

# **“Optimizing, Refining, and Enhancing Anterolateral Chest Wall Blocks (IPPB, PSPB & SAP)”**

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## **ABSTRACT**

In the realm of pain management for breast and thoracic surgeries, regional analgesia techniques are vital for enhancing patient outcomes and comfort. Among these techniques, Pectoral Nerve (PECS) and Serratus Anterior Plane (SAP) blocks stand out for their efficacy in providing targeted pain relief, thereby minimizing the need for systemic opioids and their associated side effects.

This article provides a detailed technical description and anatomical knowledge of the Pectoral Nerve (PECS) and Serratus Anterior Plane (SAP) blocks, essential for effective pain management in breast and thoracic surgeries. It covers the anatomical targets and landmarks, including the lateral cutaneous branch of the intercostal nerve and the pectoral nerves, providing insights into both superficial (SAP-1) and deep (SAP-2) approaches. Additionally, the article offers practical tips and tricks for mastering these regional analgesic techniques, such as optimizing ultrasound-guided needle placement and recognizing key anatomical structures. By understanding the precise anatomical and technical considerations, clinicians can enhance their proficiency in these blocks, improving surgical outcomes and patient comfort.

#ChestWallBlocks #ThoracicWallBlocks #InterPectoralPlaneBlock #PectoSerratusPlaneBlock  
#SerratusAnteriorPlaneBlock #IPPB #PSPB #SAP #Anesthesia #PainManagement  
#RegionalAnesthesia #BreastSurgery #ThoracicSurgery #UGRA #RegionalAnesthesia  
#MedTwitter #EDRA

## **INTRODUCTION**

The advancement of regional anesthesia techniques has revolutionized pain management in breast and thoracic surgeries. Among these techniques, the Pectoral Nerve (PECS) blocks and Serratus Anterior Plane (SAP) blocks have become particularly prominent due to their efficacy and safety profiles. These blocks are highly effective for a range of procedures, from minor breast augmentations to major thoracic surgeries, including rib fractures and thoracotomies. This article delves into the technical aspects and anatomical foundations of PECS and SAP blocks, highlighting their applications, benefits, and challenges. It also provides essential tips and tricks to master these techniques, ensuring optimal pain management and improved patient outcomes.

## My 10 Points:

### 1. OVERVIEW

#### a) Indications:

- **Breast Surgeries:** Minor (breast augmentations, Local excision, and subpectoral device insertions), Major (mastectomies, breast reconstructions, and axillary surgeries).
- **Anterolateral thoracic wall Analgesia:** Rib fractures, thoracotomy incisions, and breast surgeries.

#### b) Contraindications:

- Patient refusal.
- Local infection.
- Local Anesthetic (LA) allergy.
- Coagulopathy/ anticoagulant therapy (Cautious approach).
- Loss of injection planes (ineffective)

#### c) Complications:

- Local hematoma/infection.
- Transient sensory deficits.
- LAST (Volume dependent).
- Pneumothorax (for deeper blocks).

#### d) Advantages:

- Effective Perioperative analgesia for superficial chest procedures.
- Minimal risk of complications.
- No impact on respiratory function.
- Reduce the need for additional analgesics.
- Motor-Sparing and opioid-sparing advantages.
- Reduced pain scores post-op 24 hrs.
- Less incidence of PONV.
- Fewer requirements of sedation.
- Less post-op respiratory complications and early weaning from the ventilator.
- Short PACU and hospital stay.
- Less incidence of chronic pain.

