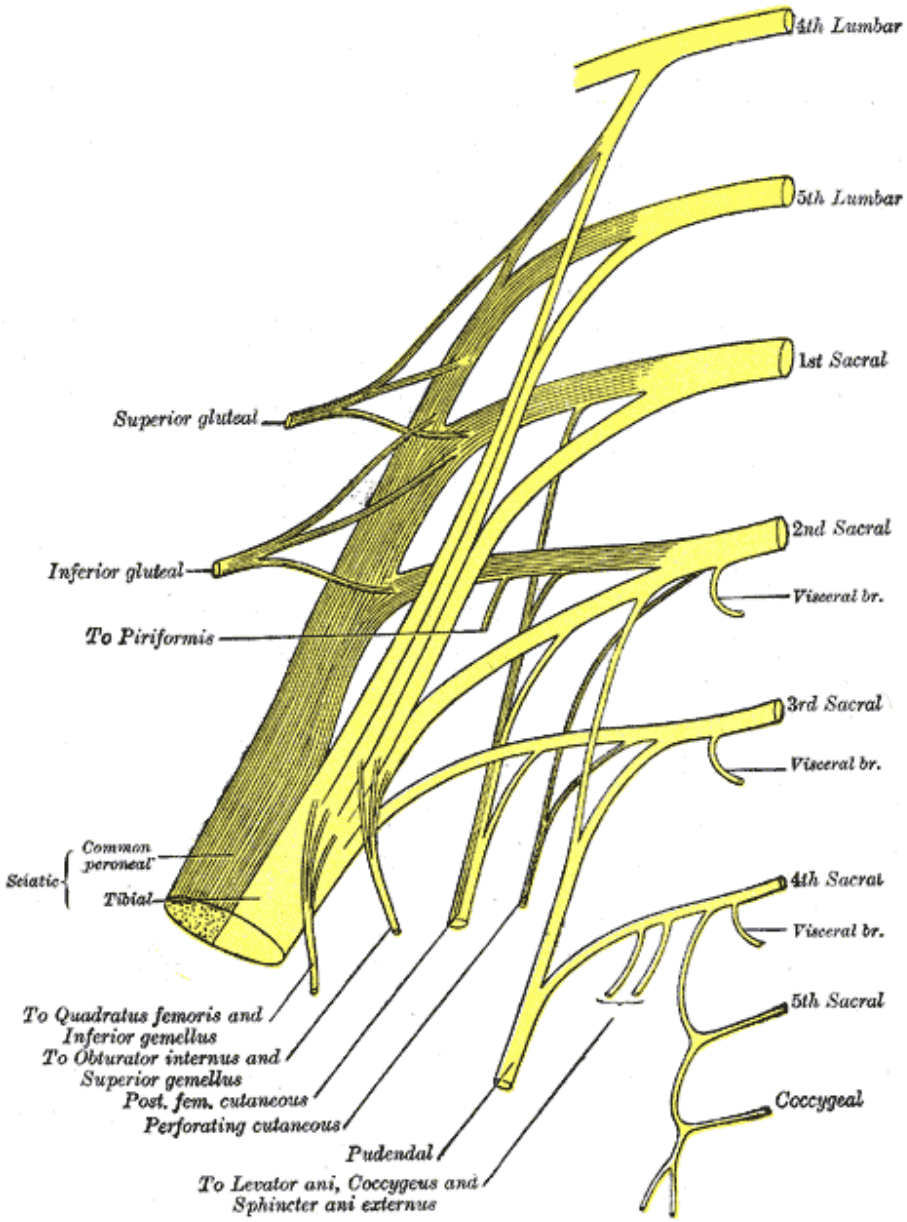
LOWER LIMB BLOCKS

LUMBAR PLEXUS



SACRAL PLEXUS



FEMORAL NERVE BLOCK:

BLOCK AT A GLANCE:

Indication: Anterior thigh, femur & knee surgery

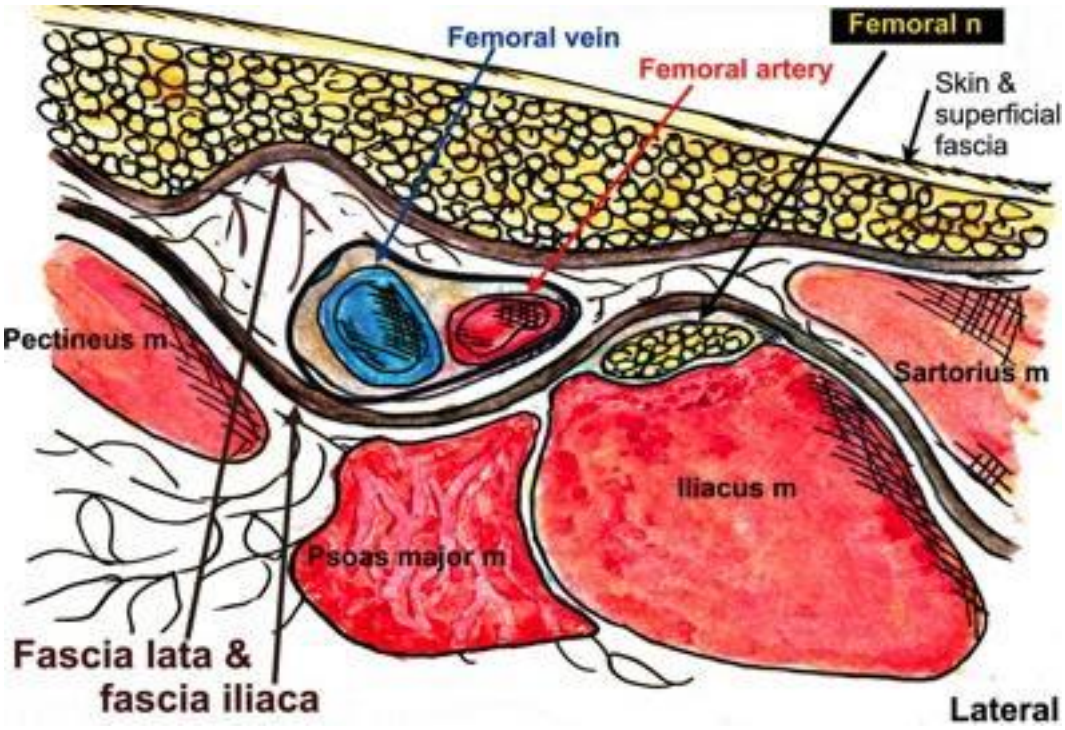
Transducer & position: 38/25 mm, linear, transverse &below inguinal crease

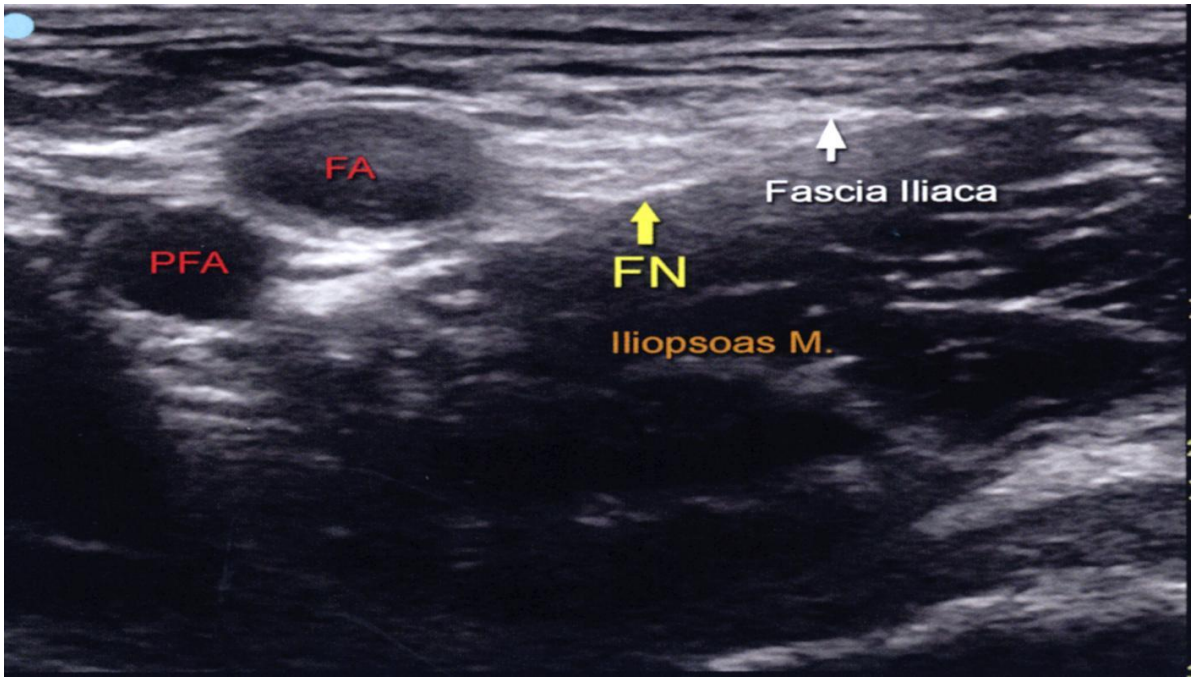
Patient position: Supine

Goal: LA spread adjacent to femoral nerve

Needle: 22 G 100 mm for IP technique and 50 mm for OOP technique, blunt

LA volume: 15-20 ml





Femoral Nerve Block

CLINICAL PEARLS:

- Ultrasound guided femoral nerve block is a “humbling” block. Pay extra attention to the structures on ultrasound
- Remember “ Navel” nerve, artery, vein, empty space, lymph node for orientation of neurovascular structures
- Femoral nerve divides into branches after passing below the inguinal ligament. Often these branches appear as hyper echoic structures in a triangular area formed medially by femoral vessels, anteriorly by fascia iliaca and posteriorly by the iliopsoas muscle
- Slight tilt cranially or caudally helps brightening up of femoral nerve
- To expose the inguinal region in a patient with large abdominal pannus, use a tape or assistant to retract the abdomen
- Beware of “false” femoral nerve block. Medial side of femoral vessels may resemble the triangular hyper echoic area on the lateral side of femoral artery
- Transducer location is very important. If it is too low, the artery and nerve are divided & imaging of small branches of femoral nerve is difficult. If it is too proximal, nerve and artery dive away from the transducer on the surface of iliacus muscle
- Imaging of femoral nerve is highly sensitive to anisotropy, it is important to pay attention to tilt angle of transducer to get a brighter image of nerve
- Distinguish lymph nodes from femoral nerve. Lymph nodes are above the fascia iliaca
- Circumferential spread of LA is not necessary for a successful block. Pool of LA in postero-lateral position, below the fascia iliaca but above the iliopsoas muscle is sufficient

FASCIA ILIACA COMPARTMENT (FICB) BLOCK:

BLOCK AT A GLANCE:

Indications: Anterior thigh. Fractured femur and knee surgery. Post op analgesia following hip and knee surgery

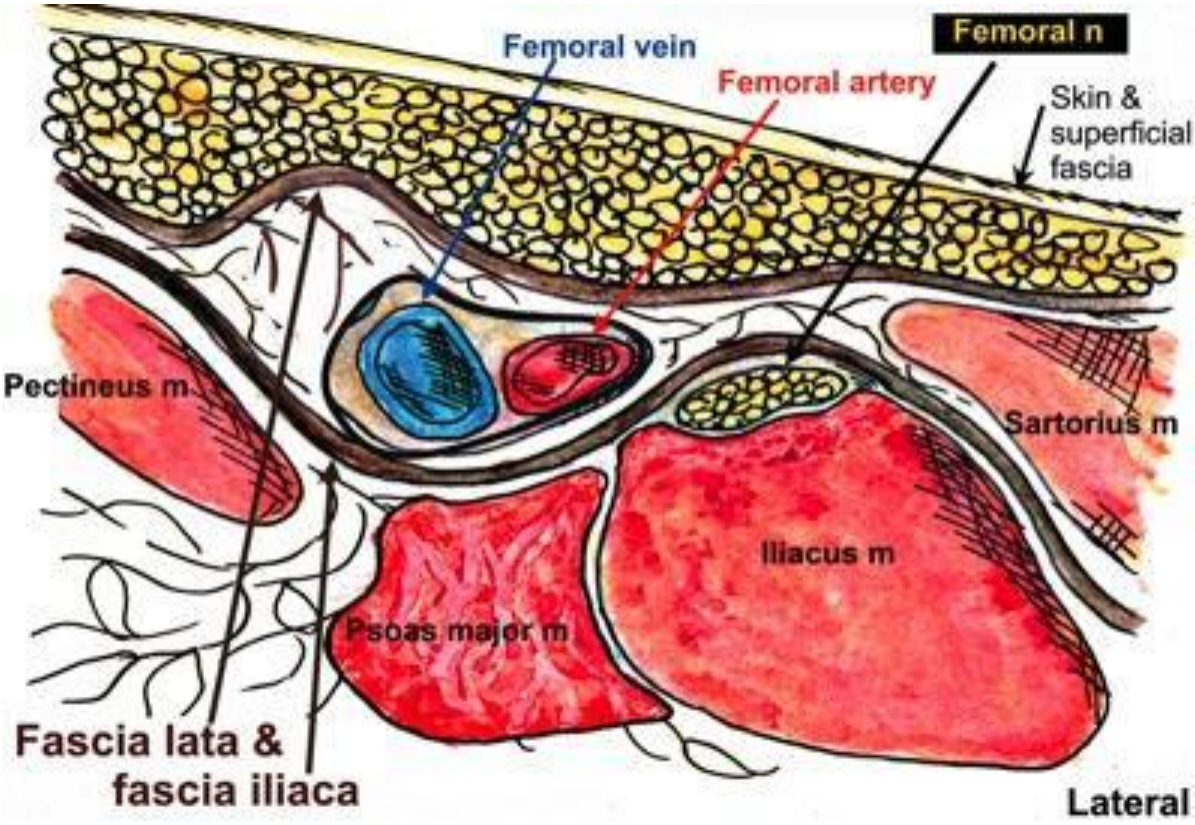
Transducer & position: 38/25 mm, linear, transverse, close to femoral crease & lateral to femoral artery. Alternatively longitudinal position of transducer

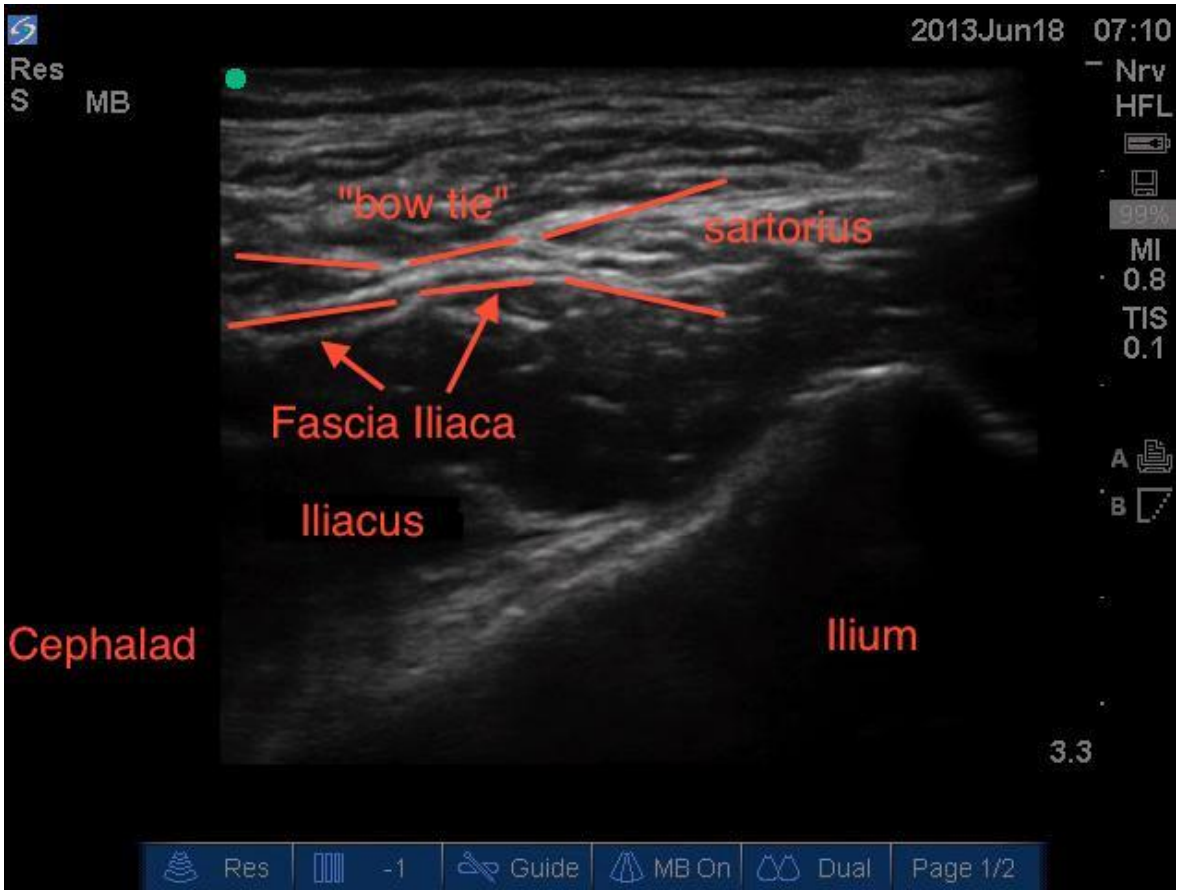
Patient position: Supine

Needle: 22 G, 100/50 mm, blunt

Goal: Medial-lateral spread of LA below fascia Iliaca

LA volume: 30-40 mls of low concentration of LA


Femoral vein
Femoral n
Femoral artery
Skin &
superficial
fascia
Pectineus m
Sartorius m
Iliacus m
Psoas major m
Fascia lata &
fascia iliaca
Lateral


2013Jun18 07:10
Res
S MB
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"bow tie"
sartorius
Fascia Iliaca
Iliacus
Cephalad
Ilium
3.3
Res
-1
Guide
MB On
Dual
Page 1/2

FICB

CLINICAL PEARLS:

- Transducer should be placed on the femoral crease and parallel to the crease
- Identify the fascia iliaca near the femoral vessels and trace it laterally
- Identify the “bow tie” sign
- Injection point is at the summit of bow tie sign, between femoral vessels medially and ASIS laterally
- Attention for a click when fascia iliaca is pierced
- FICB is a volume block. At least 30-40 ml LA should be injected
- Spread of LA should be monitored ultrasonography. Reposition the needle if required
- If unable to identify fascia iliaca, block the femoral nerve and the lateral femoral cutaneous nerve of the thigh individually
- FICB is at the most 2 in 1 block. Obturator nerve is not blocked
- In 30-40% people the LFCN may lie above the fascia iliaca, under the fascia lata

OBTURATOR NERVE BLOCK:

BLOCK AT A GLANCE:

Indications: analgesia of knee surgery, prevention of “adductor kick” during TURP, relief of adductor spasticity

