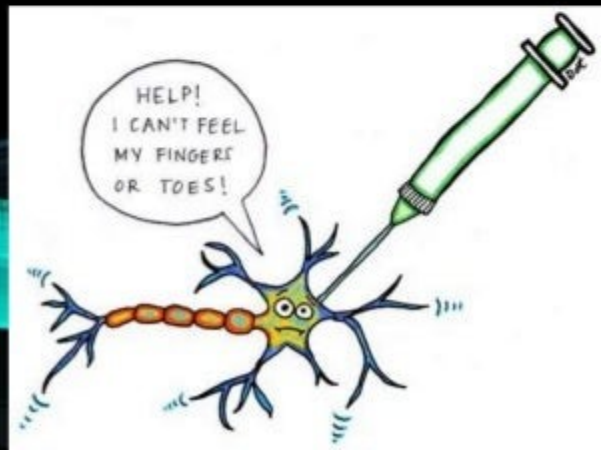


BLOCKS OF THE UPPER LIMB & THORAX

PRESENTER- DR. RANJITH R THAMPI

MODERATOR- DR. ELDO ISSAC



REGIONAL BLOCKS

- UPPER LIMB

1. Interscalene Block



2. Supraclavicular Block



3. Infraclavicular Block



4. Axillary Block



5. Mid Humeral

6. Distal Blocks



- THORAX

1. Intercostal Block



2. Paravertebral Block



3. PEC 1 Block



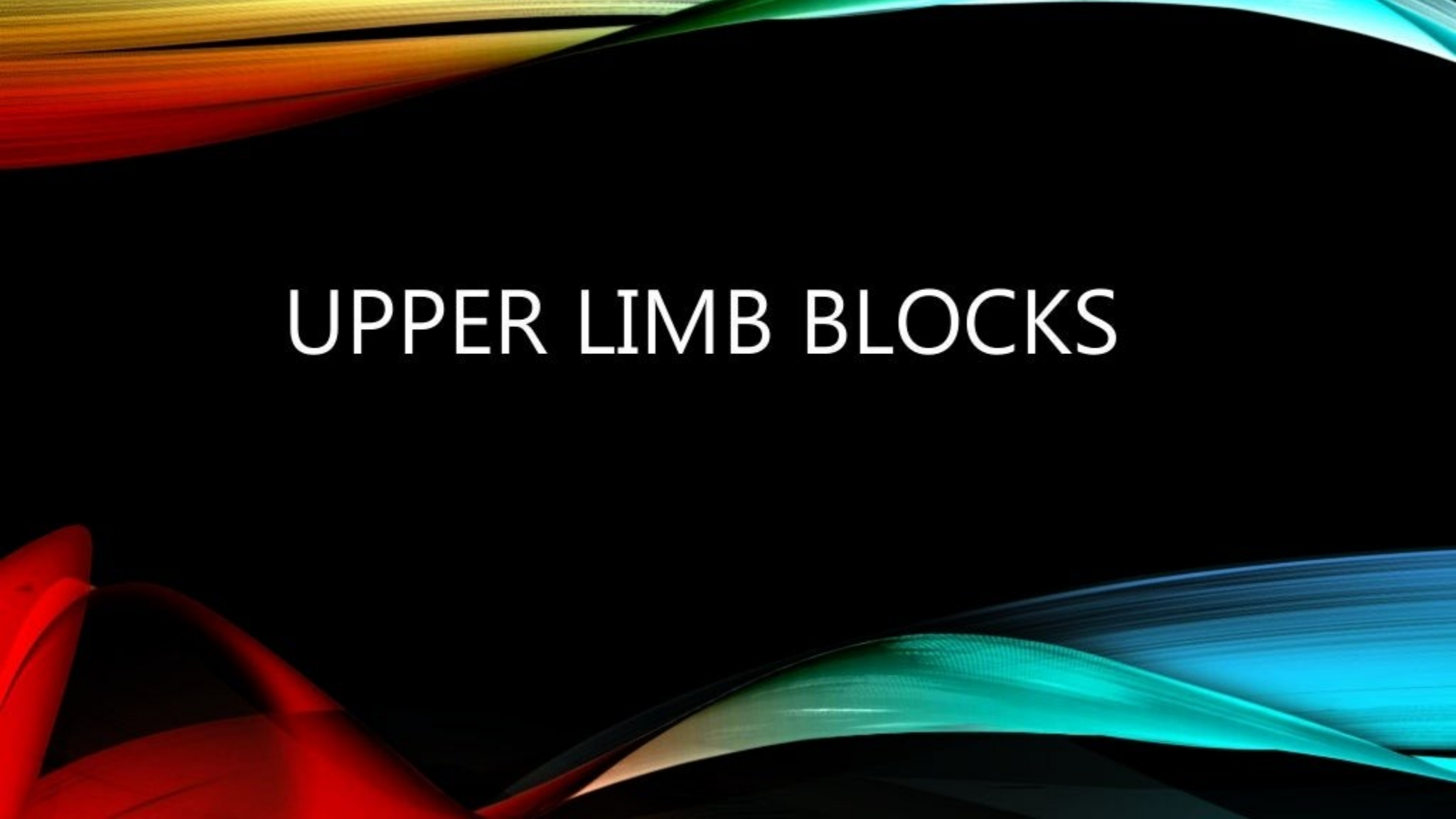
4. PEC 2 Block



5. Serratus Anterior Plane Block

6. Intrapleural Block

UPPER LIMB BLOCKS

The background features a series of flowing, translucent ribbons in vibrant colors: red, orange, yellow, and blue. These ribbons curve and swirl across a solid black background, creating a dynamic and abstract visual effect. The lighting on the ribbons gives them a three-dimensional appearance, with highlights and shadows that suggest movement and depth.

SURGERIES INDICATED



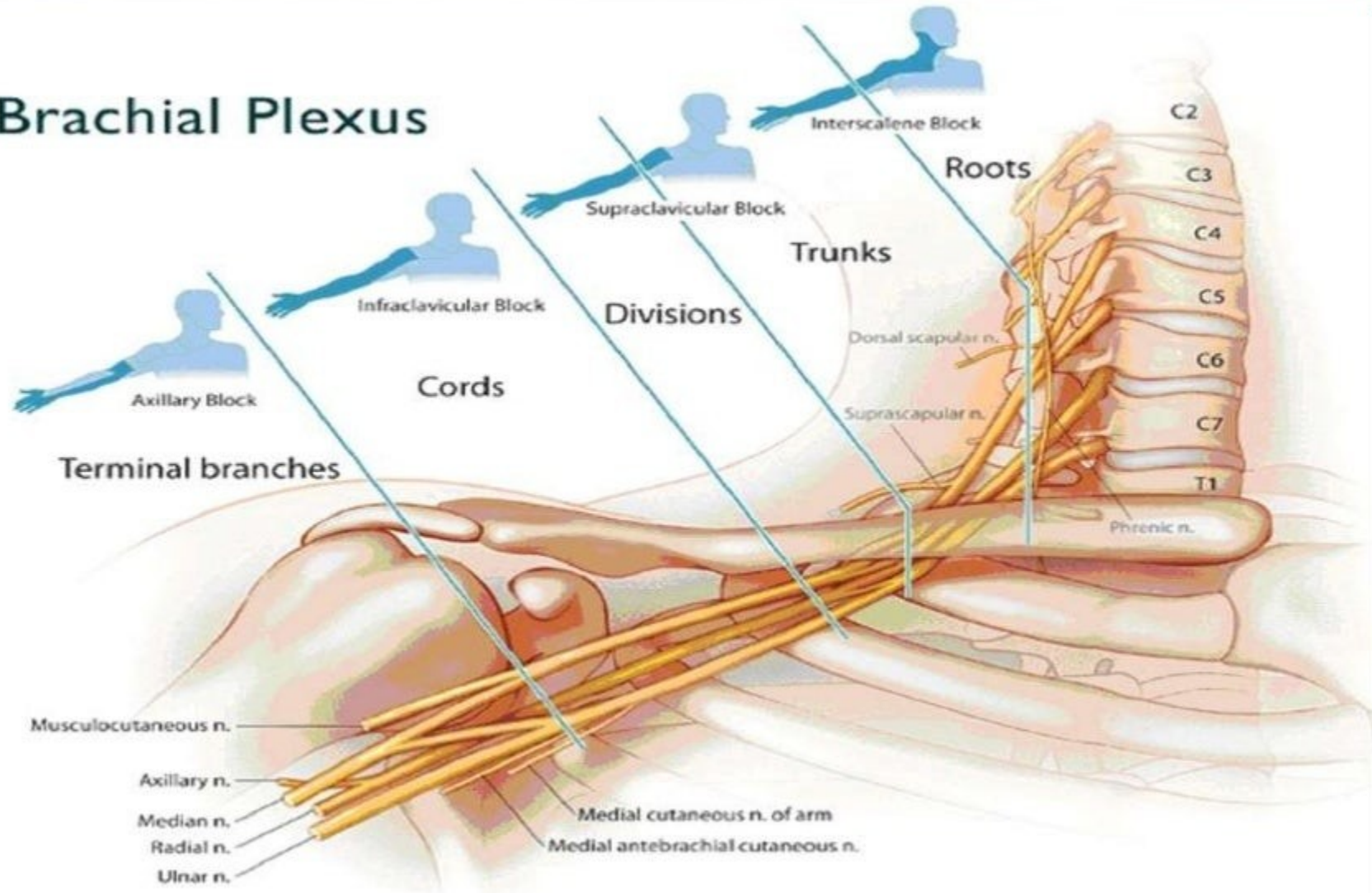
Interscalene Blocks-
Shoulder, Clavicle, Arm

Periclavicular Blocks-
Arm, Elbow, Forearm(Radial Nerve)

Axillary Blocks-
Forearm and Hand

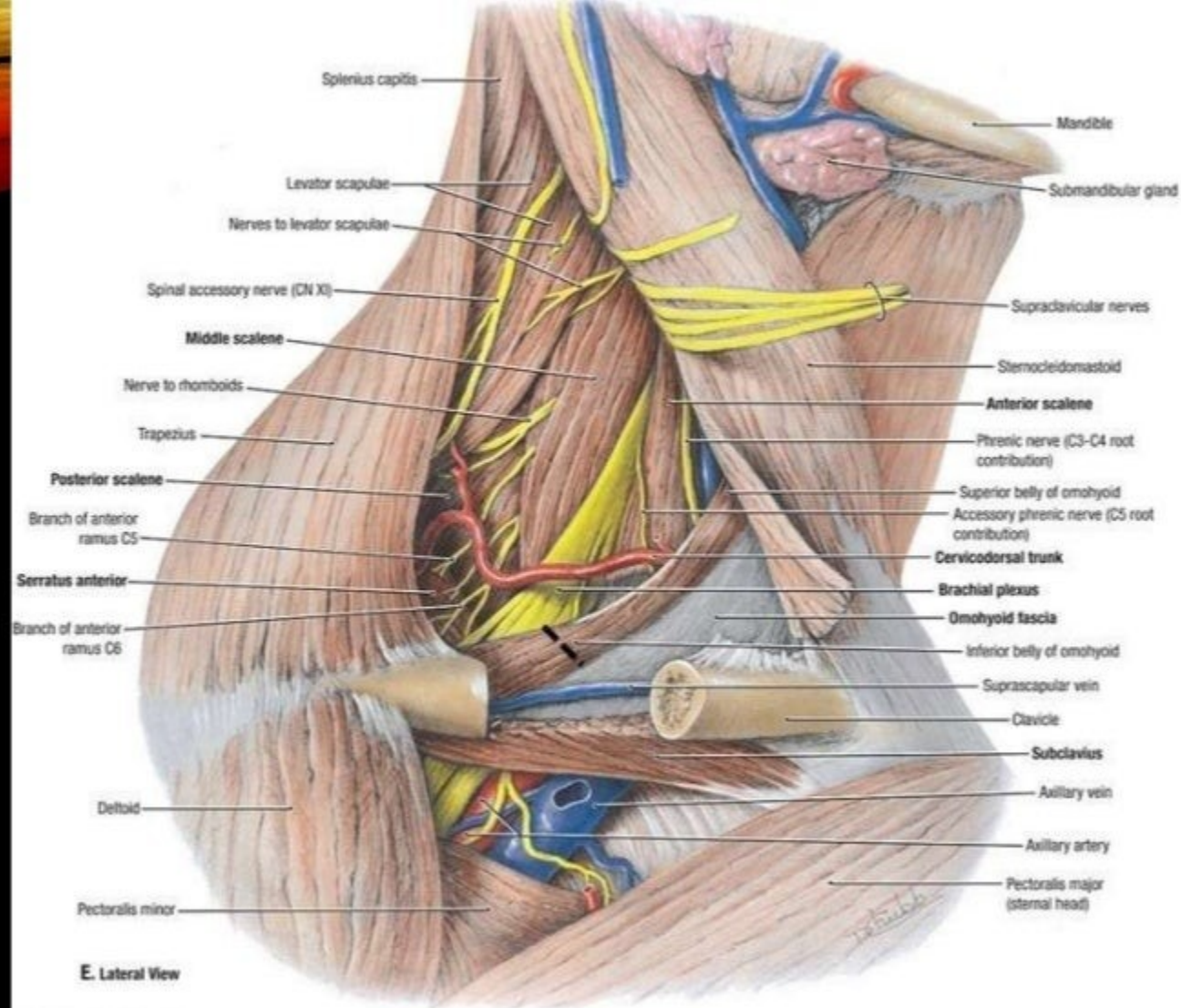
*Remember, extension of blocks reflect only cutaneous blockade. Muscular and Osseous Innervations are not strictly superimposed.