#### e) Disadvantages:

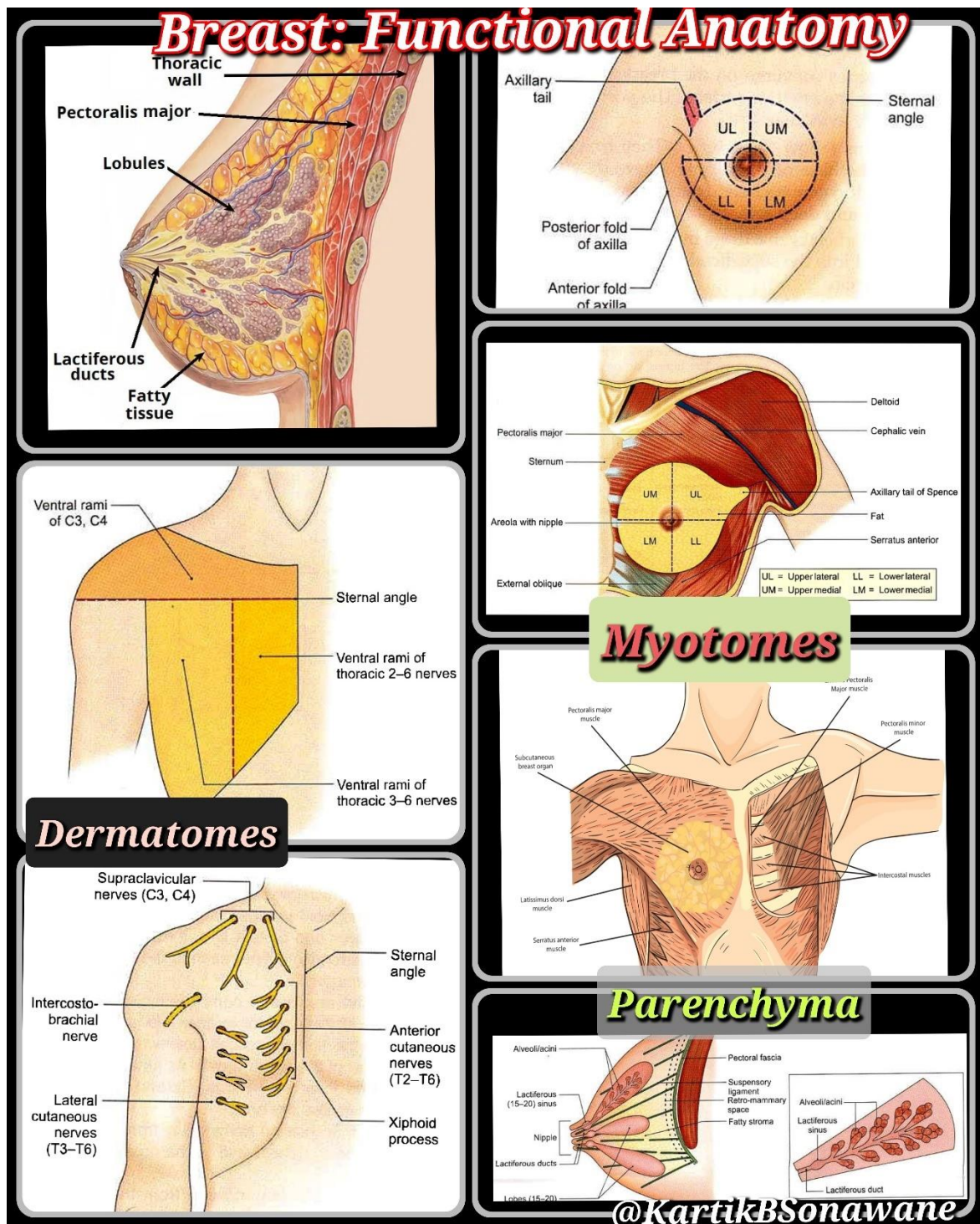
- Not effective for deeper thoracic surgeries.

## REQUIRED BACKGROUND KNOWLEDGE

Functional Anatomy [Breast, Chest wall Muscles (Anterolateral)],

Target Innervation,

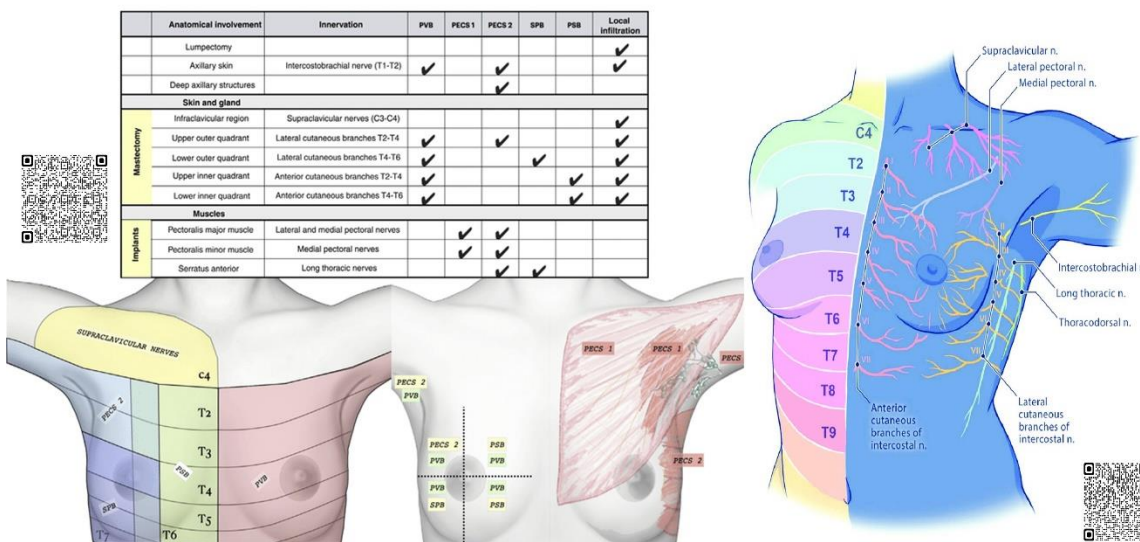
Block territories.



## 2. BREAST FUNCTIONAL ANATOMY

- a) The breast is a Modified Sweat gland that lies over the Pectoral Fascia (covering PMM) and is separated from it by loose areolar tissues – Retromammary space. A small extension of the upper lateral quadrant (**axillary tail of Spence**) passes through an opening in the deep fascia of the axilla (**Foramen of Langer**).
- b) **Breast structure includes,**
- **Skin:** Nipple (lying in the center at the 4<sup>th</sup> ICS) is pierced by 15-20 lactiferous ducts, having few modified sweat + sebaceous glands and rich nerve supply/FNEs. Areola, pigmented skin surrounding the nipple, is rich in modified sebaceous glands at the outer margin. Enlarged glands during pregnancy/lactation form raised **tubercles of Montgomery**. Lactiferous sinuses (where milk is stored) lie below the areola.
  - **Parenchyma:** Consists of tubulo-alveolar glands that secrete milk. Each gland consists of 15-20 lobes, a cluster of alveoli drained by a lactiferous duct.
  - **Stroma:** Supporting framework - partly fibrous and partly fatty. The fibrous stroma forms septa, known as **suspensory ligaments of Cooper**, which anchor the skin and the gland to the pectoralis fascia. The fatty stroma forms the main bulk distributed all over the breast except beneath the areola and the nipple.
- c) **Breast innervation:** Cutaneous and myofascial innervation.
- **Cutaneous innervation (Dermatomes):** From cervical plexus (SCN), ICBN (T2), ICNs (T3-T6).
  - **Myofascial supply (Myotomes):** From the brachial plexus [MPN (C8-T1), LPN (C5-C7), TDN (C6-C8), LTN (C5-C7)].
  - **Milk secretion:** Controlled by prolactin secreted by the pars anterior of the hypophysis cerebri.