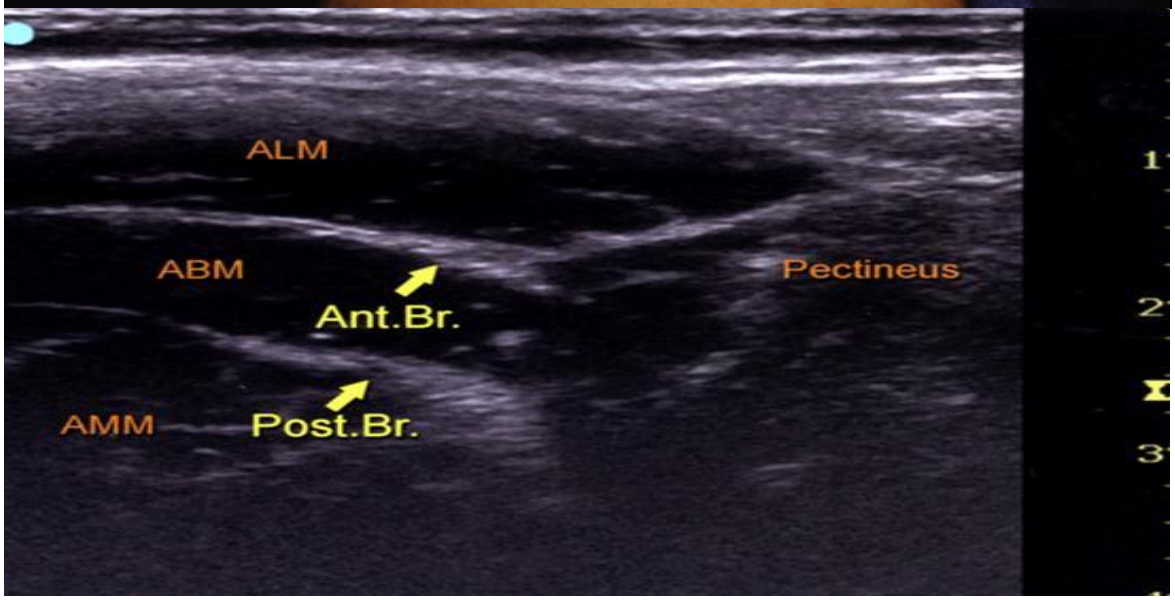
Transducer & position: 38/25 mm, linear, medial aspect of thigh

Patient position: Supine

Needle: 22g, 100/50 mm, blunt

Goal: LA spread between adductor longus/brevis & brevis/magus interfascial planes

LA volume: 5-10 ml LA in each fascial plane



CLINICAL PEARLS:

- Provides about 8-10% analgesia in knee arthroplasty
- Not a useful block for hip arthroplasty
- Usually it is difficult to identify the main nerve as it divides in the Obturator foramen
- Anterior and posterior branches lie in fascial planes between adductor longus & adductor brevis, between adductor brevis & adductor magnus respectively
- Weakness or inability to adduct the thigh is an indication of successful block
- Highly vascular area. Use colour Doppler, aspirate frequently & keep verbal contact with patient (if awake)
- Nerve stimulator can be used to confirm the nerves. Remember to use current of <1.0 MHz otherwise direct stimulation of muscles will result in twitches.

SAPHENOUS NERVE BLOCK:

BLOCK AT A GLANCE:

Indications: Saphenous vein stripping, medial side of leg & foot surgery. Analgesia for anterior cruciate ligament reconstruction

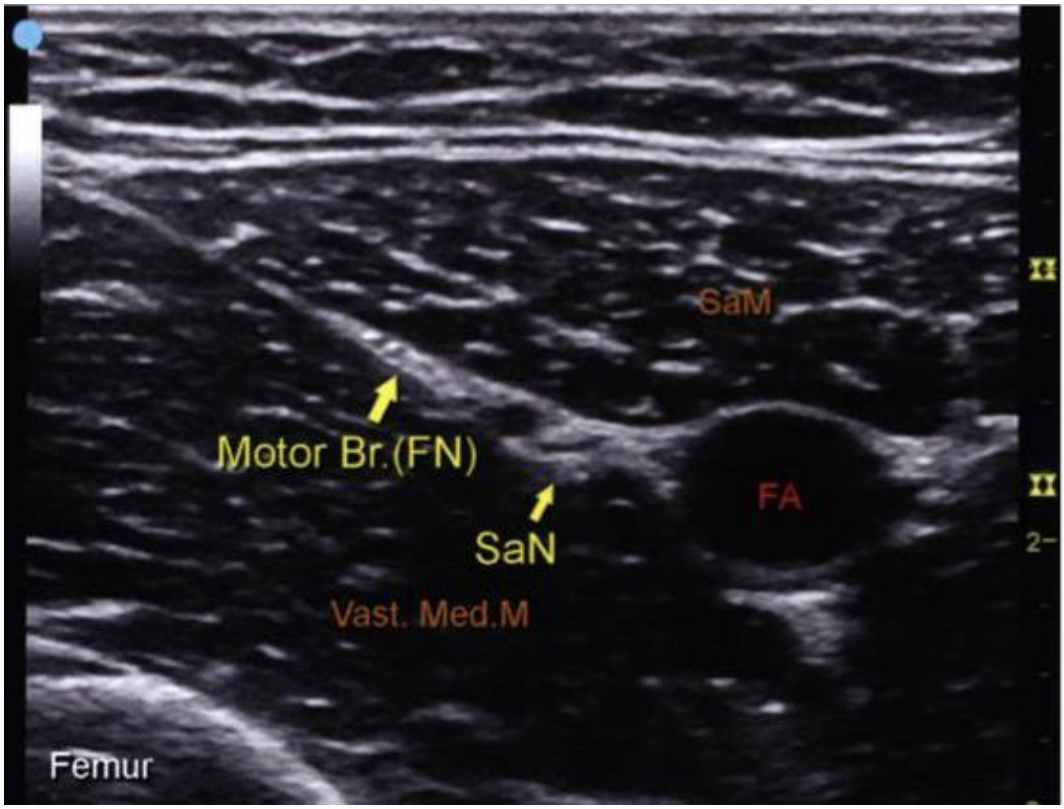
Transducer & position: 38/25 mm, linear, transverse or anteromedially on mid or lower thigh. Also below tibial tuberosity in the leg and above ankle

Patient position: Supine with leg abducted & externally rotated

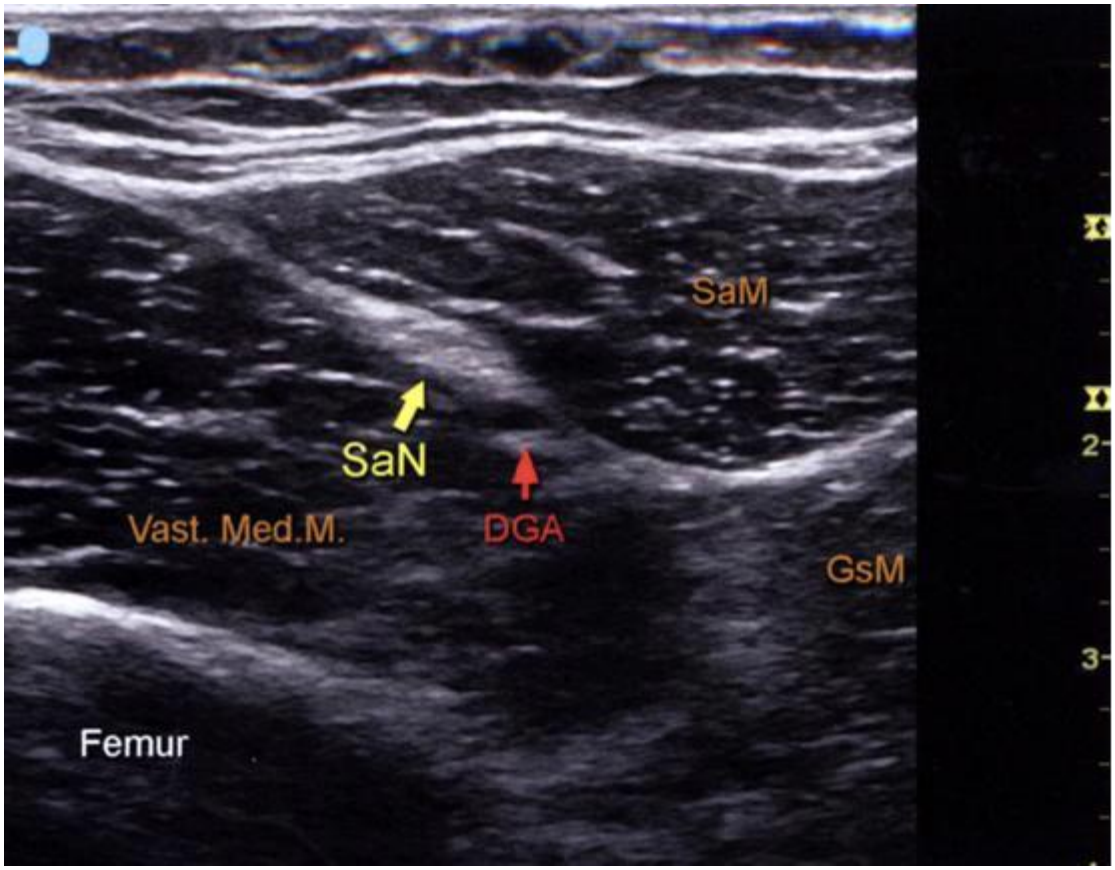
Needle: 22G, 100/50 mm, blunt

Goal: LA spread anterior to femoral artery in mid thigh below Sartorius, adjacent to saphenous vein in the leg

LA volume: 5-10 mls



Saphenous Nerve Block



Adductor Canal Block

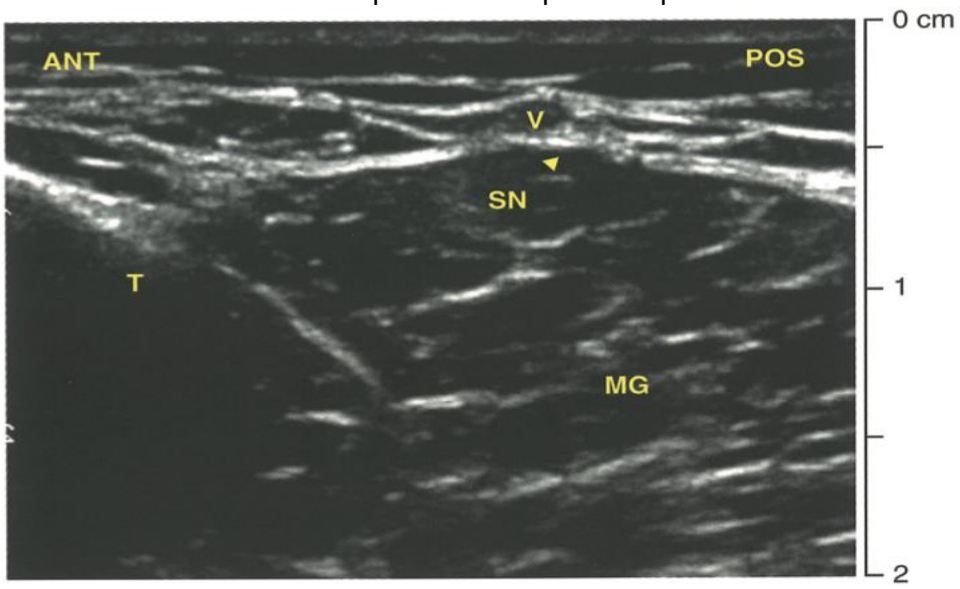
CLINICAL PEARLS:

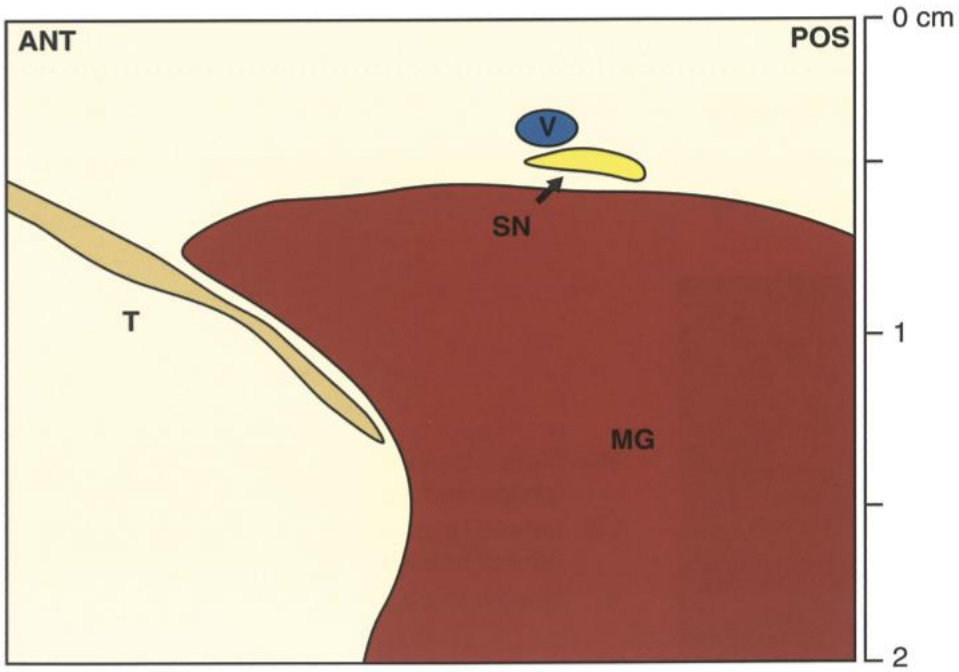
- Saphenous nerve can be blocked either at proximal or distal thirds of thigh
- Visualization of saphenous nerve is not essential before injection. Deposition of LA around femoral artery is adequate for successful block (proximal site)
- Some degree of quadriceps weakness is possible due to the blockade of nerve to vastus medialis
- Distal block (Adductor Canal Block) is preferred as the nerve is away from femoral artery and also may prevent motor block
- To perform adductor canal block, follow the femoral artery caudally. Injection site is at a point where the femoral vessels dive deep to eventually become the Popliteal vessels
- Slight external rotation of the thigh helps in identifying and blocking the saphenous nerve

SAPHENOUS NERVE leg

TECHNIQUE

Place a linear probe on the medial aspect of the leg just below the knee joint.
The nerve lies just deep to the saphenous vein.
Use a 50-mm needle with an in-plane technique from posterior to anterior.





SN Saphenous nerve, V Saphenous vein, MG Medial gastrocnemius, T Tibia and its drop-out shadow.

LAT. FEMORAL CUTANEOUS NERVE BLOCK:

BLOCK AT A GLANCE:

Indications: Post op analgesia for hip surgery, Meralgia Paraesthesia & muscle biopsy of lateral thigh

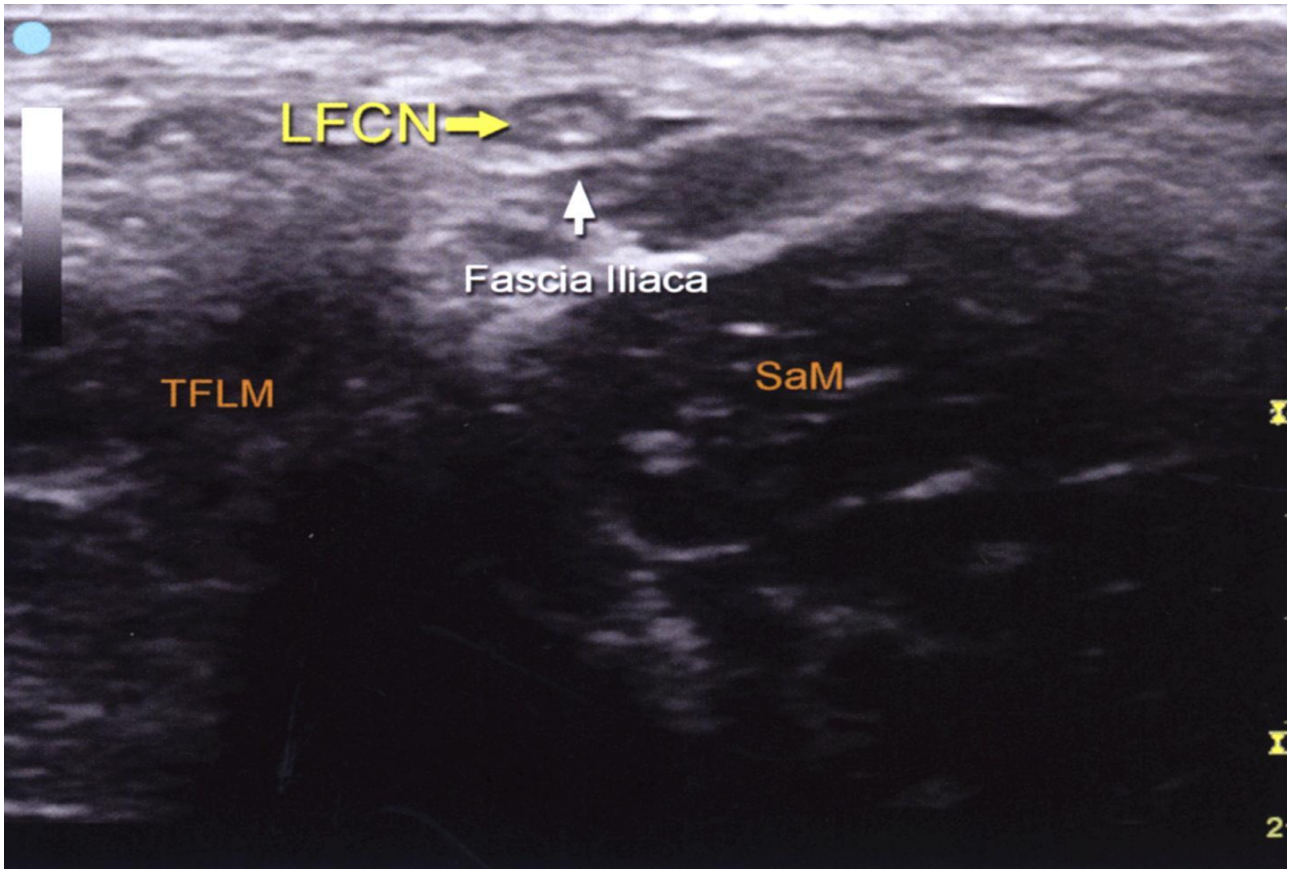
Transducer & position: 38/25 mm, linear, transverse immediately inferior to ASIS. Must identify the lateral edge of Sartorius muscle

Patient position: Supine

Needle: 22 G, 50 mm, blunt

Goal: LA spread between tensor fascia and Sartorius muscle

LA volume: 5-10 ml



Lateral Femoral Cutaneous Nerve (LFCN)

CLINICAL PEARLS:

- Only provides sensory block
- To locate the nerve, scan laterally from the femoral vessels, identify the sartorius and tensor fascial lata muscle. The nerve usually lies superficially at the junction of two muscles
- Nerve stimulator not required if block is performed in anaesthetized patient.
- If NS is used in awake patient, only objective sign is paraesthesia felt by the patient
- Needle direction is lateral to medial in IP technique. A pop may be heard when needle enters a space between tensor fascia and Sartorius muscle

SCIATIC NERVE BLOCK:

BLOCK AT A GLANCE:

Indications: Foot & ankle surgery, analgesia following hip & knee surgery

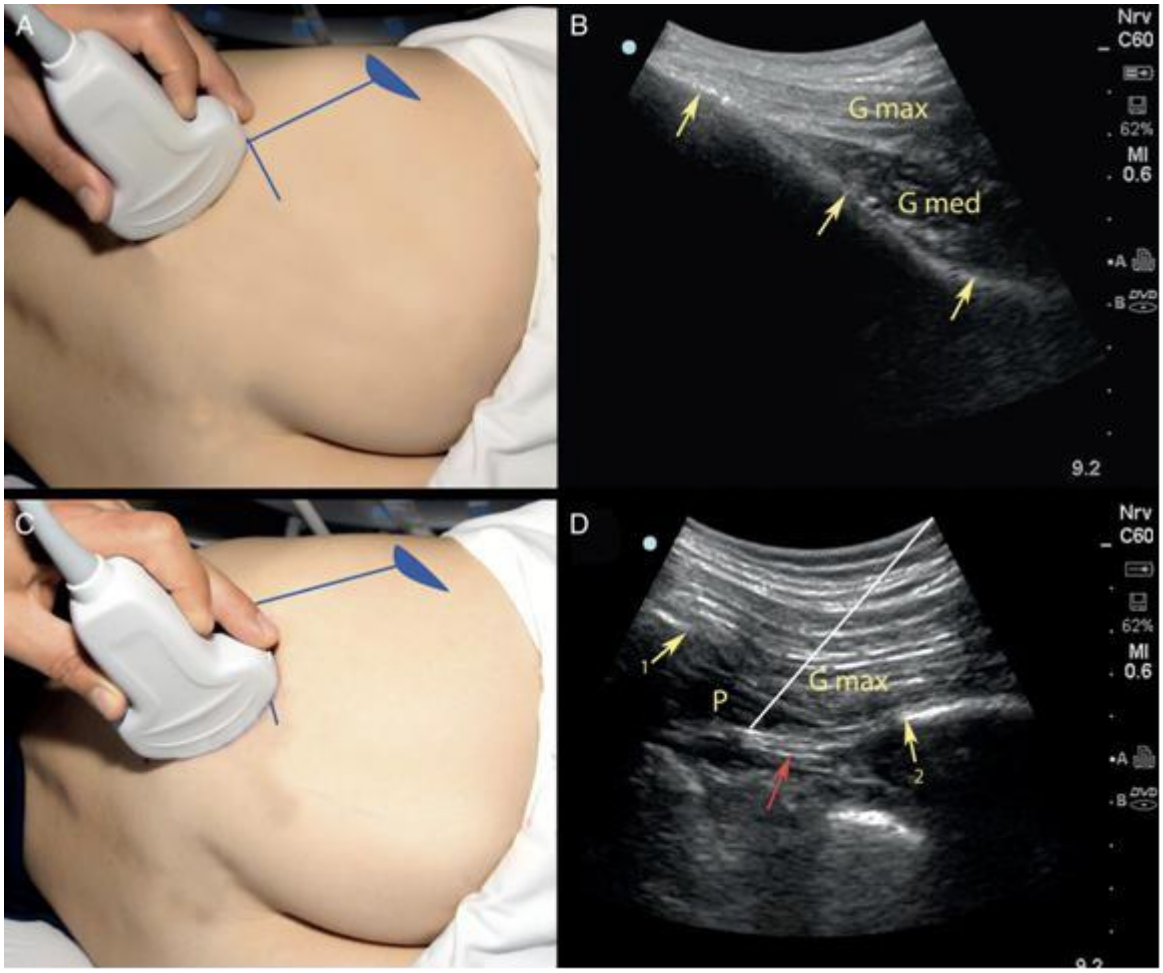
Transducer & position: 2-7 MHZ, curvilinear. Trans-gluteal & sub-gluteal approach: transverse posteriorly. Anterior approach: transverse on the proximal thigh

Patient position: Supine with hip abduction for anterior approach, midway between lateral decubitus and prone position

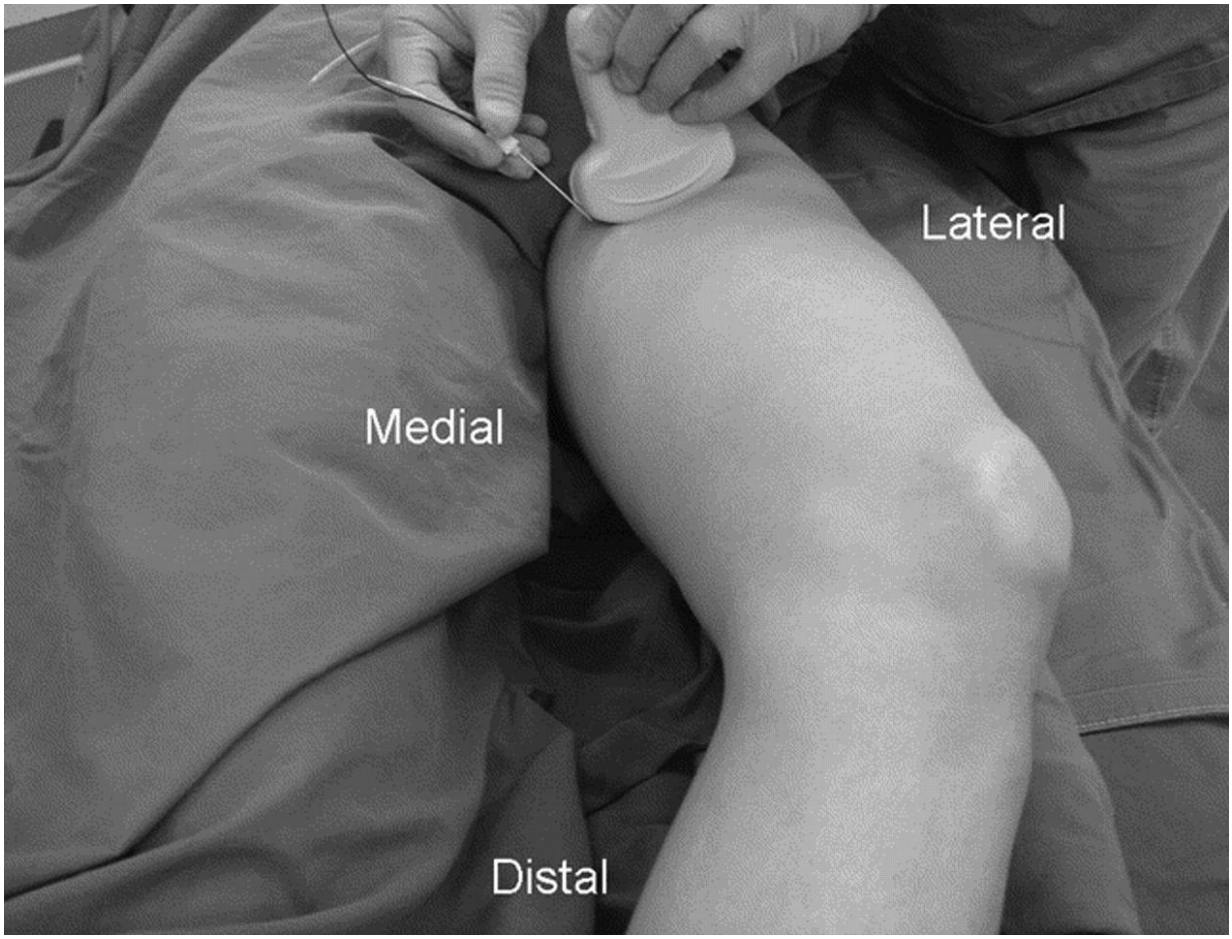
Needle: 22G, 100 mm, blunt

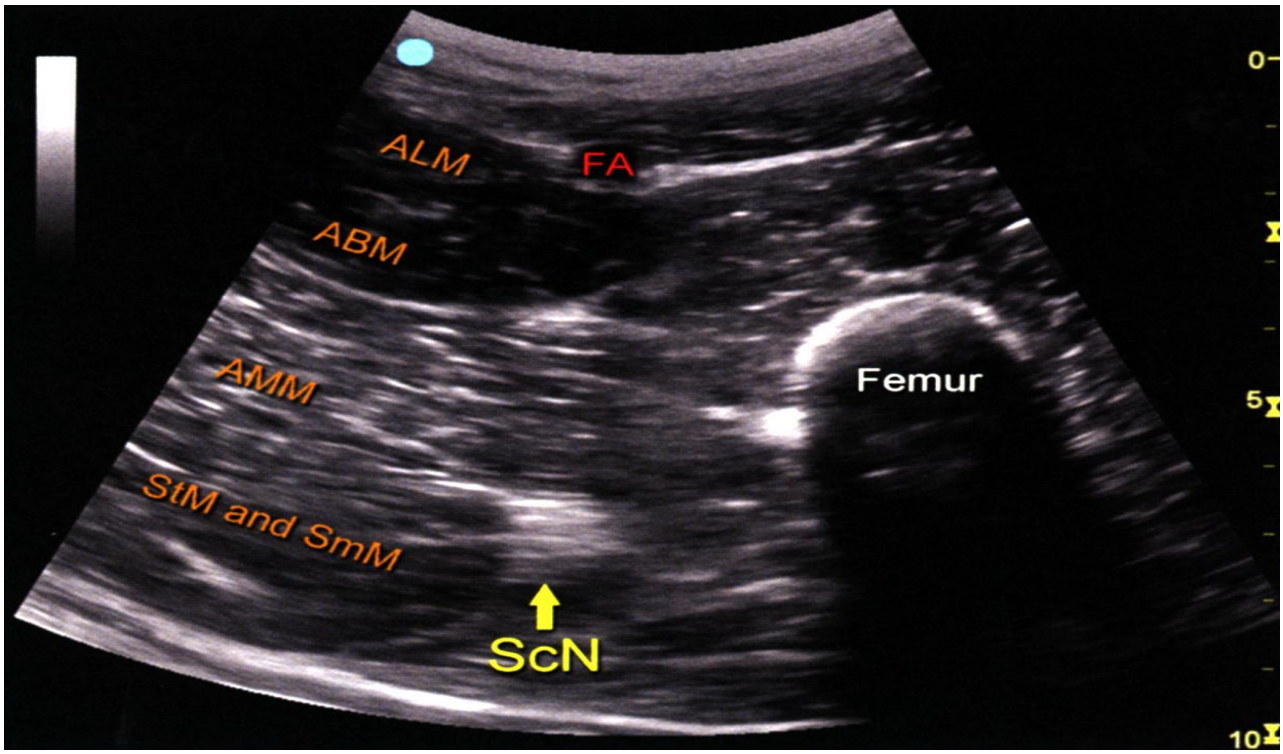
Goal: LA spread adjacent to sciatic nerve