Brachial Plexus



RELEVANT ANATOMY- GENERAL

- Brachial Plexus runs between middle and anterior scalene muscles.
 - **Phrenic nerve** passes between these muscles, runs ventrally to the anterior scalene muscle. A diaphragmatic twitch during interscalene block performed with a nerve stimulator indicates placement of the needle anterior to the plexus.
 - **Recurrent Laryngeal nerve**, more medial, also close to the plexus, mainly on the right side. Can be blocked by diffusion of local anesthetic.
- Medially to anterior scalene muscle runs the **cervical sympathetic chain**. Medially and dorsally lies the vertebral artery and central nervous structures, risk of injection into vertebral artery or epidural or intrathecal anaesthesia.
- Caudally, the plexus overhangs the pleura and the subclavian vessel.



E. Lateral View

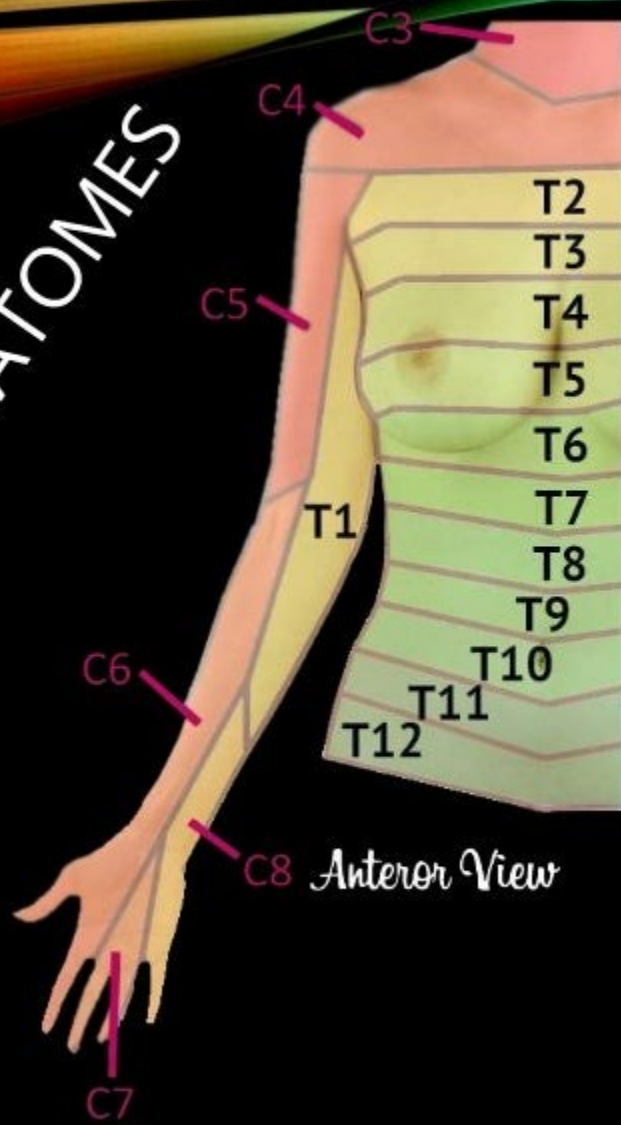
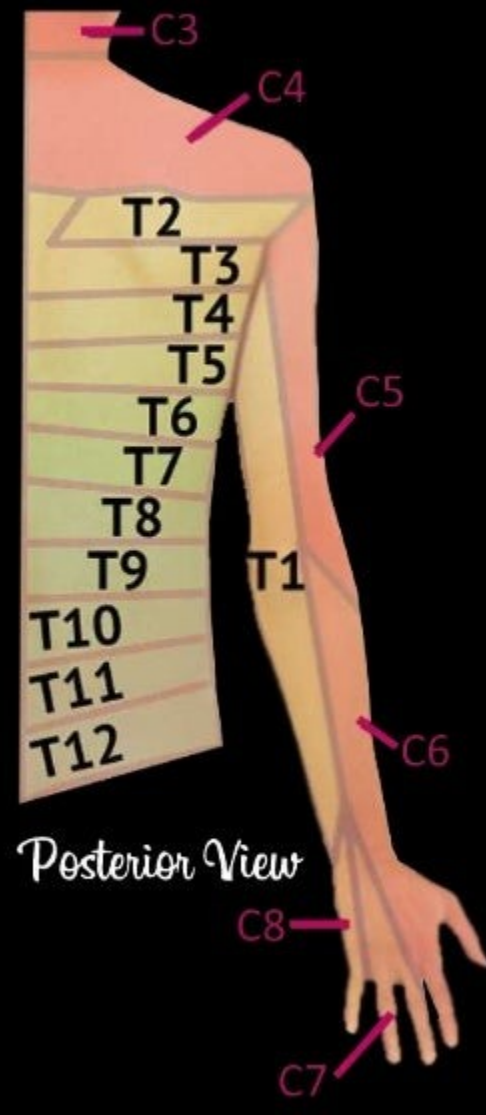
RELEVANT ANATOMY- GENERAL

- COLLATERALS OF THE BRACHIAL PLEXUS

- **Dorsal scapular nerve** arises from C5 and passes through the middle scalene muscle to supply the rhomboideus and levator scapulae muscles.
- **Long thoracic nerve** supplying the serratus anterior arises from C5,6,7 and also pierces middle scalene as it passes posterior to the plexus.
- The **suprascapular nerve** participates to the shoulder sensory innervation and provides innervation of the infra and supraspinatus muscles.

The **spinal accessory nerve** runs posterior to the brachial plexus over the middle and posterior scalene muscles. With a nerve stimulator, a contraction of the trapezius indicates placement of the needle posterior to the plexus.

UPPER LIMB DERMATOMES



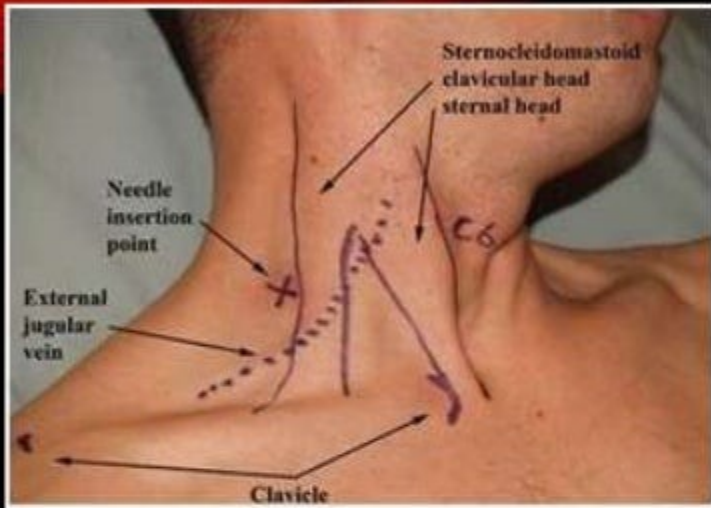
INTERSCALENE BLOCK



KEEP QUESTIONS IN MIND

- Territories concerned?
- Tourniquet required? If yes, which level?
- Can the shoulder/elbow be moved?
- Is catheter technique indicated?
- Any contraindication to scheduled approach?
- Any need to associate 2 or more techniques?
- Is it a day case surgery?

INTERSCALENE BLOCK



- Puncture is performed in the interscalene groove, between anterior and middle scalene muscles. Block mainly concerns the trunks of plexus.
- Equipment
 1. Nerve stimulator
 2. 25mm insulated needle
 3. Sterile gloves
 4. Gauze and disinfectant solution
 5. Syringes with anesthetic local solution

ADDITIVES:

- **Clonidine** (0.5-1 mcg/kg) prolongs block duration (3-4hrs).
- **Alkalinization** helps reduce onset of time of block.
- **Epinephrine** prolongs block but not more than clonidine.

LA- 0.5ml/Kg (max. 40mL)

Bupivacaine 0.5% 20-40 ml

Ropivacaine 0.5- 0.75% 20-40ml



INTERSCALENE BLOCK

INDICATIONS

- Rotator Cuff Repair
- Recidivant luxations
- Total shoulder arthroplasty
- Acromiopathies
- Arthrolyses
- Carcinologic surgery of the shoulder
- Physiotherapy of the shoulder

CONTRAINDICATIONS

- Contralateral Phrenic palsy
- Contralateral Pneumothorax
- Contralateral Pneumonectomy
- Any patient incapable of enduring a 25% decrease in VC.
A vital capacity of <1L is an absolute contraindication.
- Sensory defects in territory.
- Bilateral surgery of the shoulder
- Non specific- Coagulopathy, Infection at site of injection, personality disorder.

INTERSCALENE BLOCK

- POSITION

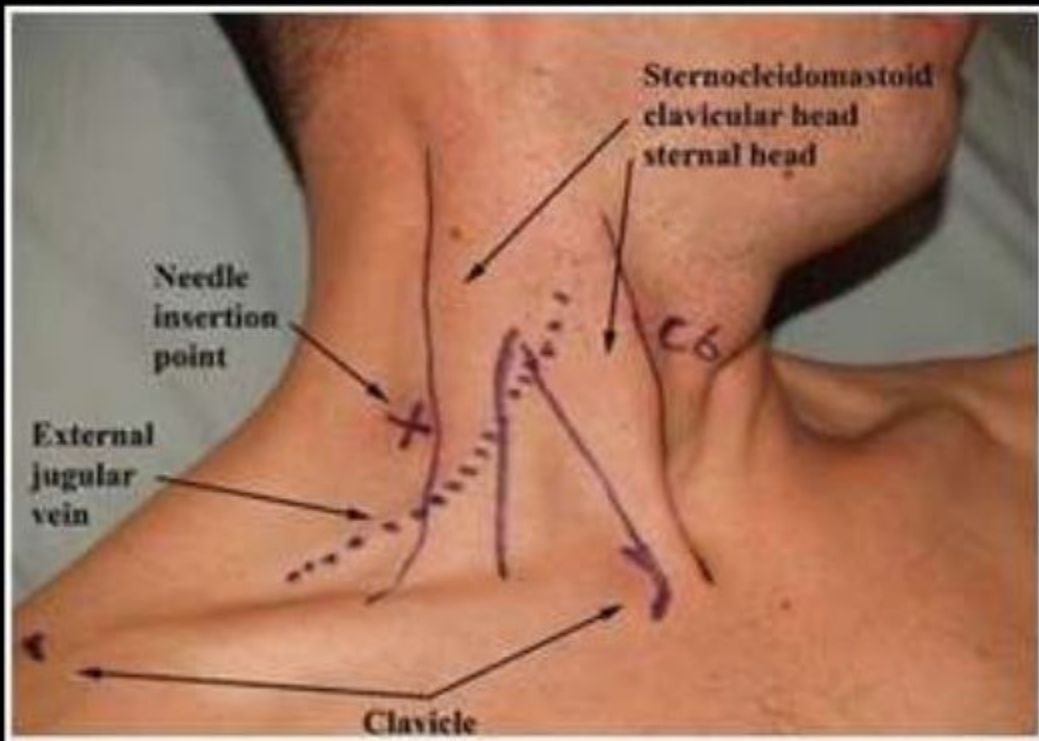
Patient supine, head slightly turned away from side to be blocked. Arm along the body, slightly flexed. Patient awake.

- ANATOMICAL LANDMARKS

Posterior head of SCM, easily palpated if the patient lifts the head against resistance. Behind this muscle, palpate interscalene groove between anterior and middle interscalene muscles. Better by asking patient to sniff.

- PUNCTURE POINT

Junction of interscalene groove and line drawn passing through cricoid cartilage. (If lateral head of SCM is difficult to palpate, puncture 3cm behind the more prominent part of the SCM.)



INTERSCALENE BLOCK

- PUNCTURE

Needle inserted to skin, nerve stimulator twitched to 2mA. Needle is inserted into the interscalene groove at the level of the cricoid cartilage and advanced into the groove with a caudal, medial and slightly posterior direction. Motor responses are looked for.

Failure to obtain motor response to nerve stimulation should prompt withdrawal of the needle and re-insertion in 5% to 10% angle anterior or posterior to the initial plane.

- INJECTION

When twitches are obtained at a current of 0.3 to 0.5mA, LA solution is injected in 3-5mL boluses, pausing to aspirate between each. Motor response disappears after first 1ml. Rapid incapacity.

Sense of pins and needles in first 2 fingers(money sign).

SURGERY can start **20-30mins** after the block performance.