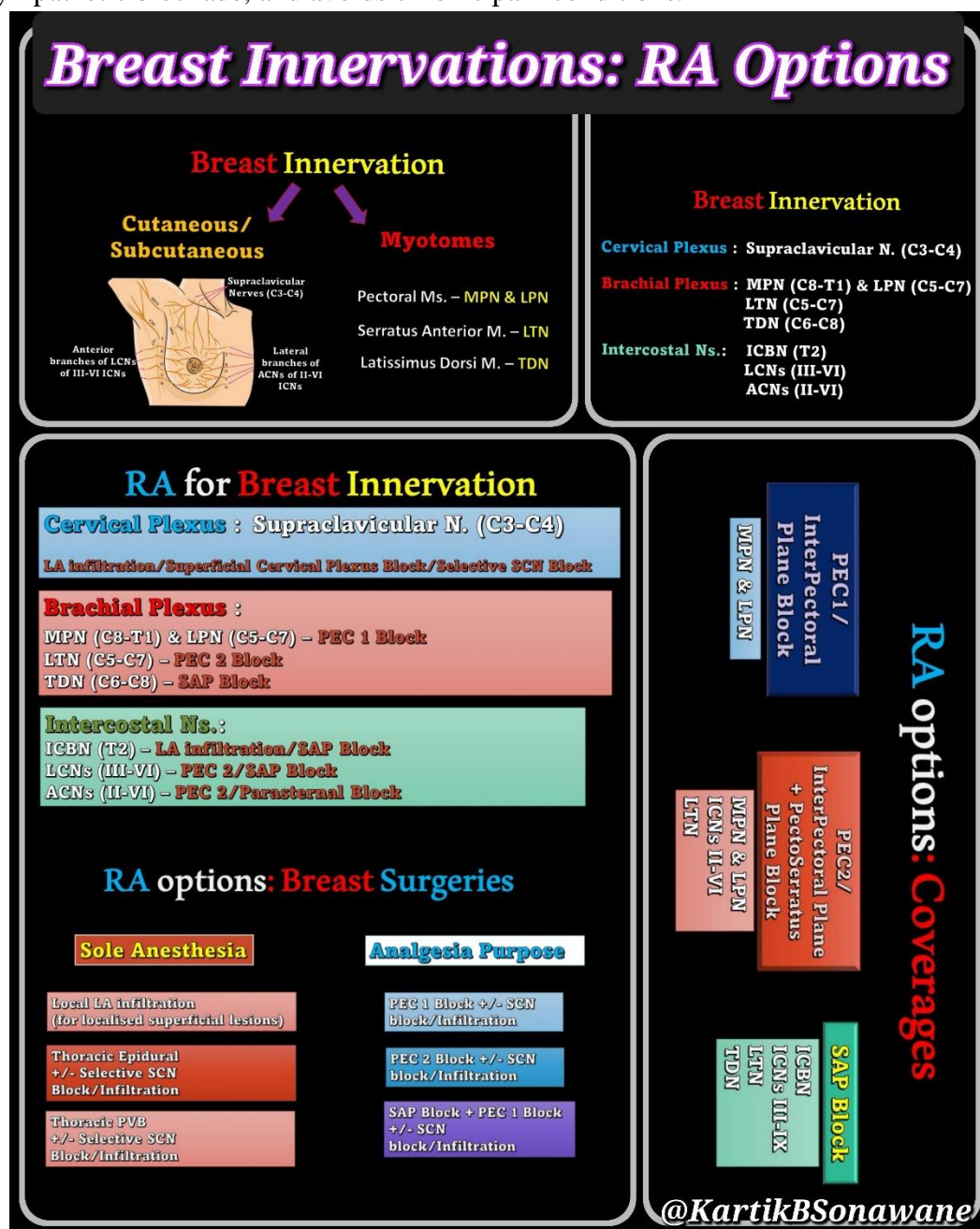
## Breast Innervations and RA options





#### d) RA OPTIONS:

- **Anesthesia options:** Thoracic EA (Bilateral Breast Sx) and Thoracic PVB (Unilateral Breast Sx) +/- LA infiltrations of spared cutaneous areas or SCN Block.
- **Analgesia options:** LA infiltrations (for BCS), PECs 2 Block (Non-BCS Without axillary clearance), and SAP + PECs 1 Blocks or PEC 2 block (Non-BCS with axillary clearance).
- **Surgical perspective:** Large LA volume in the plane can affect surgical dissection & electrical cautery function. Sometimes, surgeons try to preserve LTN to avoid winging of the scapula. They use neurostimulation to identify and preserve LTN, which can become ineffective in the presence of an LA solution.
- **Anesthetic perspective:** Optimal analgesia reduces GA drug requirements and opioid consumption, provides a clear surgical field, reduces stress response by causing Sympathetic blockade, and avoids chronic pain conditions.