LA volume: 15-20 ml

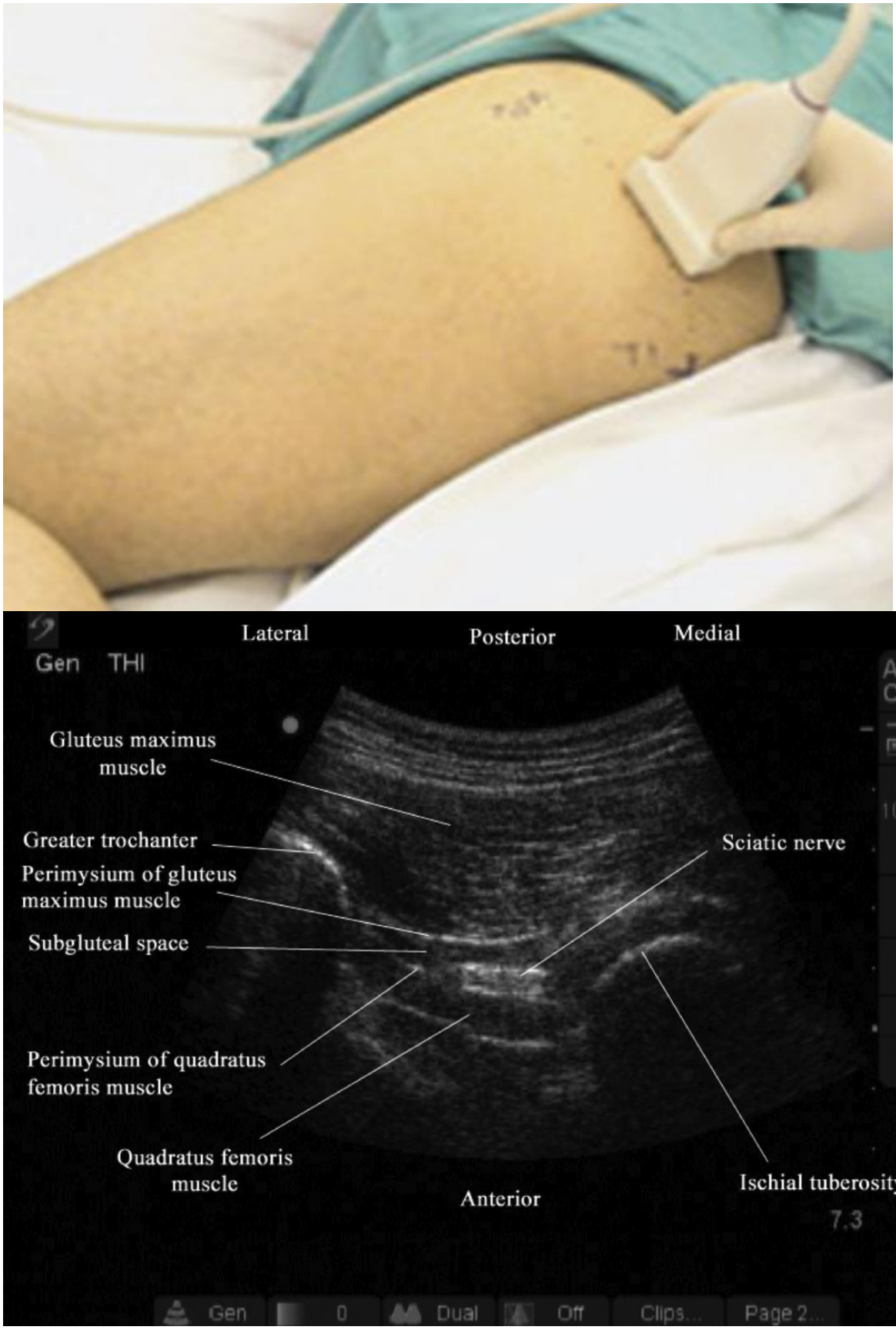


Para-sacral Sciatic Nerve Block (BJA 2011.107,2,278-279)





Sciatic Nerve Block (anterior approach)



Sub-gluteal Sciatic Nerve Block

CLINICAL PEARLS:

- Use only para-sacral/trans-gluteal block for analgesia in THR, in combination with lumbar plexus block
- For anterior approach, an out of plane (OOP) is preferred for this block
- In sub-gluteal approach, it is difficult to see ischeal tuberosity and greater trochanter in the same image
- Due to the depth of the nerve, use NS in conjunction with US to locate the nerve
- Use analgesia/sedation, if the block is performed in awake patient
- For surgery/analgesia of knee, leg and foot surgery use sub- gluteal/popliteal approach
- It may be difficult to identify the nerve at its proximal location (trans- sacral/trans-gluteal), particularly in obese patients.
- For proximal sciatic nerve block, “para-sacral parallel shift” described by Bendtsen et al In BJA 2011, is an easy technique, which improves the success in performing proximal sciatic nerve block.
- The fascia surrounding the sciatic nerve in the sub-gluteal region is thick. Correct positioning of the needle and LA spread is very important
- To confirm that a potential target is the sciatic nerve, attempt to trace it with the scanning probe along its course towards the Popliteal region
- The target can also be confirmed by rotating the probe 90 degrees to visualize the nerve in longitudinal view
- Sciatic nerve exhibits significant anisotropy. Tilt or angulate the probe to get the optimum image
- Insertion of needle from medial to lateral (IP), helps avoiding the contact with femur

POPLITEAL BLOCK:

BLOCK AT A GLANCE:

Indication: Foot and ankle surgery. Surgery below knee

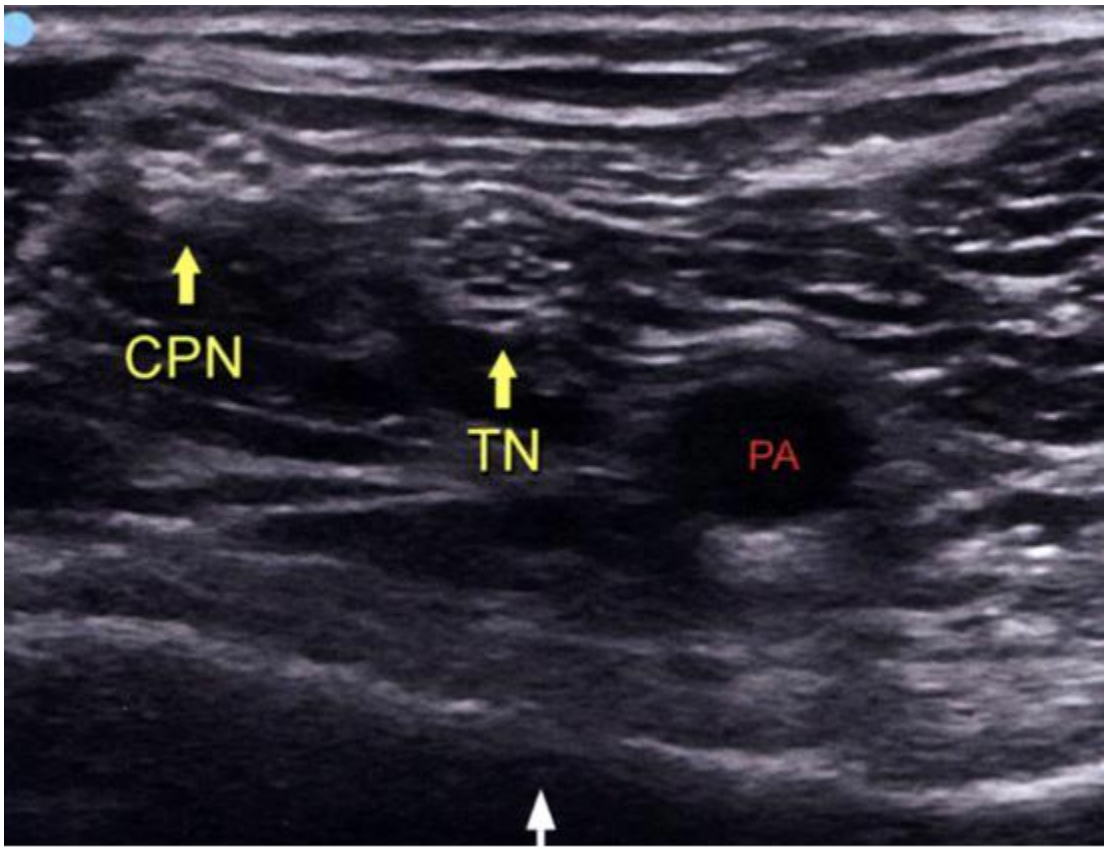
Transducer & position: 38 mm, linear & curvilinear in obese patients

Patient position: Prone, lateral or supine

Needle: 100/50 mm, linear or 2-7 mm curvilinear, transverse just above Popliteal crease

Goal: LA spread around tibial and common peroneal nerves

LA volume: 10 ml around each nerve



Popliteal Block

CLINICAL PEARLS:

- The block can be performed in prone, supine or lateral position
- In a supine position, elevation of leg (just enough to place the probe) and slight internal rotation helps in performing popliteal block. Do not over flex the knee
- A slight reverse trendelenburg position helps in scanning the posterior surface of the leg
- Start scanning at popliteal crease and trace the nerves proximally to the point of bifurcation of sciatic nerve. This is to identify TN & CPN
- Use colour Doppler to identify Popliteal vessels
- Do not press the probe hard to avoid compression of Popliteal vessels
- Inject around tibial nerve (deep) first and the common peroneal nerve
- Both in-plane and out of plane techniques can be used
- Injecting LA around TN and CPN results in faster and more successful block of sciatic nerve

IPACK BLOCK

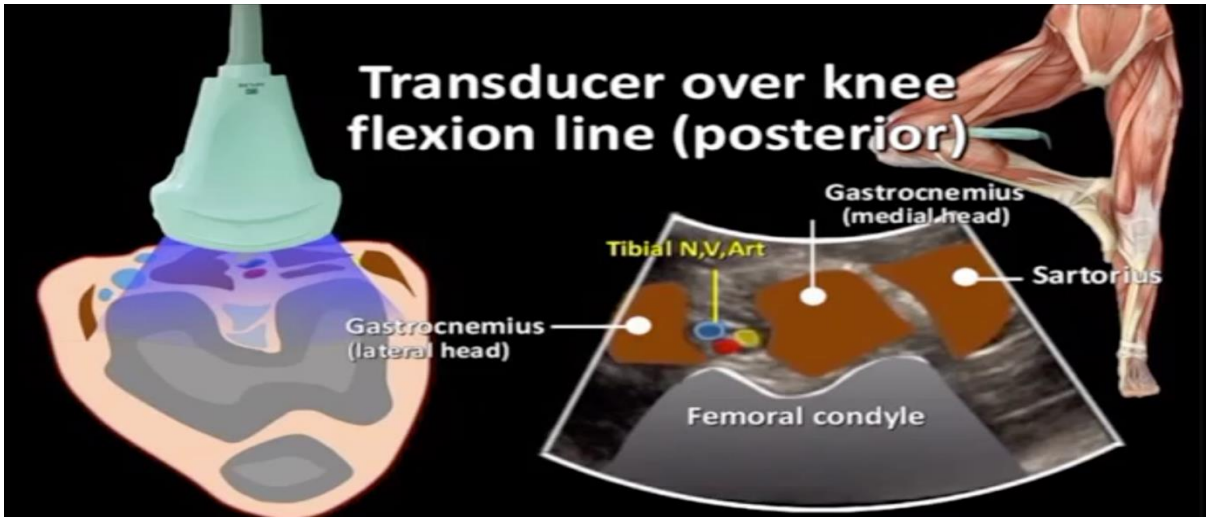
Is the ultrasound-guided local anaesthetic infiltration of the **i**nterspace between the **P**opliteal **A**rtery and the **C**apsule of the posterior **K**nee.