INTERSCALENE BLOCK

COMPLICATIONS

- **Respiratory Complications** ← **MOST COMMON**
Ipsilateral Hemidiaphragm paresis, Recurrent laryngeal nerve block, Pneumothorax
- LA Toxicity
Injection of LA in vertebral artery/ small cervical vessels.
- Neurological Complications.
Horner's syndrome- 18-20 % cases.
Pourfour- Dupetit's syndrome- exophthalmia, mydriasis, impossibility to close ipsilateral eye- **rare**- Due to irritation of cervical sympathetic chain.
- Epidural injection – Suspected if sensory defect of C/L UL occurs.
Avoid by orienting needle medially, caudally and slightly dorsally.
 - Neuropathy due to intraneural injection or a direct trauma of the nerve by the needle.

SUPRACLAVICULAR BLOCKS

Greatest chance to block Brachial Plexus with only one injection.

KEEP QUESTIONS IN MIND

- Territories ? Axillary (Inconsistent), Musculocutaneous, Median, Radial, Ulnar
- Shoulder Surgery?- Interscalene better.
- Elbow Surgery?- Infraclavicular block better suited.
- Supraclavicular??? – Proximal upper arm surgery from superior third of humerus to the elbow.
- Indwelling Catheter can be placed incase early mobilization is needed.

CONTRAINDICATIONS

LOCAL History of Ipsilateral:	GENERAL
Carotid surgery	Patients with respiratory Distress- risk of phrenic block in 30- 80% cases.
LN Surgery	Contralateral phrenic nerve palsy
Radiotherapy	Coagulation defect
-	Ambulatory surgery

SUPRACLAVICULAR BLOCK

- POSITION

Patient supine, arm along body, the head slightly rotated to opposite side. Physician on side to be blocked.

- ANATOMICAL LANDMARKS

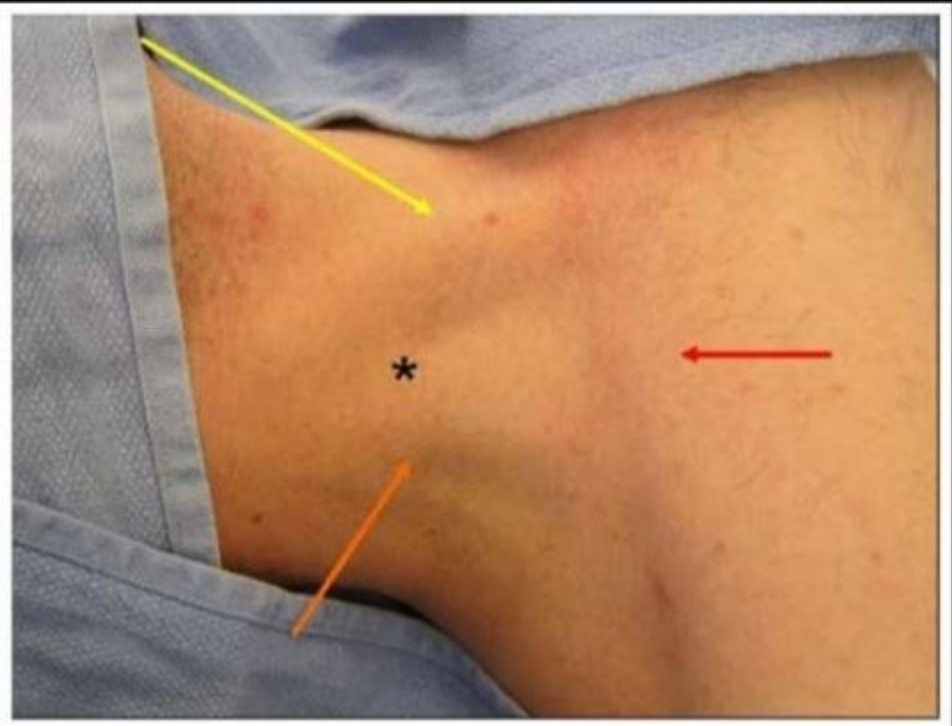
- EJV;

- Medial aspect of trapezius insertion on the clavicle

- top of Sedillot's Triangle (limited by clavicle and 2 heads of SCM).

- PUNCTURE POINT

Two lines drawn on patient: One from top of Sedillot's Triangle to medial insertion of trapezius muscle on clavicle. Second is over EJV. Puncture at intersection of lines.



SUPRACLAVICULAR BLOCKS



- Puncture is performed at intersection of the 2 lines. Caudad and laterally directed. As superficial fascia is pierced, NS is set at 1.5mA with a 0.1 msec duration.
- Usual response
Triceps contraction, contraction of posterior forearm muscles. Biceps contraction is good response.
- MAXIMUM DEPTH- 1- 2.5 cm

ADDITIVES:

- **Clonidine** (0.5-1 microgram/kg) prolongs block duration (3-4hrs).

- **Alkalinization** helps reduce onset of time of block.

- **Epinephrine** prolongs block but not more than clonidine.

LA- 0.5ml/Kg (max. 30mL)

Catheter- Bolus- Bupivacaine 0.25% 20ml/8Hr

Continuous injection of ropivacaine 0.2% 7-10ml/Hr

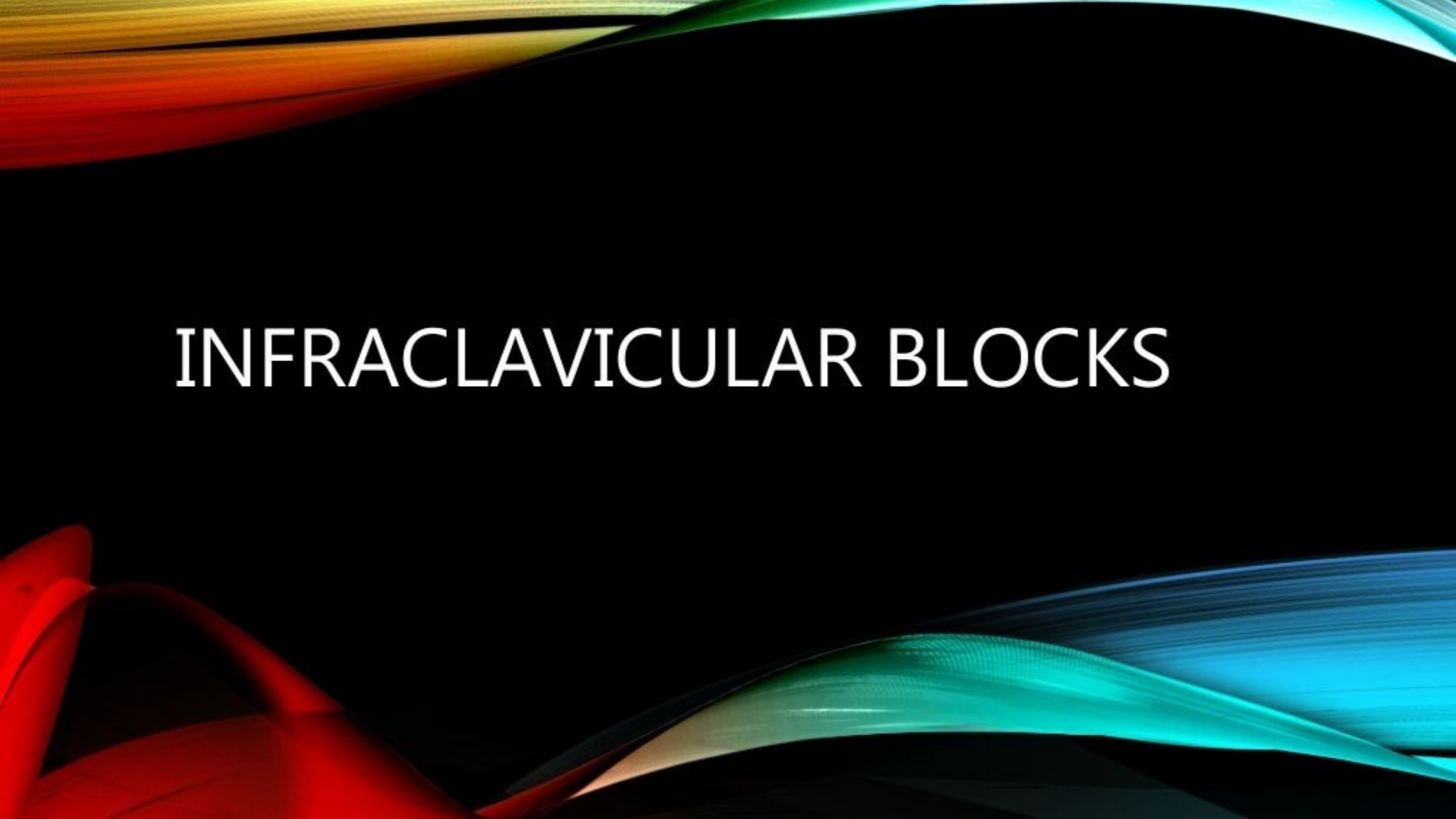
- Catheter not to be advanced more than 2cm.

SUPRACLAVICULAR BLOCK COMPLICATIONS

IMMEDIATE	OTHERS
Diaphragmatic I/L palsy- phrenic nerve	Recurrent Laryngeal nerve block
Pneumothorax	Claude Bernard Horner syndrome
Intravascular injection	

Other Named Techniques for Supraclavicular Block

- Kullenkamp, Winnie-s paravascular, **Dupre & Danel**, Dalens, Browns, Pham- Dang ISCM

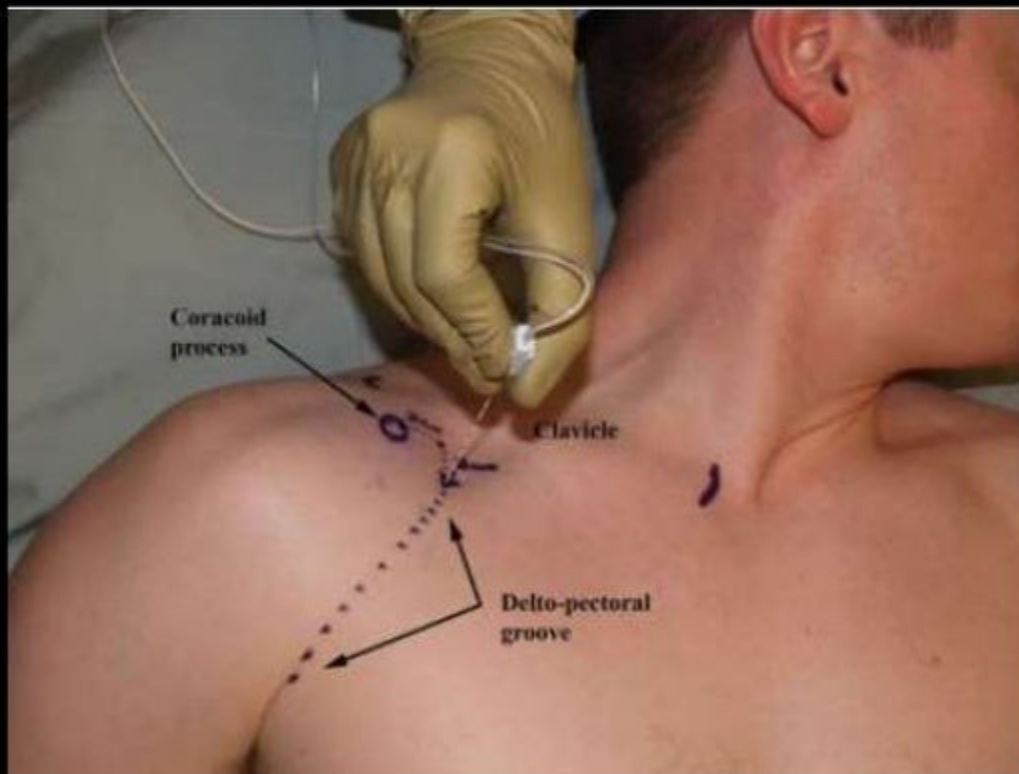


INFRACLAVICULAR BLOCKS

INFRACLAVICULAR BLOCKS

- Nerves involved: Axillary, Musculocutaneous, Median, Ulnar, Radial, Median antebrachial and brachial cutaneous nerves.
- INDICATIONS:
Anesthesia of upper arm, from shoulder to the hand.
Suitable for surgeries of Distal arm, elbow, forearm, wrist.
- Short Procedure and Ambulatory Surgery
 - Mepivacaine 1-2%
- Long Surgical Procedure
 - Ropivacaine 0.5% to 0.75%, if long duration postop analgesia needed.
- VOLUME TO INJECT:
Single injection technique- 30-40 ml
Multiple Injections technique- 20-25 ml

INFRACLAVICULAR BLOCKS



- POSITION
Patient supine, arm along body, the head slightly rotated to opposite side. Physician on side to be blocked.
- ANATOMICAL LANDMARKS
-Clavicle and Coracoid process are drawn on the skin.
- PUNCTURE POINT
Site is drawn 2cm caudad and 1cm medial to coracoid process. Thus, site is in the deltopectoral groove.

Needle progression must be very careful to avoid perforation of axillary artery.