### 3. CHEST WALL MUSCLES

Muscles of the chest wall are arranged in 3 layers, from superficial to deep.

**a) Superficial group: (Thoracohumeral group -5 Muscles)**

- Subclavius.
- Pectoralis Major & Pectoralis Minor.
- Serratus Anterior.
- Latissimus Dorsi.

**b) Intermediate layer: (Between Ribs - 3 Muscles)**

- External intercostal & Internal intercostal.
- Innermost intercostal (Intercostal Intimi).

**c) Deep layer: (2 Muscles)**

- **Anterior:** Transversus Thoracis (OR Sternocostalis).
- **Posterior:** Subcostalis.

### RELEVANT ANTEROLATERAL MUSCLES

- **Superficial Layer:** Subclavius, Pectoralis Major, Pectoralis Minor, Serratus Anterior.
- **Intermediate Layer:** External intercostal, Internal intercostal, and Innermost intercostal.

**a) Subclavius Muscle:**

- **Origin:** The first Rib and its cartilage.
- **Insertion:** Inferior surface of the clavicle.
- **Action:** Stabilizes the clavicle.
- **Innervation:** Nerve to subclavius (C5-C6), also known as Subclavian nerve.

**b) Pectoralis major Muscle:**

- **Origin:** Fan-shaped fibers, originate from the clavicle, sternum, and the costal cartilages of the upper ribs.
- **Insertion:** Crest of the greater tubercle of the humerus and intertubercular sulcus.
- **Action:** Flexion, adduction, and medial (internal) rotation of the arm.
- **Innervation:** MPN (C8-T1) and LPN (C5-C7).

**c) Pectoralis Minor Muscle:**

- **Origin:** External surface of the third to fifth ribs.
- **Insertion:** Coracoid process of the scapula.
- **Action:** Stabilizes scapula against chest wall and elevates ribs during inspiration.
- **Innervation:** MPN.

**d) Serratus Anterior Muscle:**

- **Origin:** External surface of ribs 1-9.
- **Insertion:** Medial margin of scapula.
- **Nerve:** Long thoracic nerve (C5-C7 from root).
- **Action:** Protracts and stabilizes scapula.

e) **Latissimus Dorsi Muscle:**

- **Origin:** T7-L5 SP, TL fascia, Iliac crest, Lower 3 ribs, Scapula (Inferior angle).
- **Insertion:** Intertubercular groove of the humerus.
- **Action:** Abduction, extension, and internal rotation of the arm.
- **Innervation:** Thoracodorsal nerve (C6-C8).

**Intercostal Muscles:**

f) **External Intercostal Muscles:** 11 pairs

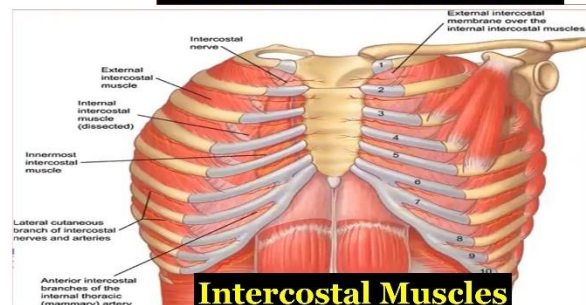
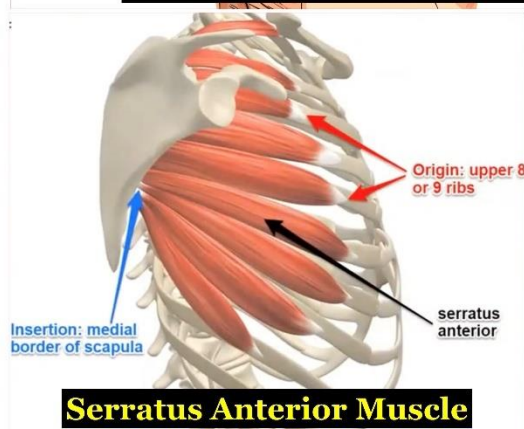
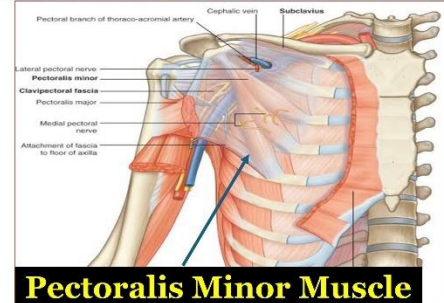
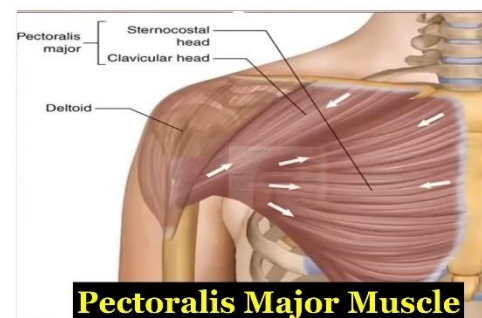
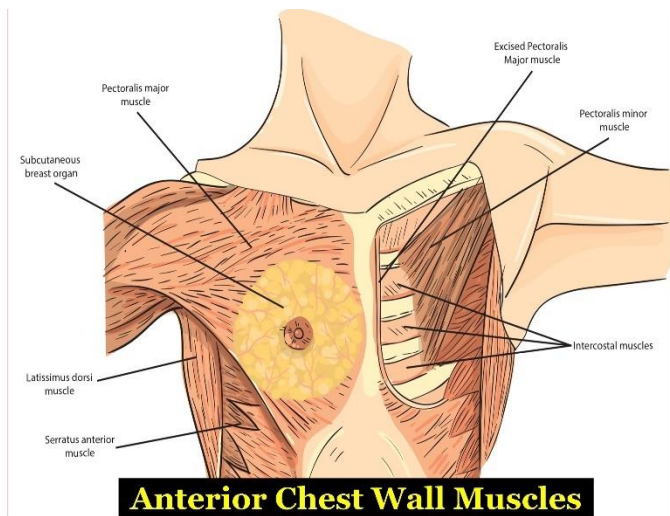
- **Origin:** Ribs 1-11. Fibers run obliquely downward and forward. Run Antero-inferiorly (Inferior border of the upper Rib to the superior border of the Lower Rib).
- **Insertion:** Ribs 2-12.
- **Action:** Assist in inspiration
- **Innervation:** ICNs (T1-11).