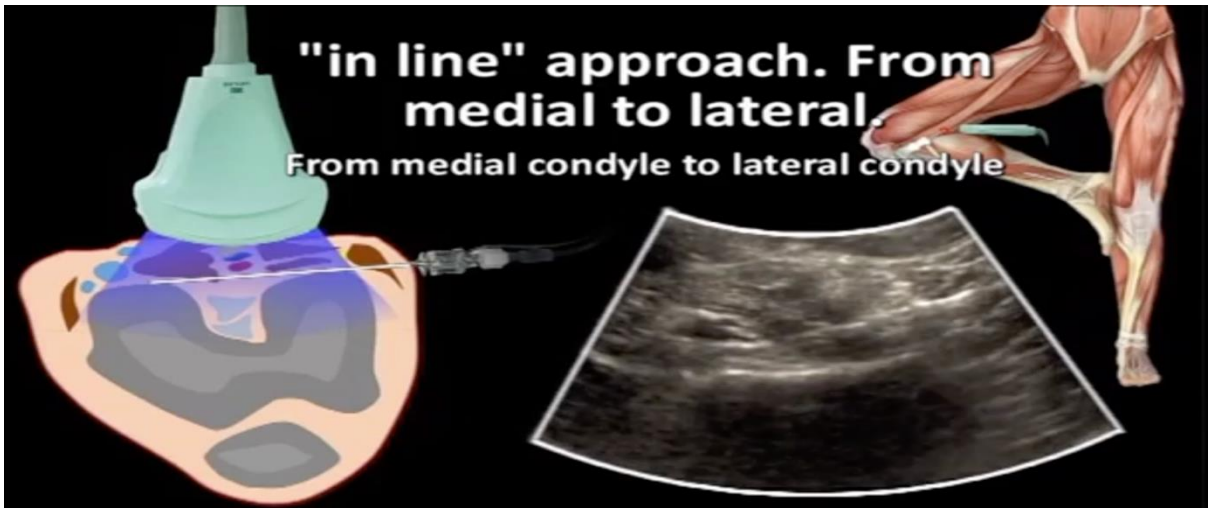
Principle:

The IPACK block spares the main trunk of the tibial and peroneal nerves and blocks only the terminal genicular branches innervating the posterior knee joint. Thus, it provides analgesia to the posterior side of the knee after TKA.

Technique:

Patient position: supine, with the knee flexed.
Probe: low frequency curvilinear probe.
Start scanning the popliteal fossa just proximal to the popliteal crease to visualise the femoral condyles.
At this level, a 100-mm needle is inserted in-plane in a medial to lateral direction between the popliteal artery and the femur, until the needle tip was 2 to 3 cm beyond the lateral edge of the popliteal artery. Inject 30 mL of 0.125% levobupivacaine between the vessels and the femoral condyles while gradually withdrawing the needle.



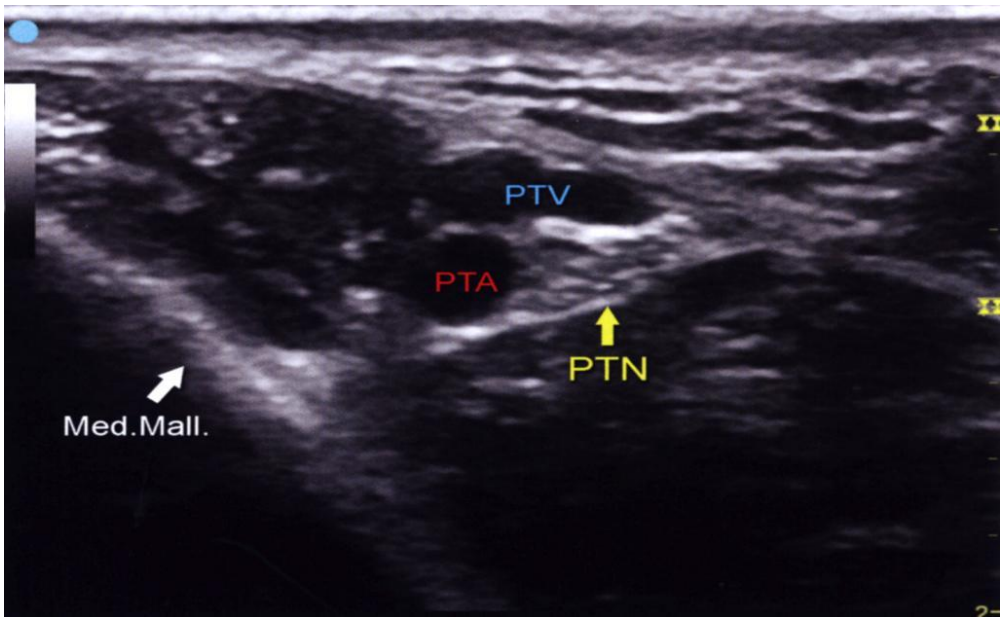


ANKLE BLOCK:

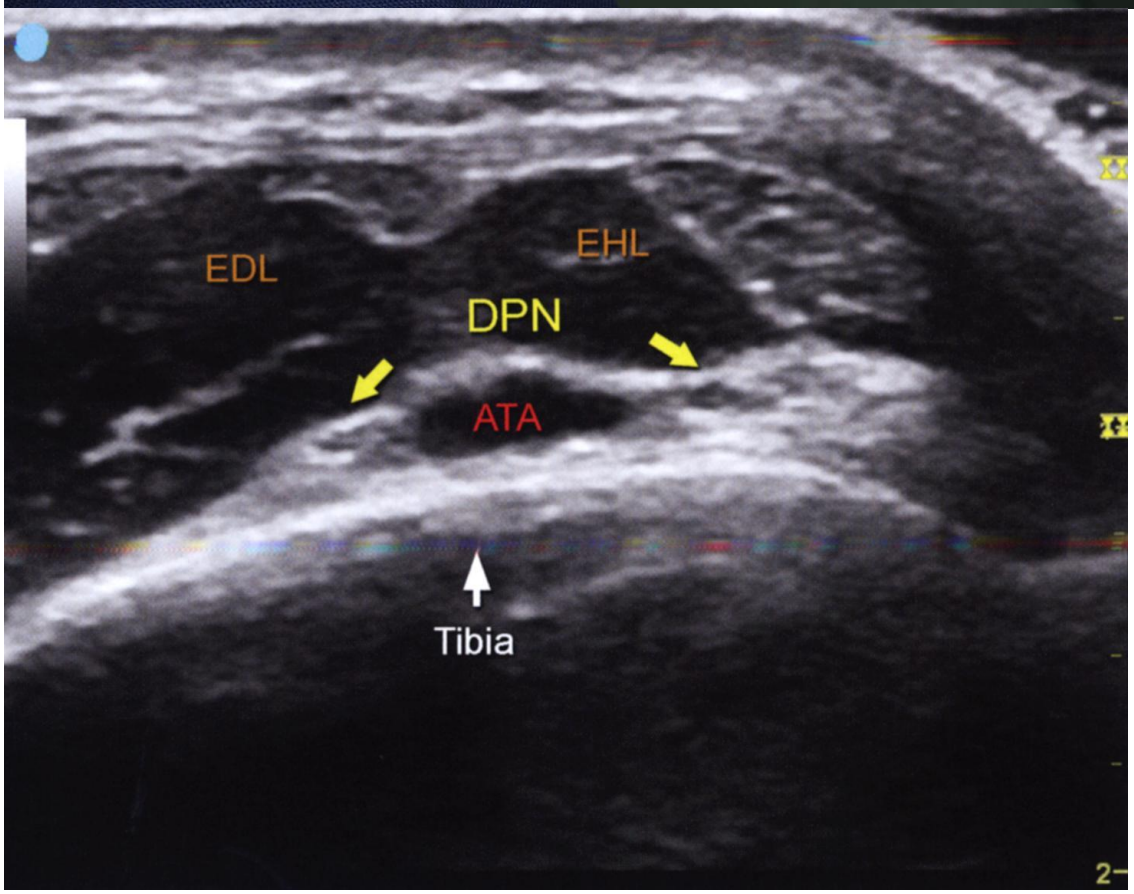
BLOCK AT A GLANCE:

Indications: Foot and toe surgery
Transducer & position: 25/38 mm, linear, transverse
Patient position: Supine. A footrest under the calf facilitates the block