INFRACLAVICULAR BLOCKS

- TECHNIQUES: Vertical Infraclavicular Block, **Coracoid Block**, Modified Raj
- CATHETER INSERTION: After anaesthetising skin, needle is inserted at puncture site, PN Stimulator activated and set up at an intensity of 1.5 mA and frequency of 1Hz. Needle slowly driven in, perpendicular to skin. While progressing, search for evoked motor response.
 - *If evoked response is stimulation of musculocutaneous nerve(elbow flexion), needle tip is too superficial and too medial. Redirect more medially.
 - *Median nerve or a radial nerve evoked motor response is more reliable(flexion and pronation of wrist).
- Reduce intensity and inject LA only when intensity is equal to or below 0.5 mA. Inject 1 ml and motor response will disappear immediately.

AXILLARY BLOCK

Lack of serious complications, Good Analgesia

AXILLARY BLOCK

- **INDICATIONS:**
Anaesthesia of Hand, Wrist, Forearm surgery of longer duration in bloodless field
- **Landmarks:**
Pulse of Axillary Artery, Coracobrachialis muscle, P.major muscle, Biceps muscle, Triceps muscle
- **Nerves involved:**
Reliably blocks the **median and radial nerves** (but *not* the axillary and **musculocutaneous** – leaves the brachial plexus at the level of the coracoid process)

AXILLARY BLOCK



- POSITION
Patient placed in supine position with the head facing away from the side to be blocked. The arm abducted to form an approximate 90° angle in the elbow joint
- ANATOMICAL LANDMARKS
course of the axillary artery of the medial upper arm can be palpated dorsad from the medial bicipital groove.
- PUNCTURE POINT
Slightly above the axillary artery, at the highest point in axilla and slightly beneath the pectoralis major muscle which borders the axilla to the ventral.



Fig. 38:
Axillary nerve block - Puncture site



Fig. 39:
Axillary nerve block -Puncture technique

- Needle is inserted parallel to the axillary artery at a 30°-angle to the skin. Contractions are sought in the area of the median nerve, or even better, of the radial nerve. Once the threshold current is reached, 40-50 ml of the local anaesthetic are injected.
- Under no circumstances should the anaesthetic be injected if the musculocutaneous nerve has been stimulated, since at this height it has already left the neurovascular sheath and runs within the coracobrachialis muscle.

AXILLARY BLOCK SUMMARY

The most important landmark is the axillary artery, as the neurovascular bundle is oriented reliably around it – **median nerve superiorly, ulnar nerve inferiorly, radial nerve posterior/lateral**

Attempt to **block the radial nerve first**, as it is deepest and hardest to access – 10 – 15 cc should be adequate at each nerve, however each perineural injection makes visualization more difficult (hence starting with the deepest)

Terminal nerves are difficult to visualize, and at the level of the axillary artery, **oftentimes the median nerve is the only one visible – in this instance, deposition of local anesthetic circumferentially surrounding the axillary artery will result in a successful block**

Supplementation

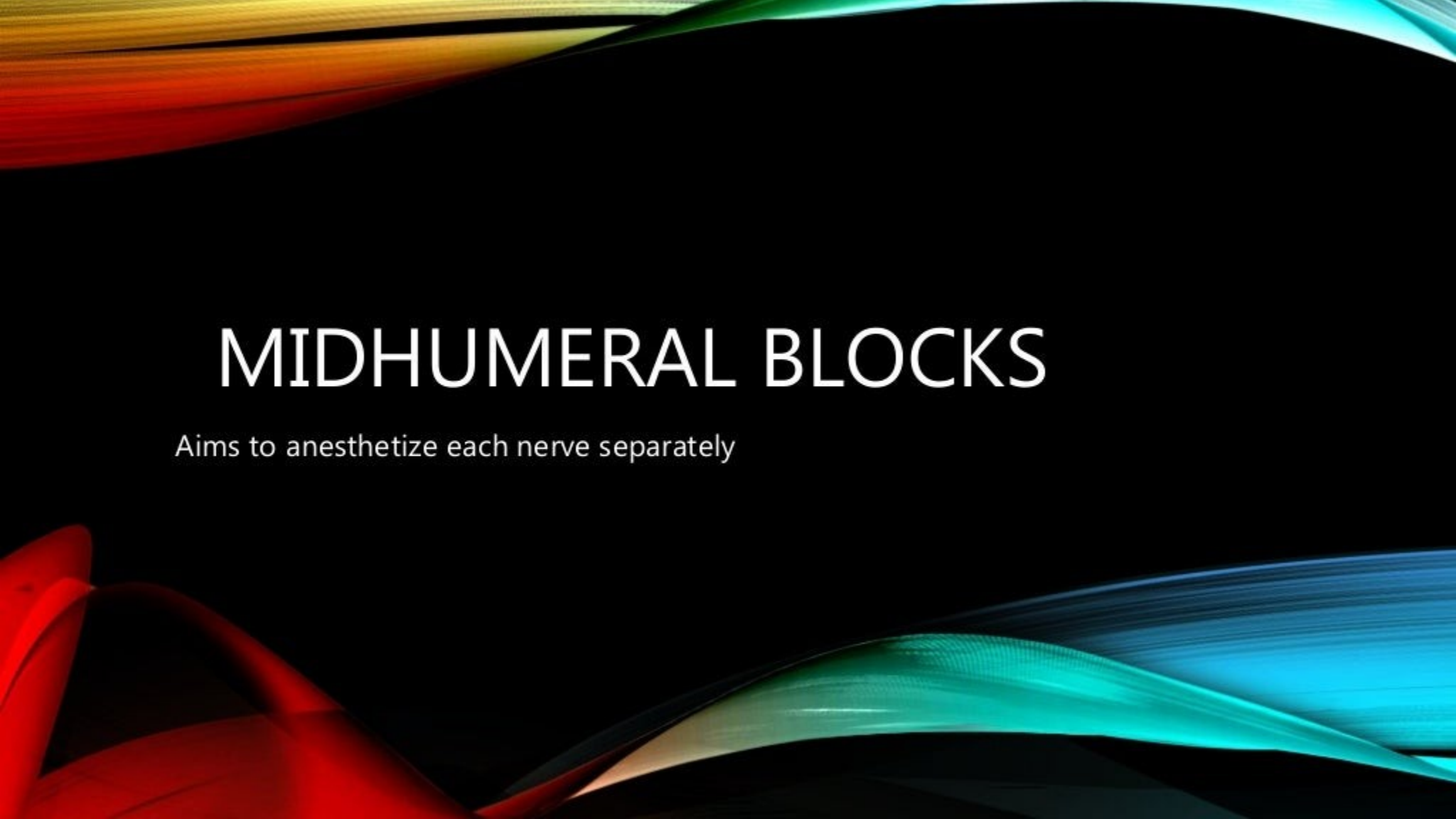
The **intercostobrachial nerve, originating from the T2 intercostal, is often blocked by the local wheal over the axillary artery** in this approach, however to ensure complete blockade, an additional 1-2 mL of local anesthesia can be added superficially around the palpable axillary pulse.

The **musculocutaneous nerve can be blocked either by injecting into the coracobrachialis muscle or at the lateral, superficial aspect of the antecubital fossa** just above the interepicondylar line

AXILLARY BLOCK

COMPLICATIONS AND TECHNIQUES TO AVOID THEM

Infection	<ul style="list-style-type: none">• An aseptic technique is used.
Hematoma	<ul style="list-style-type: none">• Avoid multiple needle insertions, particularly in patients on anticoagulant therapy.
Vascular puncture	<ul style="list-style-type: none">• A steady pressure at the site of needle insertion for 3–5 min should be maintained if the axillary artery is punctured.
Local anesthetic toxicity	<ul style="list-style-type: none">• Systemic toxicity occurs most commonly during or shortly after the injection of local anesthetic. The most common cause is inadvertent intravascular injection.• Careful reconsideration of the use of large volumes of long-acting anesthetic in frail and elderly patients is needed.• Careful, frequent aspiration should be performed during the injection.• Avoid fast, forceful injection of local anesthetic.
Nerve injury	<ul style="list-style-type: none">• Never inject local anesthetic when abnormal resistance (high injection pressure) is encountered on injection.• Local anesthetic should never be injected when a patient complains of severe pain or exhibits a withdrawal reaction suggestive of severe discomfort on injection.• When stimulation is obtained with a current intensity of $<0.2\text{--}0.3\text{ mA}$, the needle should be withdrawn slightly to obtain the same response with the current $\geq 0.2\text{mA}$.



MIDHUMERAL BLOCKS

Aims to anesthetize each nerve separately

MIDHUMERAL BLOCKS

- Site of needle entry is the junction between the upper 1/3 and lower 2/3 of the arm. Terminal nerves of the brachial plexus are separated at this location. The **median** and **ulnar** nerves are found superficial and adjacent to the brachial artery, the **musculocutaneous** nerve under the biceps muscle belly and the radial nerve posterior to the humeral shaft.

MIDHUMERAL BLOCKS

- NERVE LOCALISATION

- Place the transducer on the upper 1/3 of the arm to obtain a transverse view of the brachial artery in an outstretched arm.

- Identify the triceps, biceps and coracobrachialis muscles surrounding the artery.

- The **median** and **ulnar** nerves are expected to be superficial (often within 1 cm from the skin surface) and adjacent to the brachial artery. They often have a **honey comb appearance** and are heterogeneous in echogenicity.

- Identify the **musculocutaneous nerve** between the biceps and coracobrachialis muscles. This nerve appears predominantly hyperechoic.

- The **radial nerve** is not usually visualized at this level since it lies posterior to the humeral shaft.



MIDHUMERAL BLOCKS

- NEEDLE INSERTION

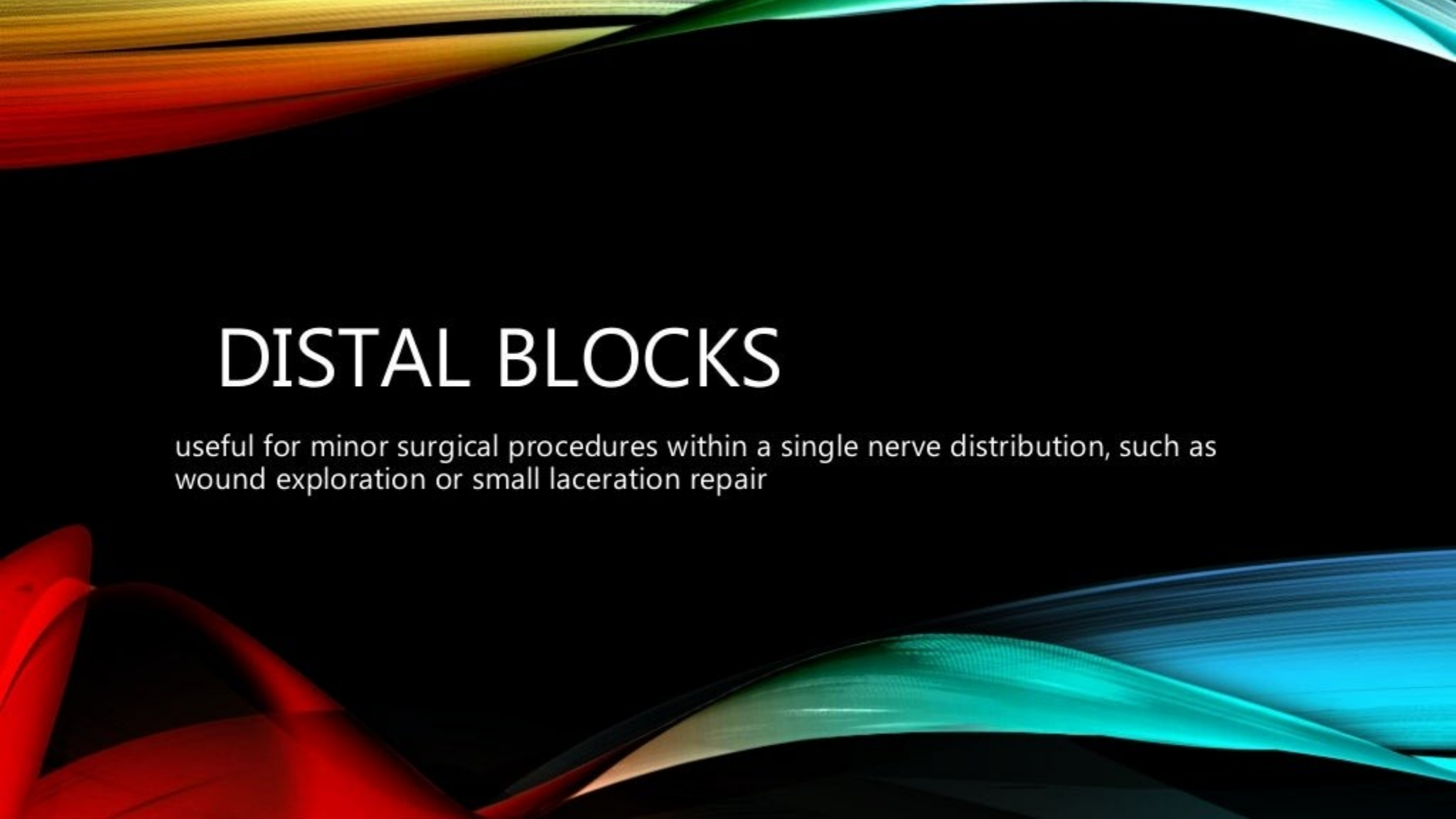
- Ultrasound guided midhumeral block is considered a BASIC skill level block because this is a superficial block.