g) **Internal Intercostal Muscles:** 11 pairs

- **Origin:** Ribs 2-12. Fibers run obliquely downward and backward. Runs Infero-posteriorly.
- **Insertion:** Ribs 1-11.
- **Action:** Assist in expiration.
- **Innervation:** ICNs (T1-T11).

h) **Innermost Intercostal Muscles** (deepest of intercostal muscles)

- The neurovascular bundle runs between the internal and innermost intercostal muscles in the costal groove.





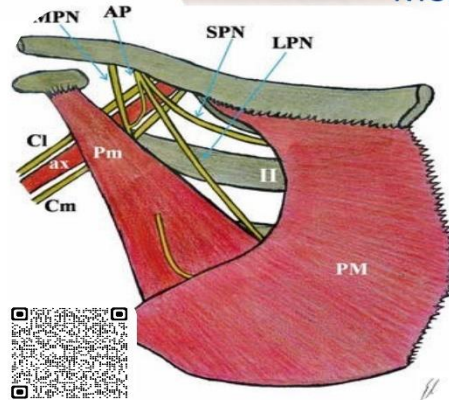
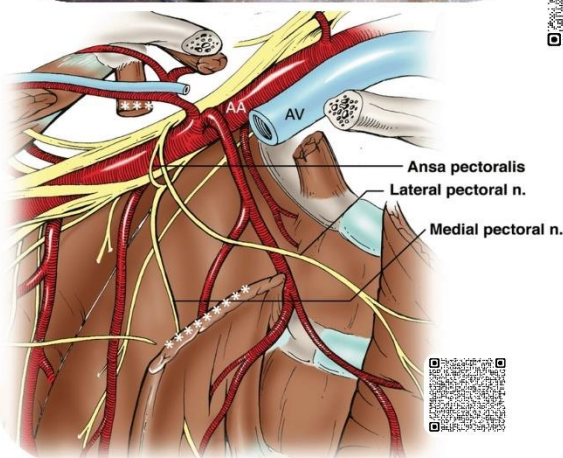
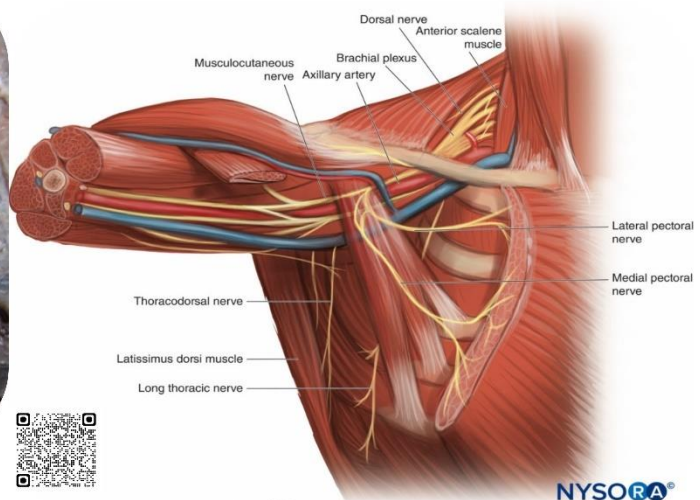
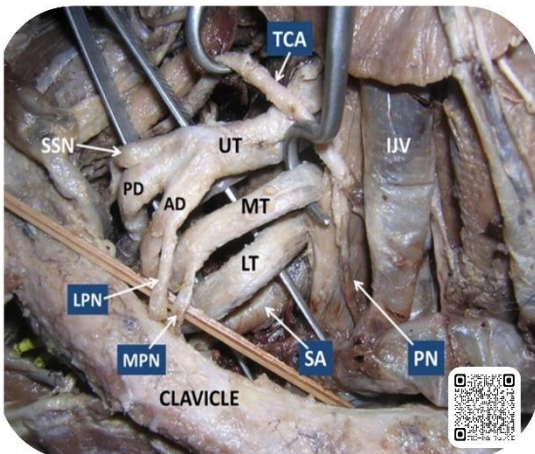
#### 4. TARGET NERVES (for Anterolateral chest wall blocks)

- **Brachial Plexus:** Long Thoracic Nerve (LTN), Thoracodorsal Nerve (TDN), Medial Pectoral Nerve (MPN) and Lateral Pectoral Nerve (LPN).
- **Intercostal Nerves:** T1-T11.