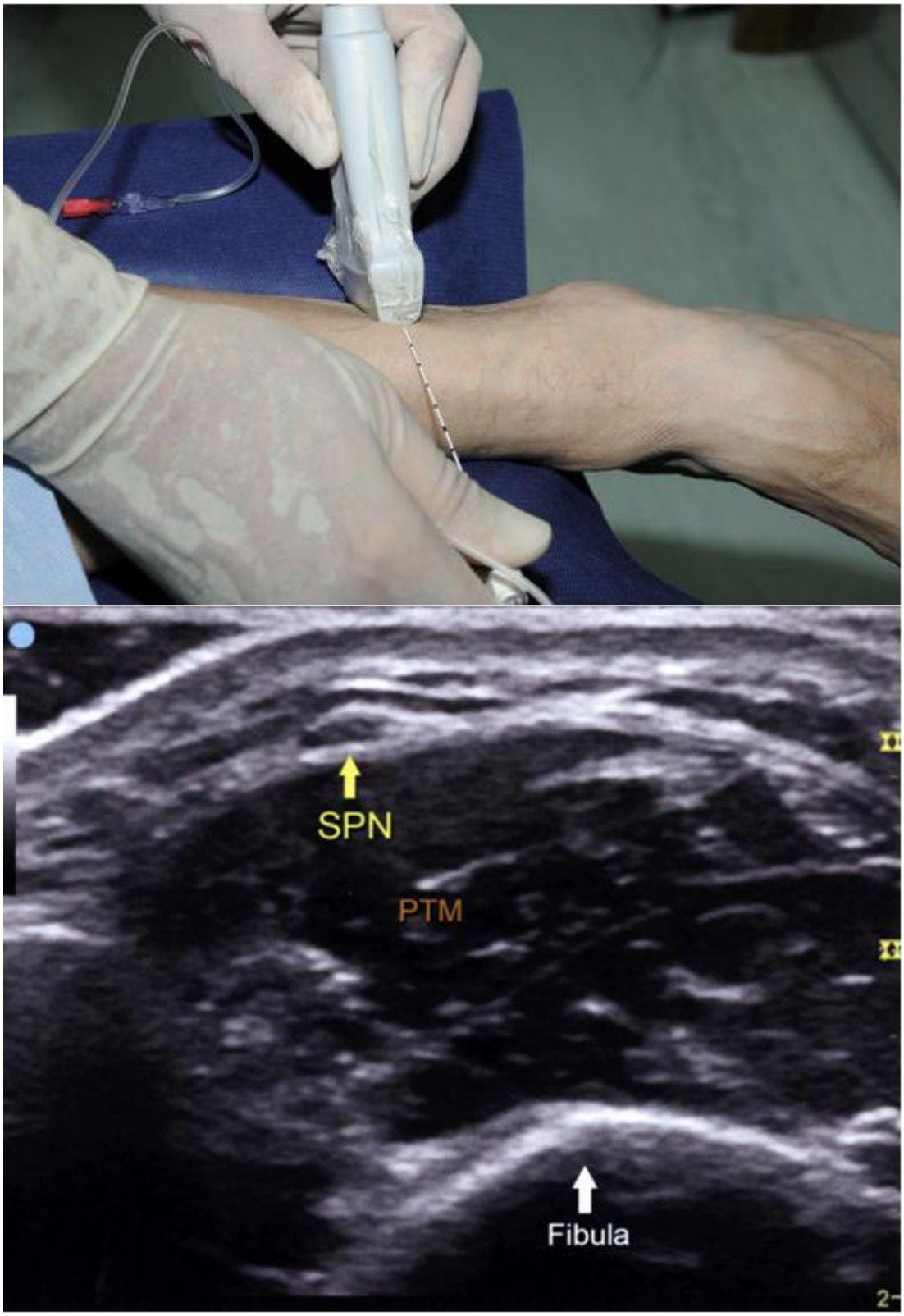
Needle: 22G, 50 mm long
Goal: LA spread around individual nerves
LA volume: 3-5 ml LA around each nerve



Tibial Nerve Block



Deep Peroneal Nerve Block



Superficial Peroneal Nerve Block

Sural Nerve Block

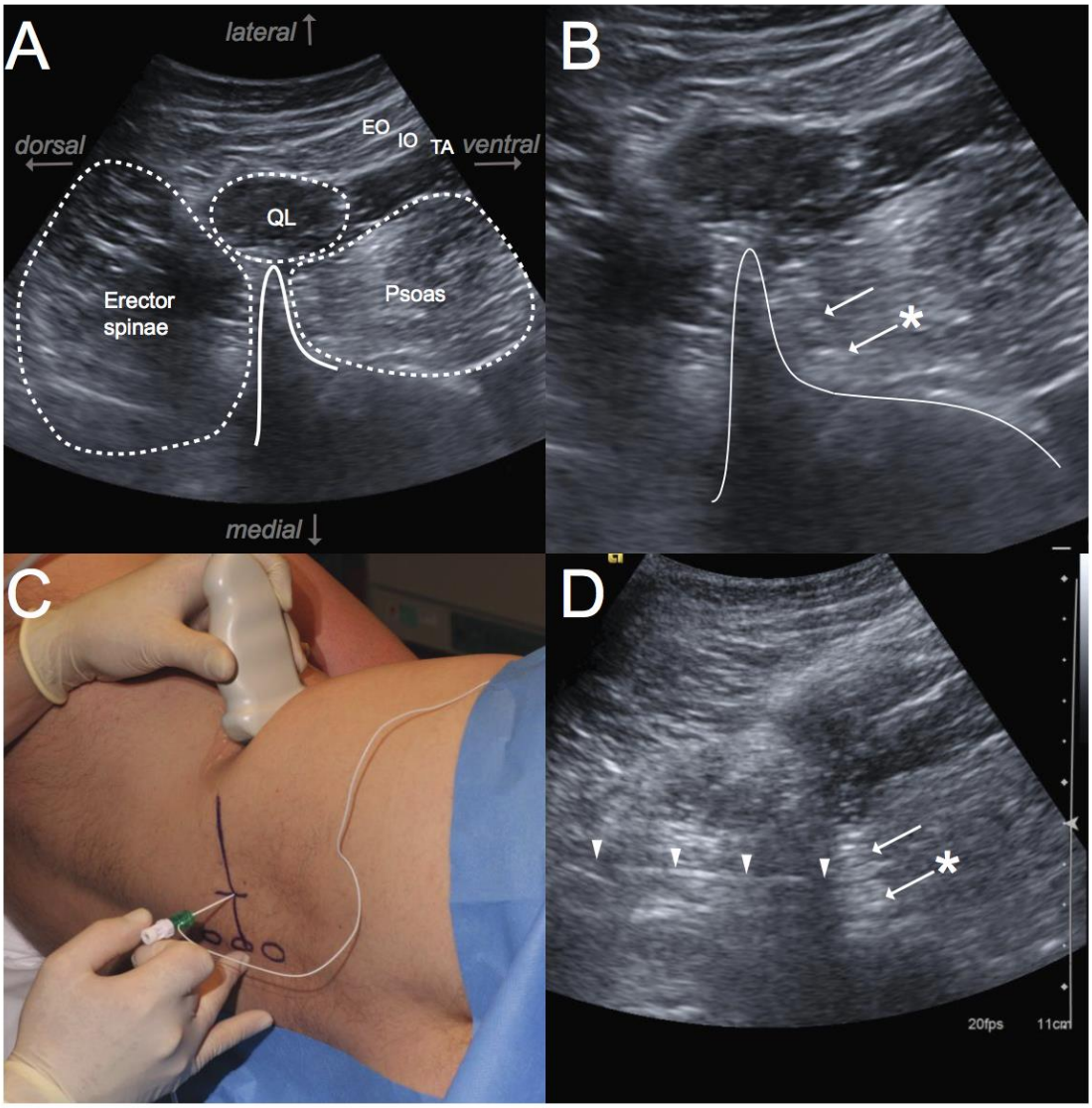
CLINICAL PEARLS:

- Ankle block is preferred than proximal nerve blocks in the leg for foot surgery in ambulatory setting
- Due to limited and compact space at the angle, OOP needling technique is easier to perform than the IP technique
- Use smaller gauge needle to avoid patient discomfort in awake patient
- When using veins as landmark, use as little pressure as possible to avoid collapsing the veins
- Use of tourniquet can help identify the veins
- Deep peroneal nerve (DPN) should be blocked just above the ankle just before it crosses over the anterior tibial artery (before it branches into medial & lateral components)
- The DPN is difficult to distinguish from neighbouring structure. Injection of LA around the artery usually distinguishes it
- Superficial peroneal nerve (SPN) can be identified by scanning at anterior and proximal to lateral malleolus
- An IP technique is recommended for SPN
- To block the tibial nerve (TN), externally rotate the leg and use IP technique half way between medial malleolus and the bulk of gastrocnemius muscle.
- Applying calf tourniquet to visualize the short saphenous vein can easily identify sural nerve. The nerve lies adjacent to the vein
- Sural nerve can be blocked by using IP technique, if leg is elevated
- Use Popliteal and proximal saphenous nerves block instead of ankle block in oedematous leg.

LUMBAR PLEXUS BLOCK:

BLOCK AT A GLANCE:

Indications: analgesia for hip and knee surgery
Transducer & position: 2-7 mm, curvilinear, transverse or longitudinal
Patient position: lateral decubitus, operative side up or prone
Needle: 22G, 150/100 mm long, blunt
Goal: LA spread within the Psoas muscle
LA volume: 30-40 mls



Lumbar Plexus Block
(Sauter et al. BJA Feb 2013)

CLINICAL PEARLS:

- This is an advanced US guided block technique to be performed by an experienced operator
- As it is a deep block, use of nerve stimulator with US is helpful.
- If hamstring twitch is seen (sacral plexus), withdraw the needle and re- insert laterally or cephaloid direction
- Presence of twitches after injection 1-2 ml LA, represent intravascular or dural sleeve injection
- Ensure that the spine is not over rotated
- Slight tilt of pelvis forward allows better position for scanning and performing the block
- The peritoneum lies deep to Psoas muscle. It is important to identify the peritoneum and define the maximum insertion of needle to prevent needle entry into peritoneum
- A pre-procedural scan is essential to identify the kidney
- If performed in awake patient, use appropriate sedation to prevent/ reduce patient discomfort
- Avoid high pressure and fast injection to prevent nerve damage and epidural spread
- A new technique, described by Sauter et al in BJA Feb. 2013, using ultrasound-guided lumbar plexus (shown in diagram) is recommended.