- Insert a 5 cm 22 G insulated needle parallel to the long axis of the transducer inline with the ultrasound beam (in plane approach).

- Visualize the median, ulnar and musculocutaneous nerves in transverse view.
- Identify the pulsatile brachial artery which is anechoic. Apply firm transducer pressure to collapse surrounding venous structures.

- The needle should be inserted at a shallow angle because the median and ulnar nerves are both superficial. As the needle travels in the same plane as the ultrasound beam, the path of advancement can be visualized in real-time as the needle approaches the target nerves.
 - Inject LA to achieve circumferential spread.





DISTAL BLOCKS

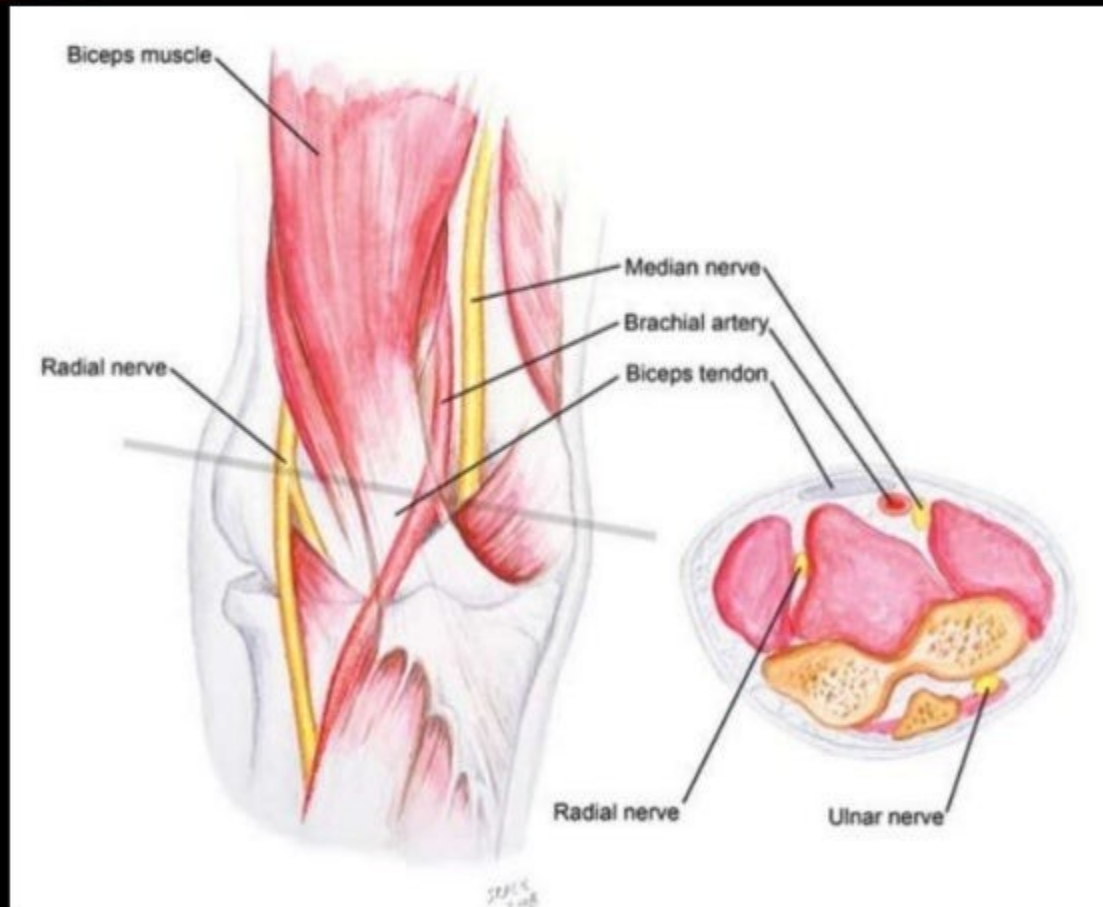
useful for minor surgical procedures within a single nerve distribution, such as wound exploration or small laceration repair

RELEVANT ANATOMY- GENERAL

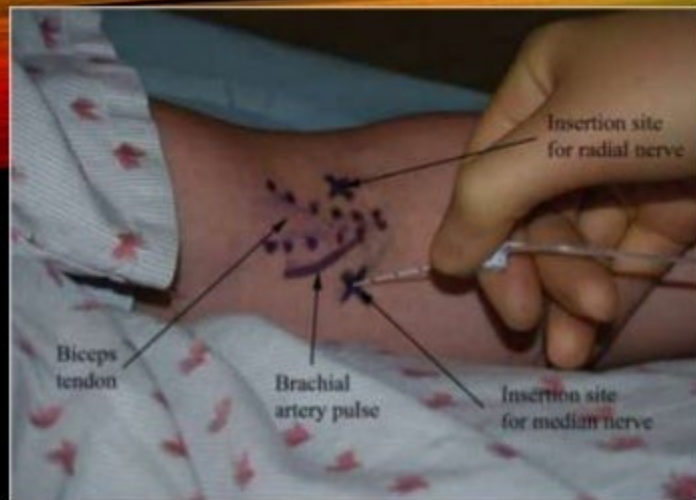
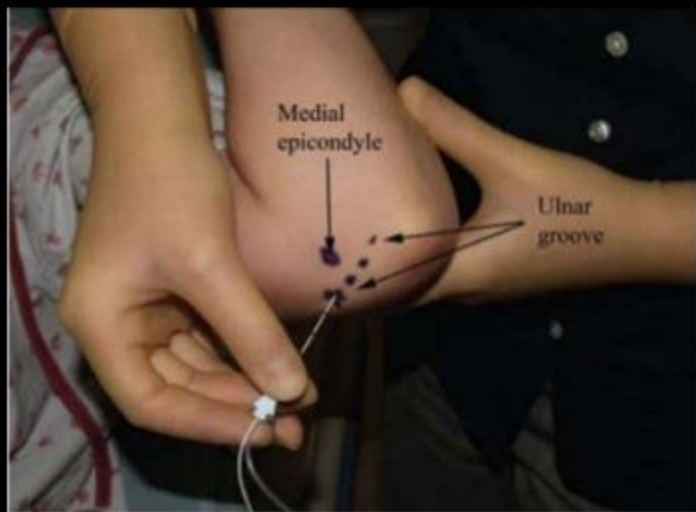
The three major peripheral nerves of the upper extremity (radial, median, and ulnar) may all be blocked at the level of the elbow.

- Because of its location within the **ulnar groove**, the **ulnar nerve** has the most reliable landmarks. The ulnar groove is palpated between the medial epicondyle of the humerus and the olecranon process. Ulnar nerve blockade at this level provides sensory blockade to the medial aspect of the hand, including the fifth digit and the medial half of the fourth digit.
- The **brachial artery** is the landmark for median nerve blockade at the level of the elbow. The **median nerve** lies just medial to the artery and may be blocked utilizing paresthesia, nerve stimulation, or ultrasound guidance based on this landmark. Median nerve blockade is useful for the anterolateral surface of the hand, including the thumb through middle finger.
- The **radial nerve** lies between the brachialis and brachioradialis muscles, **1 to 2 cm lateral to the biceps tendon**. Using the biceps tendon as a landmark, the radial nerve can be blocked using paresthesia, stimulator, or ultrasound-based techniques. The radial nerve block at this level provides sensory anesthesia to the dorsolateral aspect of the hand (thumb, index, middle, and lateral half of the ring finger) up to the distal interphalangeal joint.

DISTAL BLOCKS



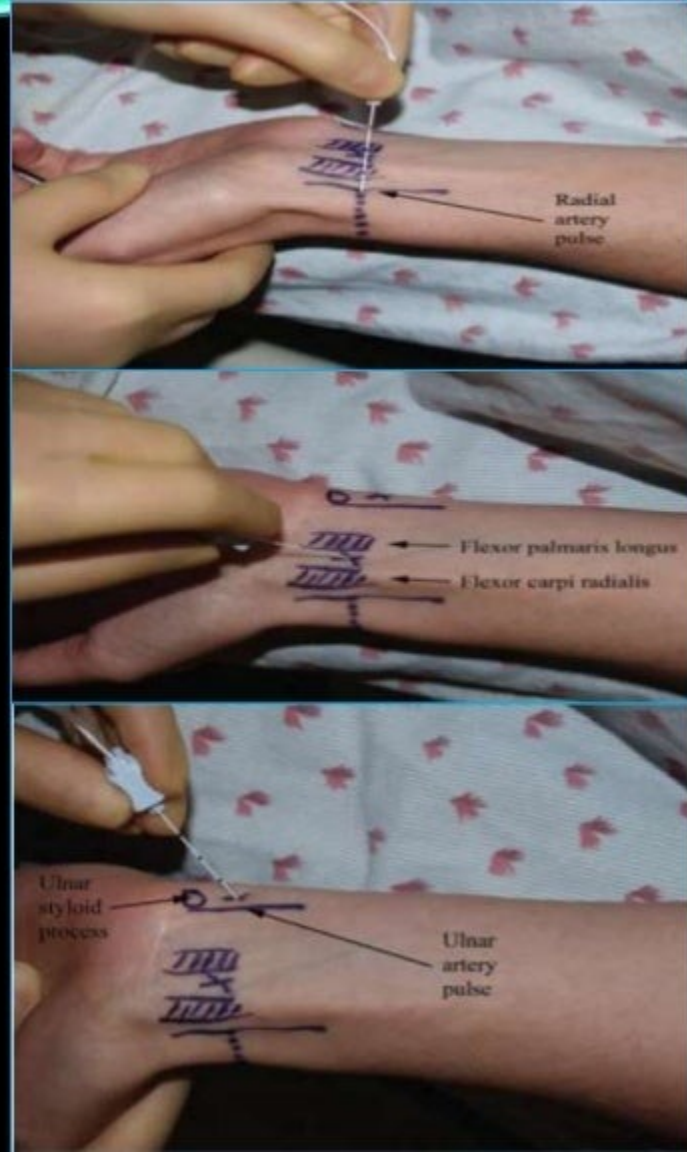
AT THE ELBOW



- **Radial nerve.** Identify the biceps tendon. Insert the needle lateral to the tendon and above the antecubital crease. The nerve lies within the groove between the tendon and the brachioradialis muscle. Two excellent localization cues are paresthesia and motor response (finger/wrist extension) elicited by a nerve stimulator. Inject 5 to 7 mL of local anesthetic.
- **Median nerve.** Insert the needle at the antecubital crease, just medial to the palpated brachial pulse. When a paresthesia or motor response (finger/wrist flexion or hand pronation) is elicited, usually at 1- to 2-cm depth, inject 5 to 7 mL of local anesthetic.
- **Ulnar nerve.** With the elbow flexed at mid-range, **insert the needle into the ulnar groove** 1 to 3 cm proximal to the medial epicondyle. Take care to avoid excessive injection pressure or intraneural injection in this relatively tight space. **Limit local anesthetic injection to 4 or 5 mL.**