##### a) MPN (C8-T1):

- **Origin:** Arises from the Medial Cord of the brachial plexus.
- **Course:** Pierces through the pectoralis minor from beneath it, close to the third intercostal space.
- **Branches:** The branches from the MPN loop around the pectoralis minor to enter the pectoralis major muscle and go deep to the pectoralis major
- **Innervation:** Pectoralis minor + Pectoralis major (inferior part) muscles.

### Course of Medial Pectoral Nerve (C8-T1)

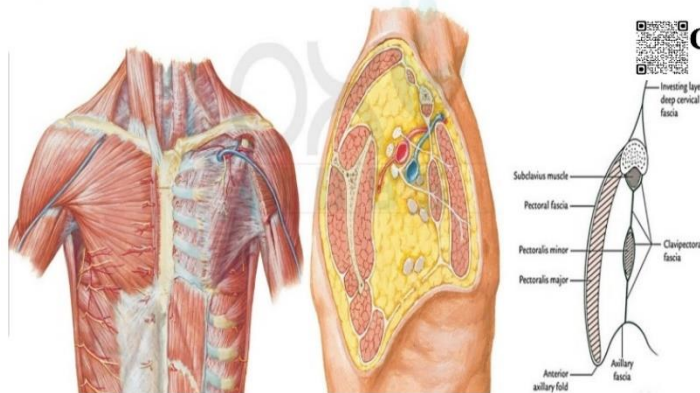




**b) LPN (C5-C7):**

- **Origin:** Arises for the Lateral Cord of the brachial plexus.
- **Course:** LPN crosses the lateral and superior border of pectoralis minor, pierces Clavipectoral Fascia, and enters the plane between both pectoral muscles.
- **Structures piercing Clavipectoral Fascia:** (CALL) Cephalic vein, Thoracoacromial artery, LPN, Lymphatics.
- **Innervation:** Pectoralis Minor (Superior and Medial aspects).

## Course of Lateral Pectoral Nerve (C5-C7)



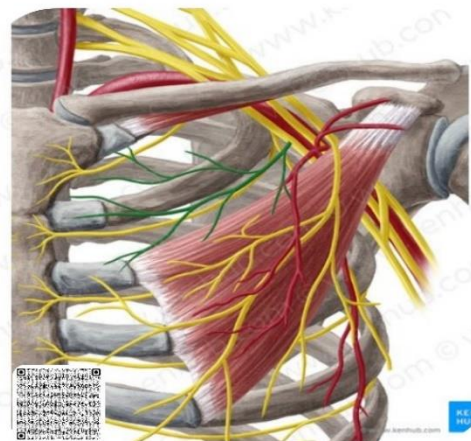
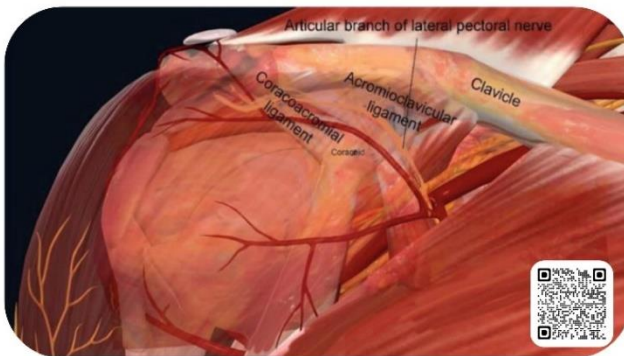
Clavipectoral Fascia is Pierced By “**CALL**”

**C: Cephalic Vein**

**A: Thoracoacromial Artery**

**L: Lateral Pectoral Nerve**

**L: Lymphatics**



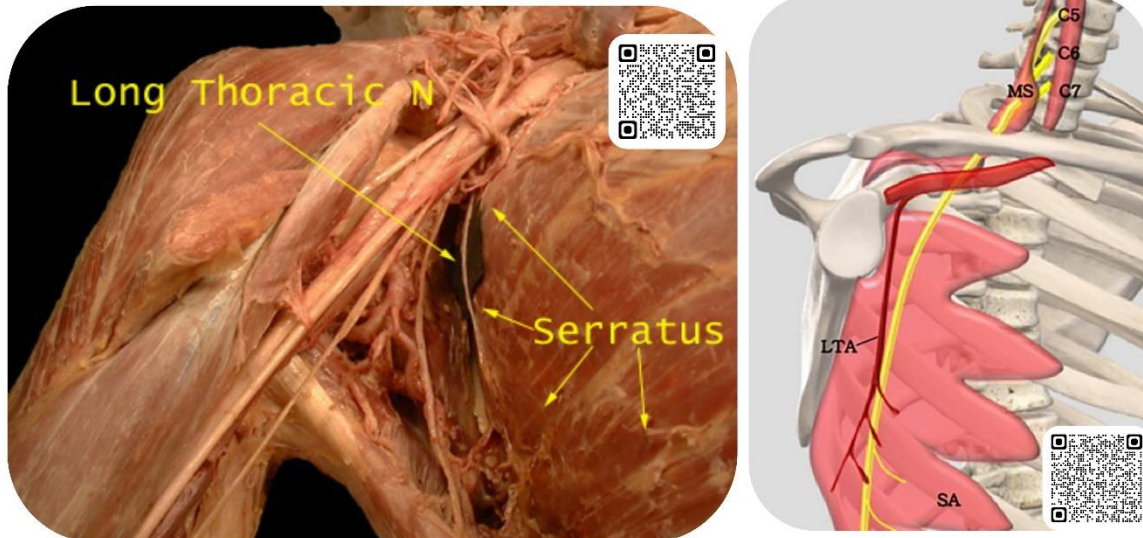
**c) INTERPECTORAL PLEXUS:**

- **Formation:** Formed by the branches of the MPN and LPN.
- **Location:** In the intermuscular plane between the pectoralis major and minor muscles.
- **Innervation:** Transmit nociception and proprioception, apart from motor impulses.
- **Myofascial pain:** MPN and LPN are motor nerves but also carry nociceptive and proprioceptive fibers. Therefore, disruption and stretching can cause myofascial pain.