AT THE WRIST

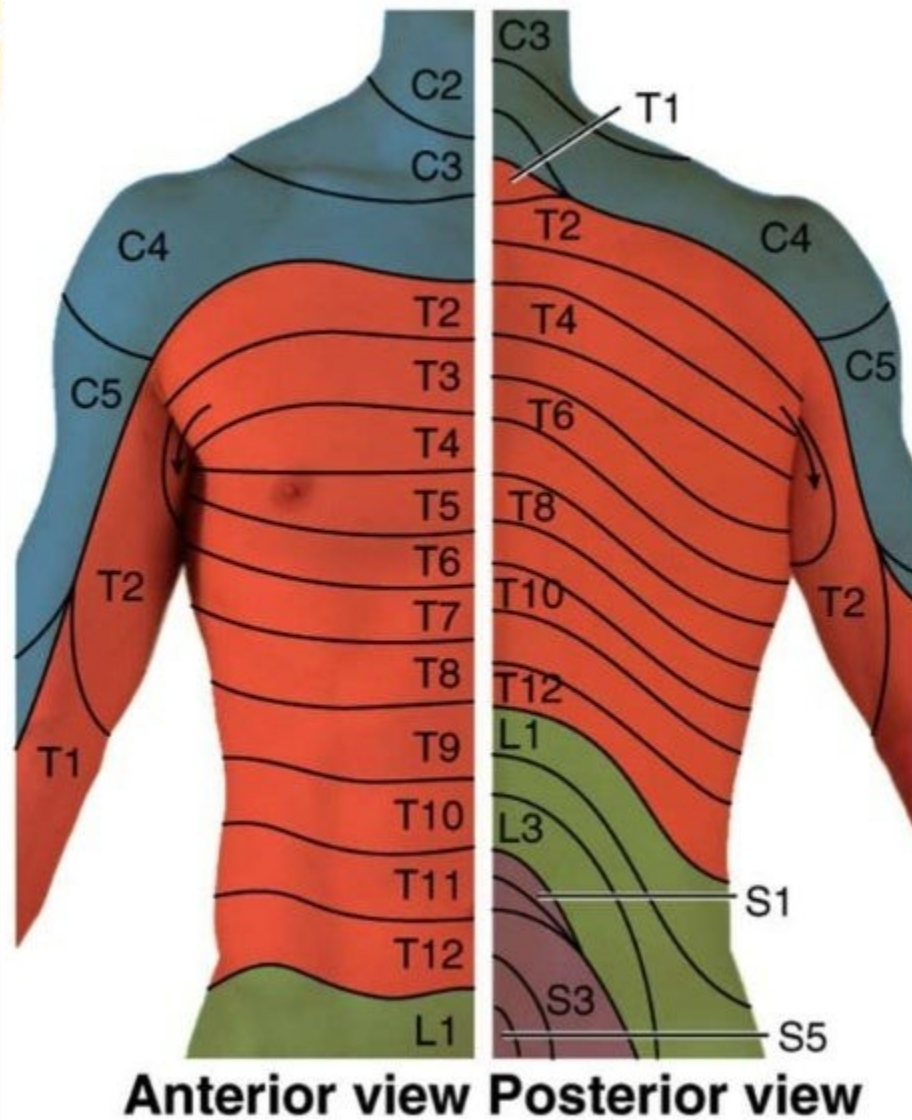
- **Radial nerve.** Make an injection along the lateral border of radial artery 2 cm proximal to the wrist. Then extend the injection dorsally over the border of the wrist, covering the anatomic snuffbox. Injection of 5 to 7 mL of local anesthetic is usually sufficient.
- **Median nerve.** Identify the tendons of the flexor palmaris longus and flexor carpi radialis by flexing the wrist during palpation. Insert the needle between the tendons 2 cm proximal to the wrist flexor crease, posteriorly towards the deep fascia. Inject 3 to 5 mL of local anesthetic while withdrawing the needle.
- **Ulnar nerve.** Ulnar pulse is difficult to appreciate in many patients. A practical approach is to insert the block needle just proximal to the ulnar styloid process. After aspiration to confirm that the needle is not within the ulnar artery, inject 3 to 5 mL of local anesthetic.





THORACIC LEVEL- BLOCKS

THORAX DERMATOMES





INTERCOSTAL BLOCK

INTERCOSTAL BLOCK

Essentials

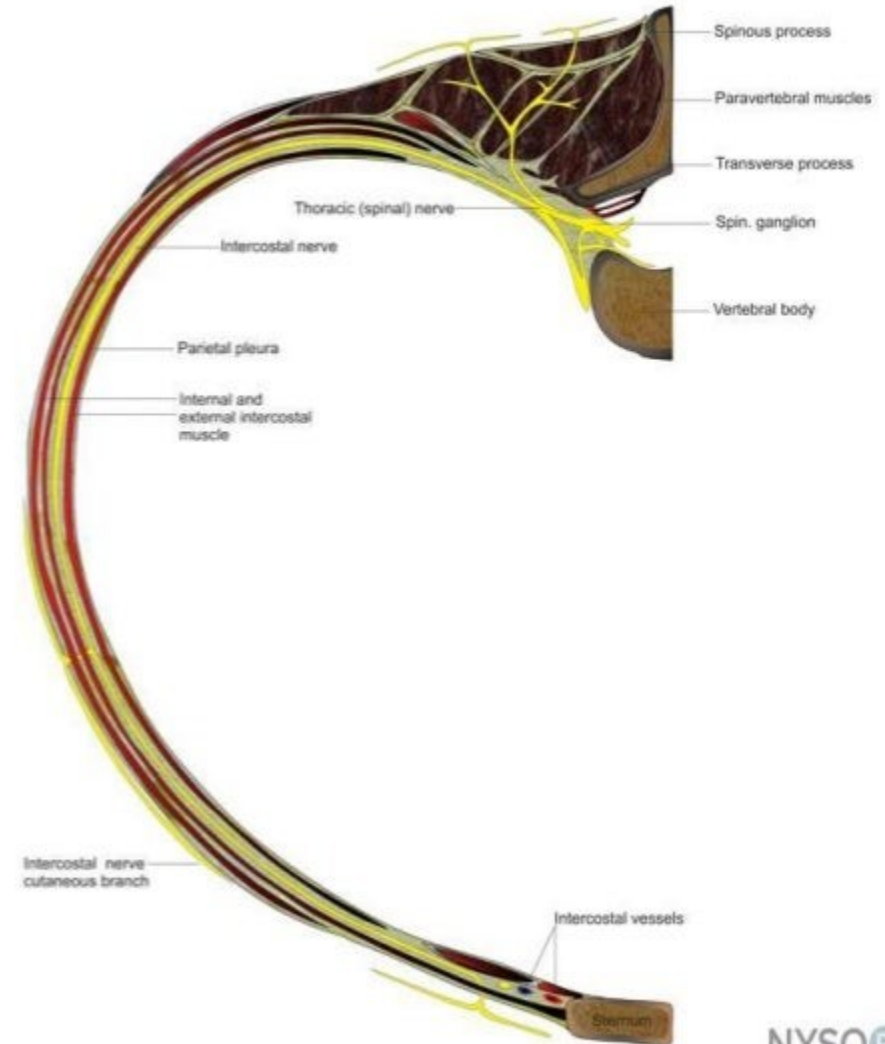
- Indications: thoracic or upper abdominal surgery, rib fractures, breast surgery
- Landmarks: angle of the rib (6-8 cm lateral to the spinous process)
- Needle insertion: Under the rib with approximately 20-30° cephalad angulation
- Target: needle insertion 0.5 cm past the inferior border of the rib
- Local anesthetic: 3-5 mL per intercostal level
- Complexity level: advanced



INTERCOSTAL BLOCK

Regional Anesthesia Anatomy

- After emerging from their respective intervertebral foramina, the thoracic nerve roots divide into dorsal and ventral rami. Dorsal ramus provides innervation to the **skin and muscle of the paravertebral region**; Ventral ramus continues laterally as **the intercostal nerve**. This nerve then pierces the **posterior intercostal membrane** approximately 3 cm lateral to the intervertebral foramen and enters the subcostal groove of the rib, where it travels inferiorly to the intercostal artery and vein.
- Initially, the nerve lies between the parietal pleura and the inner most intercostal muscle. Immediately proximal to the angle of the rib, it passes into the space **between the innermost and internal intercostal muscles**, where it remains for much of the remainder of its course.
- At the midaxillary line, gives rise to the lateral cutaneous branch, which pierces the internal and external intercostal muscles and supplies the muscles and skin of the lateral trunk. The continuation of the intercostal nerve terminates as the anterior cutaneous branch, which supplies the skin and muscles of the anterior trunk, including the skin overlying the sternum and rectus abdominis.



INTERCOSTAL BLOCK

Choice of Local Anesthetic

- The performance of intercostal blocks is associated with relatively minor patient discomfort, although needle contact with the periosteum can be uncomfortable.
- A small dose of midazolam (2 mg) and alfentanil (250-500 µg) just before beginning the block procedure is usually adequate to decrease the discomfort.
- Excessive sedation should be avoided because positioning becomes difficult when patients cannot keep their balance in a sitting position.
- The first sign of successful blockade is the loss of pinprick sensation at the dermatomal distribution of the nerve being blocked. The higher the concentration and volume of local anesthetic used, the faster the onset.

INTERCOSTAL BLOCK

Patient Positioning

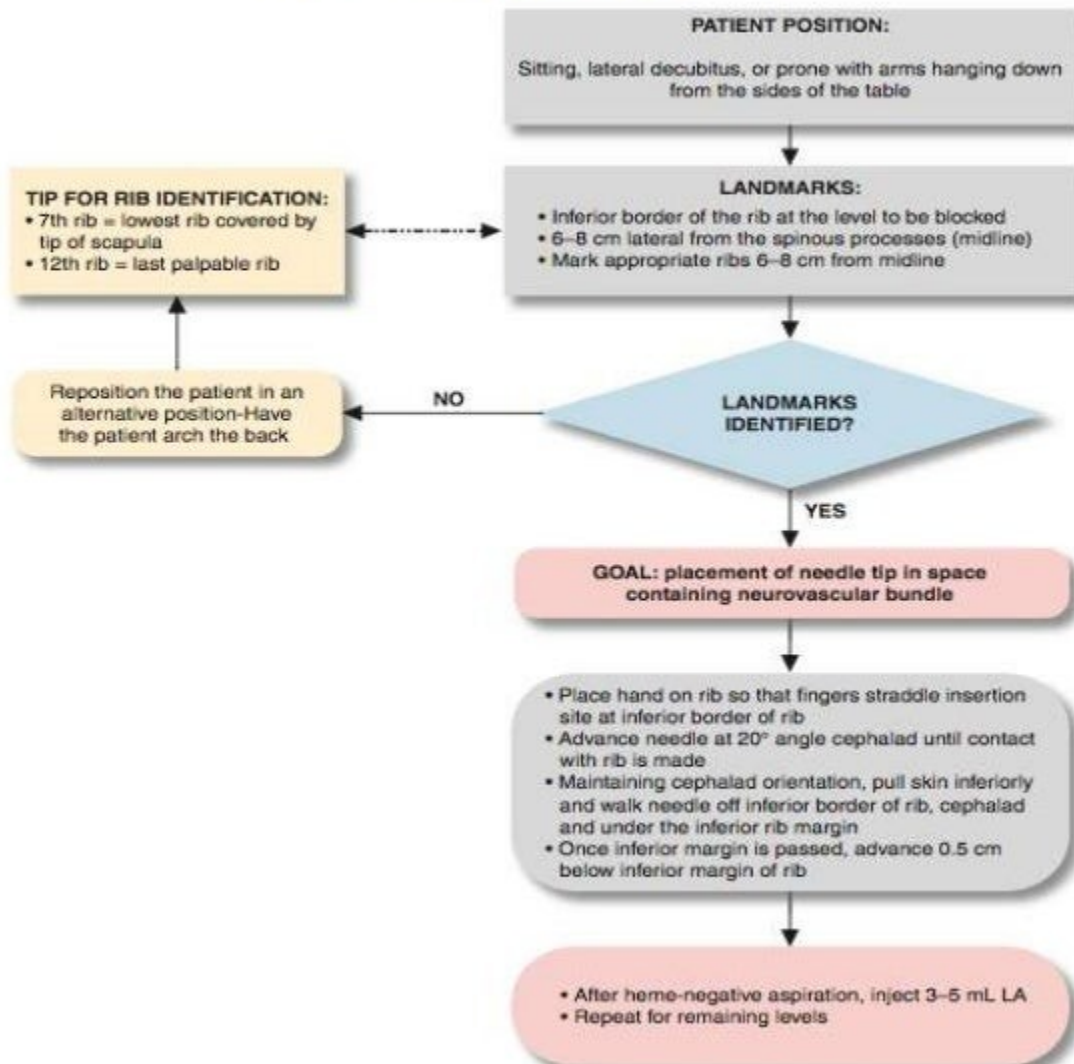
An intercostal block can be performed with the patient in the sitting, lateral decubitus, or prone positions. With the patient in sitting or lateral position, it is helpful to have the patient's spine arched with the arms extended forward. Patients who are prone are best positioned for the block by placing a pillow under the abdomen and with the arms hanging down from the sides of the bed. This rotates the scapulae laterally and permits access to the angles of the rib above the level of T7.

- For thoracotomy or upper abdominal incisions, an estimate of the levels required for effective analgesia can be made after discussion with the surgeon as to the planned approach and length of incision.
- Analgesic blocks for rib fractures are planned based on the area of the injury. Typically, in addition to the estimated dermatomal levels, one additional level above and one below the estimated levels are also blocked.





INTERCOSTAL NERVE BLOCK



COMPLICATIONS OF INTERCOSTAL BLOCK AND PREVENTIVE TECHNIQUES

Infection	<ul style="list-style-type: none">• An aseptic technique should be used.
Pneumothorax	<ul style="list-style-type: none">• Avoid intercostal blockade where a pneumothorax would be catastrophic. Limit advancement of needle under the rib.• Maintain precise control of the needle at all times.• The palpating hand should rest firmly on skin to prevent inadvertent movement.
Peritoneal/visceral injury	<ul style="list-style-type: none">• Rare. Avoid excessive needle advancement.
Local anesthetic toxicity	<ul style="list-style-type: none">• An important concern because systemic absorption can be rapid. Large volumes of long-acting anesthetic should be reconsidered in older and frail patients.• Consider using chlorprocaine for skin infiltration to decrease the total dose of the more toxic, long-acting local anesthetic.
Spinal anesthesia	<ul style="list-style-type: none">• Because the dural sleeves can extend up to 8 cm from the midline, there is a small risk of subarachnoid spread if the needle tip contacts the dural sleeve.• Maintain a high index of suspicion of neuraxial spread. If bilateral block occurs treat hemodynamic/respiratory symptoms accordingly (may mimic tension pneumothorax).

PARAVERTEBRAL THORACIC BLOCK

Bolus of LA injected in the vicinity of the thoracic spinal nerves following their emergence from the intervertebral foramen.

PARAVERTEBRAL BLOCK

The resulting ipsilateral somatic and sympathetic nerve blockade produces anesthesia or analgesia that is conceptually similar to a "unilateral" epidural anesthetic block. Higher or lower levels can be chosen to accomplish a unilateral, bandlike, segmental blockade at the desired levels without significant hemodynamic changes.

Essentials

- Indications: **breast surgery, analgesia after thoracotomy or in patients with rib fractures**
- Landmarks: spinous process at the desired thoracic dermatomal level
- Needle insertion: 2.5 cm lateral to the midline
- Target: needle insertion 1 cm past the transverse process
- Local anesthetic: 5 mL per dermatomal level



PARAVERTEBRAL BLOCK

Patient Positioning

- The patient is positioned in the sitting or lateral decubitus (with the side to be blocked uppermost) position and supported by an attendant. The back should assume knee-chest position, similar to the position required for neuraxial anesthesia. The patient's feet rest on a stool to allow greater patient comfort and a greater degree of kyphosis. The positioning increases the distance between the adjacent transverse processes and facilitates advancement of the needle between them.

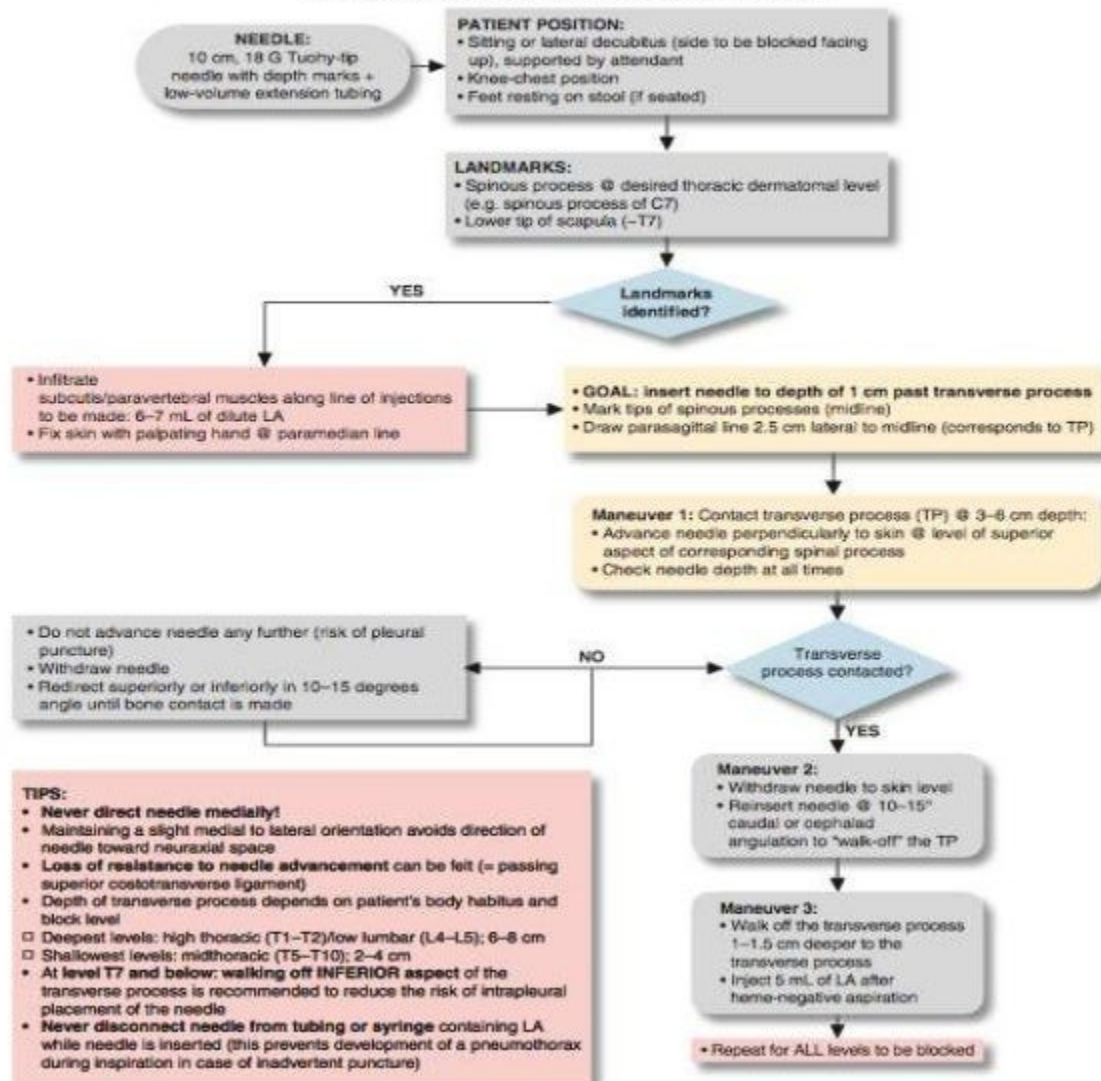
Landmarks and Maneuvers to Accentuate Them

- The following anatomic landmarks are used to identify spinal levels and estimate the position of the relevant transverse processes:
 - 1. Spinous processes (midline)
 - 2. Spinous process C7 (the most prominent spinous process in the cervical region when the neck is flexed)
 - 3. Lower tips of scapulae (corresponds to T7)

The tips of the spinous processes should be marked on the skin. Then a parasagittal line can be measured and drawn 2.5 cm lateral to the midline. For breast surgery, the levels to be blocked are T2 through T6. For thoracotomy, estimates can be made after discussion with the surgeon about the planned approach and length of incision.

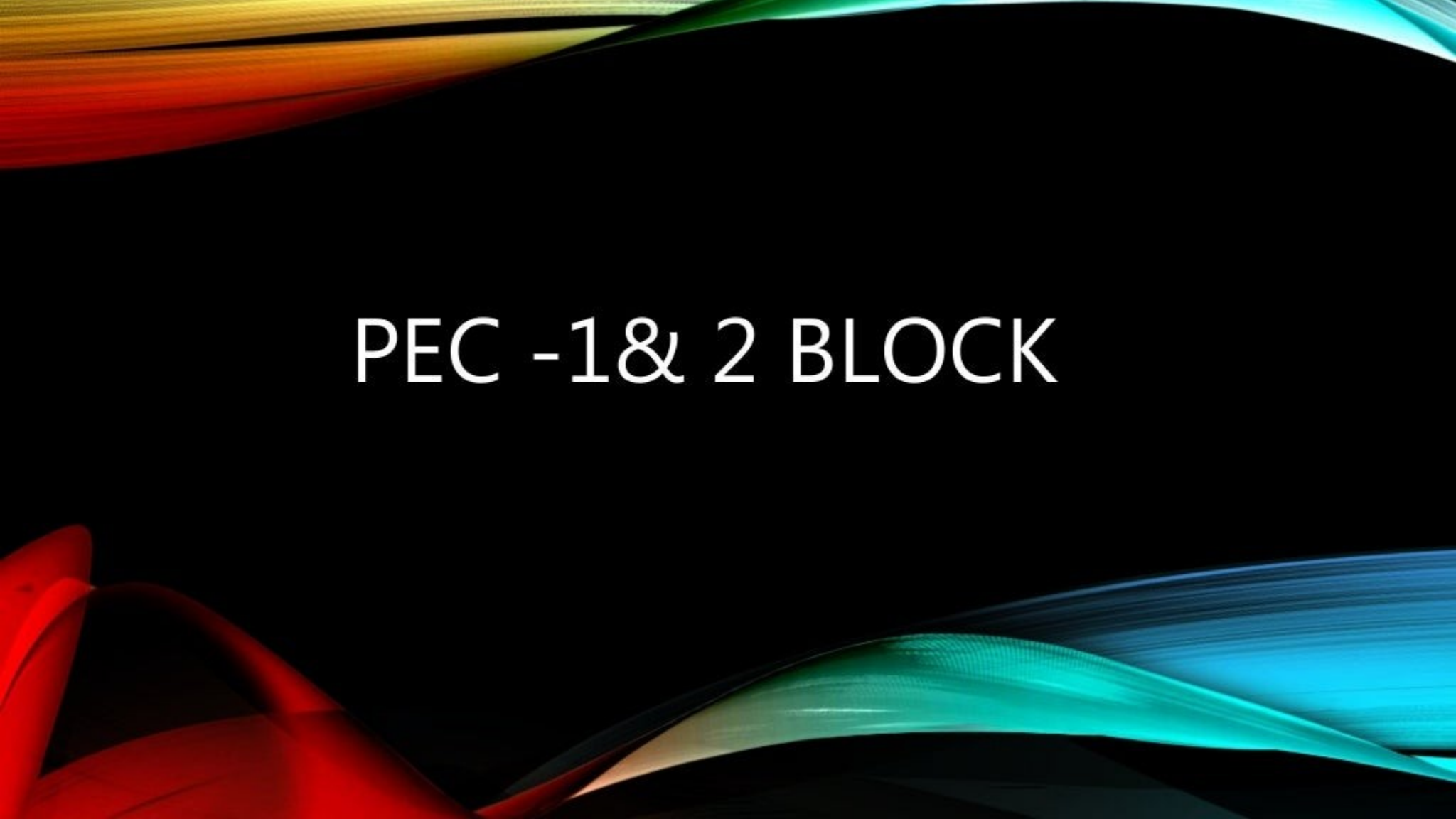


THORACIC PARAVERTEBRAL BLOCK



COMPLICATIONS OF THORACIC PARAVERTEBRAL BLOCK AND PREVENTIVE TECHNIQUES

Infection	<ul style="list-style-type: none">• A strict aseptic technique should be used.
Hematoma	<ul style="list-style-type: none">• Avoid multiple needle insertions in patients undergoing anticoagulation therapy.
Local anesthetic toxicity	<ul style="list-style-type: none">• Rare.• Large volumes of long-acting anesthetic should be avoided in older and frail patients.• Consider using chlorprocaine for skin infiltration to decrease the total dose of the more toxic, long-acting local anesthetic.• Never inject local anesthetic forcefully; this can lead to a more rapid absorption of local anesthetic.
Nerve injury	<ul style="list-style-type: none">• Local anesthetic should never be injected when a patient complains of severe pain or exhibits a withdrawal reaction on injection.
Total spinal anesthesia	<ul style="list-style-type: none">• Avoid medial angulation of the needle, which can result in an inadvertent epidural or subarachnoid needle placement.• Aspirate before injection (to detect blood and cerebrospinal fluid).• Do not inject local anesthetic forcefully; this can lead to a greater risk of an epidural spread.
Paravertebral muscle pain	<ul style="list-style-type: none">• Paravertebral muscle pain, resembling a muscle spasm, is occasionally seen, particularly in young muscular men and when a larger gauge Tuohy-tip needle is used.• Injection of local anesthetic into the paravertebral muscle before needle insertion and the use of a smaller gauge (e.g., 22 gauge) needle is suggested to avoid this side effect.



PEC -1& 2 BLOCK

PEC I & II BLOCK

- Paravertebral block was the most widely used technique of RA for breast surgeries. However there is a risk of pneumothorax, inadvertent entry of needle into the vertebral canal, with consequent spinal cord trauma. Also it did not provide complete analgesia to the anterior chest wall, since the innervation was not exclusive to thoracic spinal nerves, but also brachial plexus, via medial and lateral pectoral nerves.
They all rely on placing LA between the thoracic muscles
- Depending on the extent of surgery, the regional techniques chosen vary
- **PEC 1:** LA injection between pectoralis major and minor at the 3rd rib level to block the **lateral and medial pectoral nerves**. Appropriate for surgery limited to pectoralis major.
- **PEC 2:** a PECS 1 block, in addition a LA injection between pectoralis minor and serratus anterior at the 3rd rib level. By The latter injection blocks the lateral branch of the T2-4 spinal nerves, and possibly the anterior branch if sufficient LA penetrates the external intercostal muscles. By entering the axilla, the long thoracic nerve may also be blocked . Suitable for more extensive excisions e.g. tumour resections, mastectomy, axillary clearance.