d) LTN (C5-C7):

- **Origin:** Arises from the roots of the brachial plexus (C5, C6, and C7).
- **Course:** Descends through the cervicoaxillary canal, passes through the middle scalene muscle, and runs along the lateral chest wall.
- **Innervation:** Serratus anterior muscle.

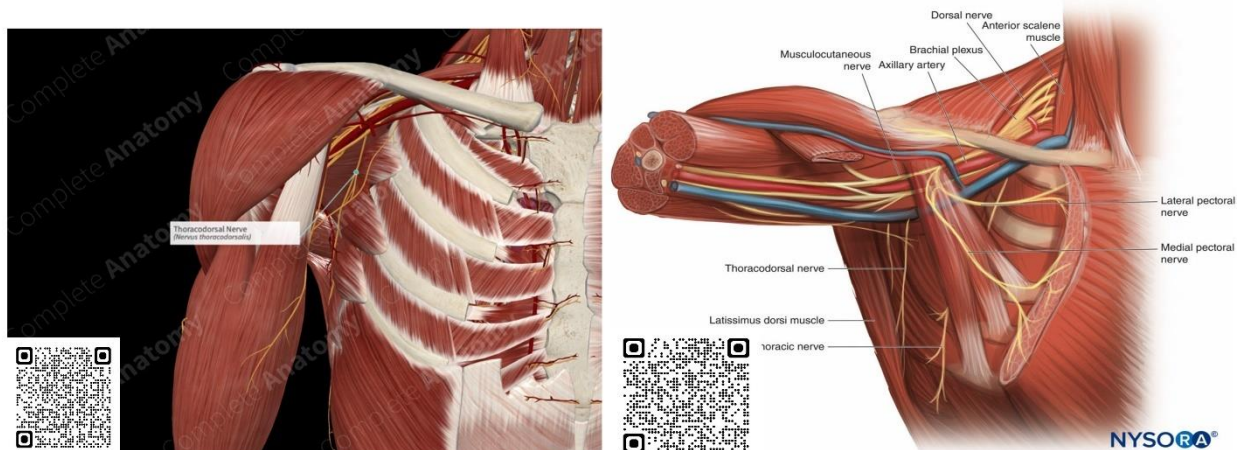
## Course of Long Thoracic Nerve (C5-C7)



e) TDN (C5-C8):

- **Origin:** Arises from the posterior cord of the brachial plexus.
- **Course:** Descends along the posterior axillary wall, running inferiorly on the subscapularis muscle and traveling with the thoracodorsal artery.
- **Innervation:** Latissimus dorsi muscle.

## Course of Thoracodorsal Nerve (C6-C8)





## f) ICNs:

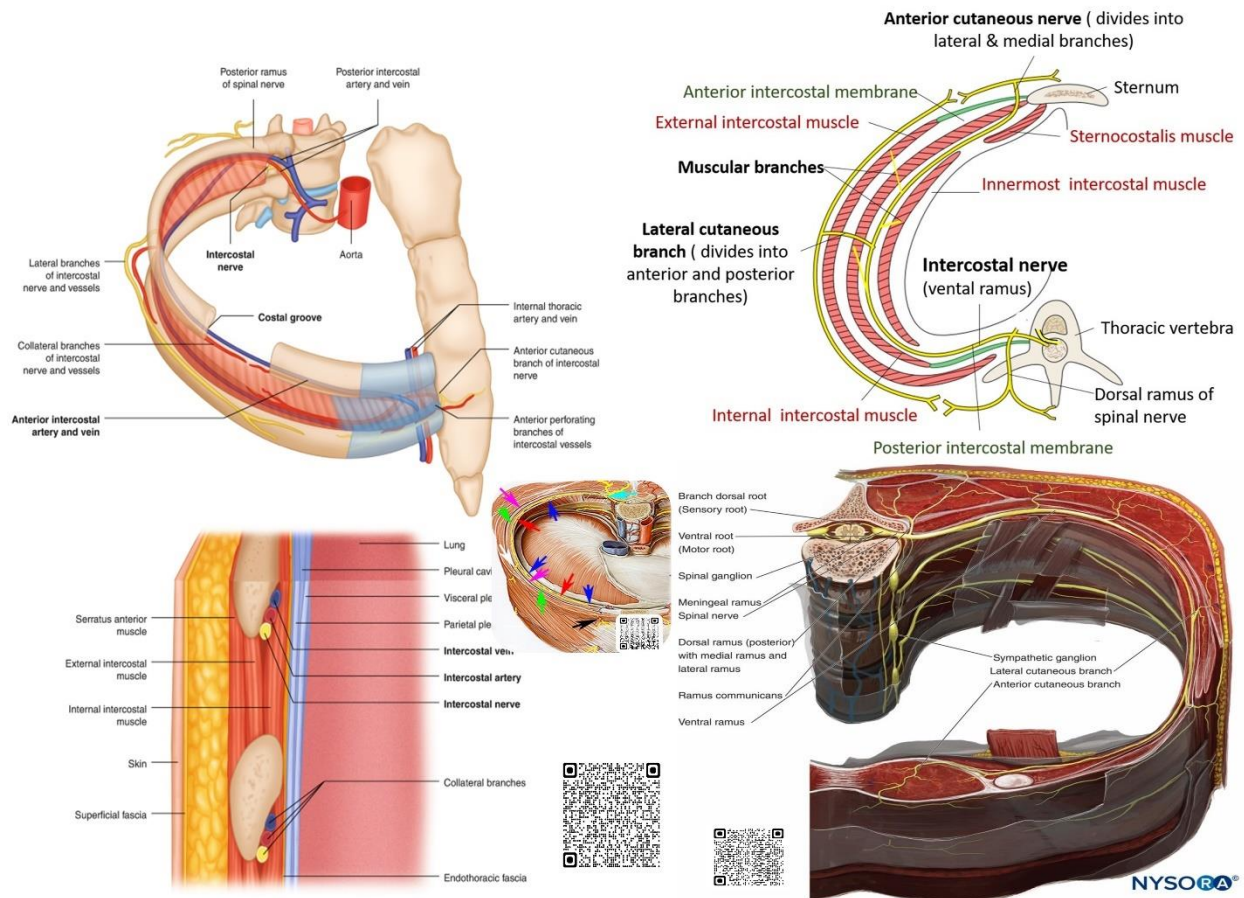
**Origin:** Thoracic spinal nerve divides into ventral and dorsal rami. **Dorsal rami** supply posterior chest wall. Ventral rami (**T1-T11**) continue as intercostal nerves (ICNs). The **Ventral rami** of **T12** is called the **Subcostal nerve**.