PEC I & II BLOCK

PECS " THE ORIGINAL " BLOCK

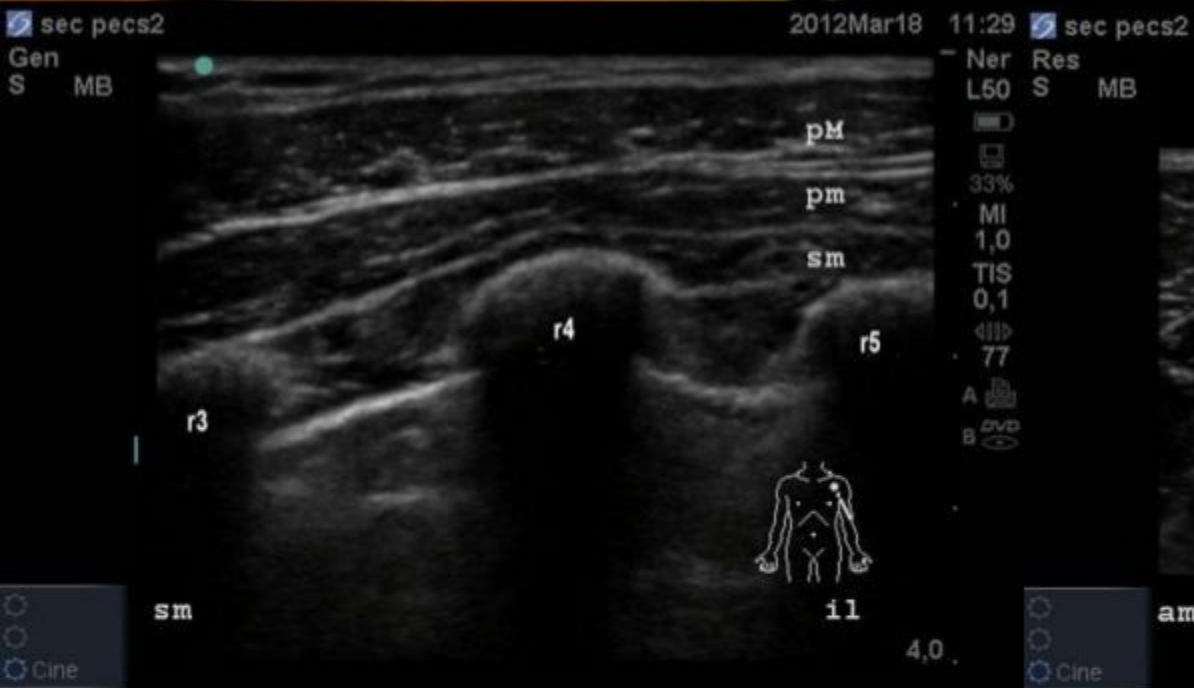
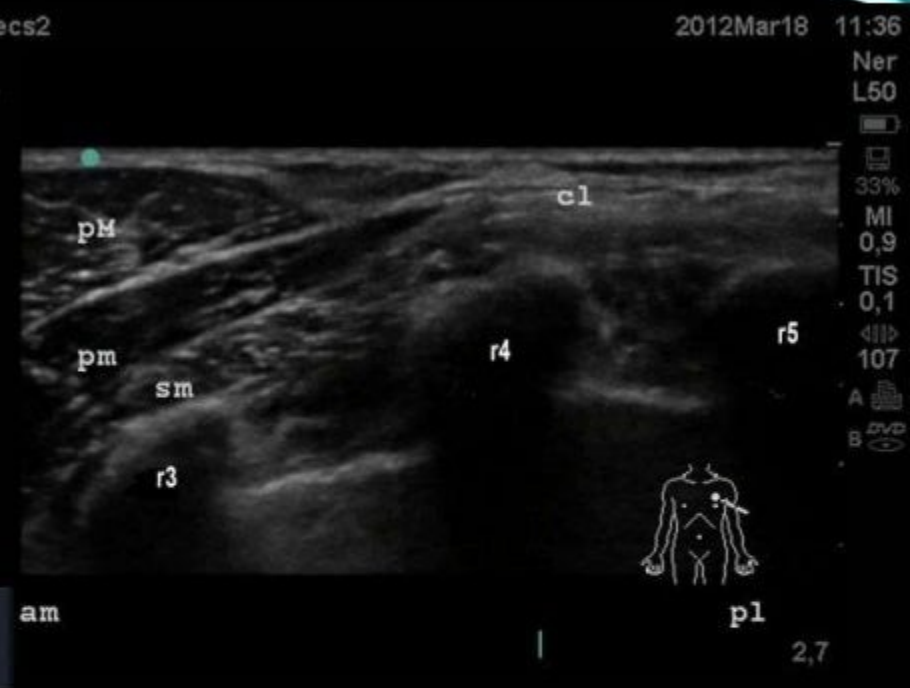
- Nerves Blocked- **Lateral and medial pectoral nerves.**
- Indications: **surgeries involving pectoralis major muscle.** (breast expanders, traumatic chest injuries, portocath, pacemaker insertion).
- LA: 10ml of the solution, to be deposited between pec major and minor at the 3rd rib level.
- **Technique** – with the probe at the mid clavicular level and angled inferolaterally, first locate the axillary artery and vein. Next move the probe laterally until pectoralis minor and serratus anterior are identified. Locate the 2nd rib immediately under the axillary artery, then count the 3rd rib, and with further lateral probe movement, the 4th rib. • With the image centered at the level of the 3rd rib, advance the needle in- plane from medial to lateral in an oblique manner until the tip lies between pectoralis major and minor. Inject 10 mL LA between pectoralis major and minor.

PECS II " MODIFIED " BLOCK

- Nerves blocked– **T2-4 spinal nerves (including intercostobrachial nerve) and long thoracic nerve.**
- Indications **(more extensive breast surgery involving serratus anterior and the axilla) tumour resection, sentinel node excision, axillary clearance, tissue expanders.**
- LA deposition – 20 mL LA injection between pectoralis minor (laterally) and serratus anterior at the 3rd rib level (this injection aims to enter the axilla to reach the target nerves, but LA will only enter the axilla if the fascia on the pectoralis minor lateral border is breached by surgery).
- **Technique** – Perform sonography as for PECS 1 , but also identify the potential space between the lateral extent of pectoralis minor and serratus anterior. First perform a PECS 1 injection between pectoralis major and minor, then a second 20 mL injection between pectoralis minor and serratus anterior .



Thoracic wall blocks: Left=PECS 1 block, Middle=PECS 2 block, Right=Serratus plane block.

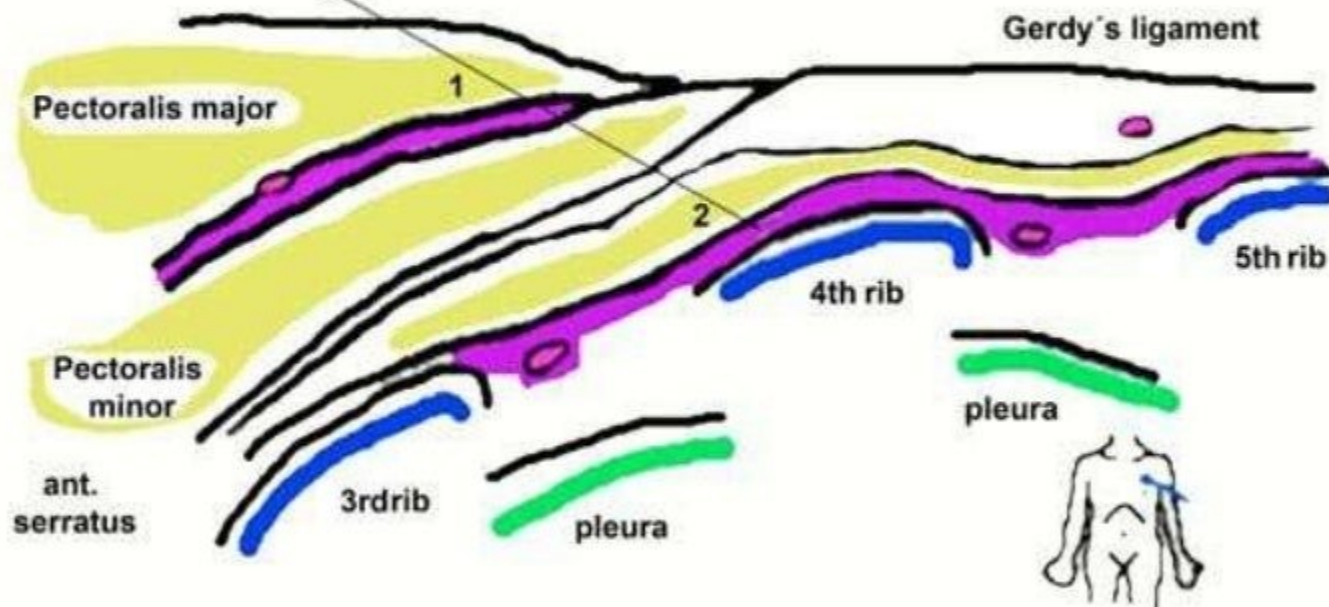


PECS BLOCK- Location for injection of LA

A two steps infiltration
aiming towards the 4th rib

1 (between muscles): 10 ml between Pec M & Pec m
Injection for the pectoral nerves

2 (entering the axilla): 20 ml under Pec m & around serratus m
Intercostals plus the long thoracic nerve

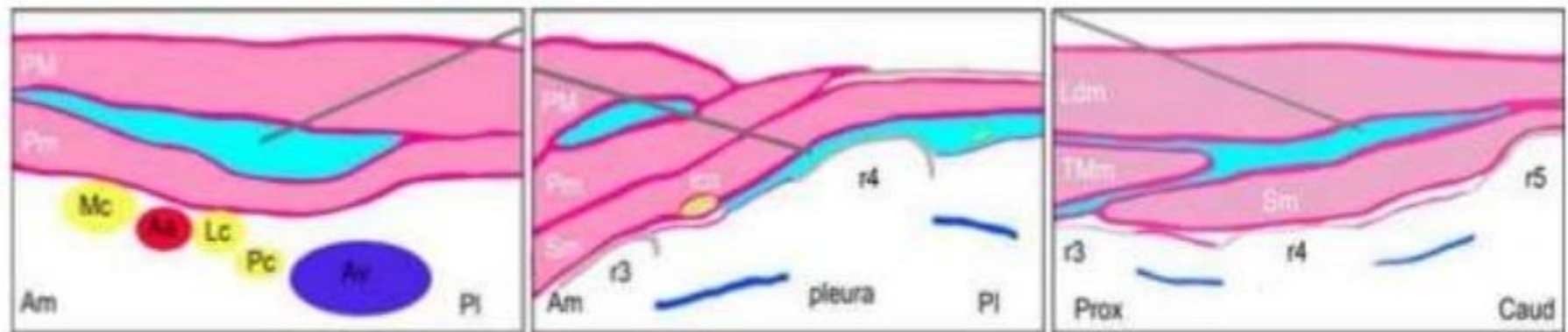


Indications:

Tumorectomies, wide excisions, mastectomies, axillary clearances
sentinel nodes, subpectoral prosthesis and multiple chest trauma

Medial

Lateral



Diagrammatic representation of the three blocks, left(PECS), middle (PECS 2), Right (serratus).



Typical sensory block produced by the PEC II block

SERRATUS ANTERIOR BLOCK

- **SA:** A single LA injection between latissimus dorsi and serratus anterior at the 5th rib level in the mid axillary line. This injection blocks the thoracodorsal nerve.

SERRATUS PLANE BLOCK

- Nerve blocked: **thoracodorsal** , **thoracic intercostal nerves**. Lateral part of the thorax is blocked.

Position: supine patient, arms abducted, high frequency linear probe. With in plane technique from medial to lateral(or posterior) needle direction.

- Indication: **latissimus dorsi flap reconstruction, multiple rib fractures**
- LA: Probe in the midclavicular line in sagittal plane, to visualise the ribs and at the 5th rib the probe oriented in the midaxillary line, latissimus dorsi is superior and posterior, teres major superior, serratus in deep and inferior.
- 2 planes are described for the block, superficial i.e above the muscle, deep: below the serratus anterior.



Area of sensory loss following superficial (above) or deep (below) serratus plane block.

INTRAPLEURAL BLOCK

- Interpleural block can provide analgesia over the chest wall and upper abdomen and a single injection of local anaesthetic spreads to several intercostal nerves. Intrapleural and interpleural techniques have been used interchangeably but the latter is more appropriate.
- A single epidural catheter is most commonly inserted through a Tuohy needle at a level between T6 and T8, a point anywhere between 8 cm lateral to the posterior midline and posterior axillary line. A loss of resistance can be used to find the interpleural space. The catheter is placed 3-6 cm deep to the space and fixed. 20-25 ml of local anaesthetic (usually 0.25% bupivacaine) is then injected. The reported mean duration of analgesia is 2 to 18 hours (mean 7 hours). Continuous infusion dose is at a rate of 0.125 ml/kg/hour (2).

INTRAPLEURAL BLOCK

- The technique appears to have a few recognised complications in addition to pneumothorax, including intravascular injection, chest wall haematomas, pleural effusion, pneumothorax, Horner's syndrome, L.A. toxicity and rarely LA spreading to epidural space.

Interpleural local anaesthetic administration is one of the different methods for providing perioperative analgesia in various upper abdominal surgeries like cholecystectomy, renal surgery v/l breast surgery. As well as providing analgesia for non surgical conditions like fractured ribs, cancer pain, herpes pain and pancreatic pain.

THANK YOU