- Each pursues an independent course without plexus formation
- **T3-T6:** Typical ICNs supply only the thoracic wall.
- **T1 and T2** also supply upper limbs.
- **T7-T11:** Thoracoabdominal nerves also supply the abdominal wall and peritoneum.

## Course:

- Enters paravertebral space after exiting through corresponding spinal foramina.
- Lies between the internal intercostal membrane and the parietal pleura.
- Enter the costal groove below the neck of the corresponding Rib and travel through the chest wall between 2 muscles outside (External and internal ICMs) and 1 muscle inside (Innermost ICM).

## Course of Typical Intercostal Nerves (T3-T6)





## **Branches:**

### **a) Two communicating branches**

- White and gray ramus
- Connect to corresponding sympathetic ganglia.

### **b) Muscular branches**

- Supply intercostal muscles, subcostalis, and sternocostalis.

### **c) Collateral branches**

- Run along the superior border of inferior ribs with collateral vessel branches of IC vessels.
- Supply parietal pleura and periosteum of rib.

### **d) Cutaneous branches:**

#### **i. Lateral Cutaneous Nerves (LCNs):**

- Arises from the angle of ribs.
- Pierces the ICMs and SAM to lie in the plane between the LDM and SAM.
- After giving off the lateral branch, the ICNs continue anteriorly in the same muscle plane until they reach the sternum.
- Each lateral branch divides further into anterior and posterior branches.
- Anterior branches of LCNs form a plexus with the lateral branches of ACNs.
- Posterior branches of LCNs form the plexus with the lateral branches of PCNs.
- The LCN of T2 is called as **intercostobrachial nerve**. It emerges from the intercostal space and runs superiorly and laterally to supply the axilla and upper part of the medial arm.
- **Innervation:** Cutaneous innervation to the anterolateral chest wall, including the posterior chest, until the mid-scapula level.

#### **ii. Anterior Cutaneous Nerves (ACNs):**

- Arises from the ICNs at the Parasternal region.
- Pierces the fascial extension of the external intercostal muscle (External Intercostal Membrane) and the PMM to emerge as the ACN and further divide into the medial and lateral branches to innervate the anterior and medial chest wall.
- The Medial branches of ACNs form a plexus with the medial branches of ACNs on the opposite side.
- Lateral branches of ACNs form a plexus with the anterior branches of LCNs.

## 5. TECHNIQUES

### A. PREREQUISITES:

- a) **Routine RA Preparation:** Informed Consent/IV access/Monitoring/LAST kit/Aseptic Technique/Anxiolysis as needed.
- b) **Equipment:** USG (Linear Probe with Sterile cover), 25-27 G Block needle, LA Solution.
- c) **Patient Positioning/Ergonomics:** Supine/Lateral.
- d) **Precautions:**
  - Identify pleura before needing.
  - Use Doppler to identify small vessels.

### B. BLOCK TERRITORIES:

- a) **Medial to the Midclavicular line:** Parasternal Blocks (Superficial and Deep).
- b) **Between Midclavicular - Anterior axillary lines:** PECs Zero, PECs 1, and PECs 2.
- c) **Between Anterior - Posterior Axillary lines:** BRILMA (on 4/5<sup>th</sup> ribs), modified BRILMA (on 7/8<sup>th</sup> ribs), SAP (Superficial and Deep).
- d) **Between Posterior Axillary Line-Paraspinal Line:** RISS Block and Paraspinal Intercostal Plane Block.
- e) **Medial to Paraspinal Line:** ESPB, ITP block, and PVB.

### C. BLOCK DURATION: It depends on LA type/adjuvant and patient factor/vascularity.

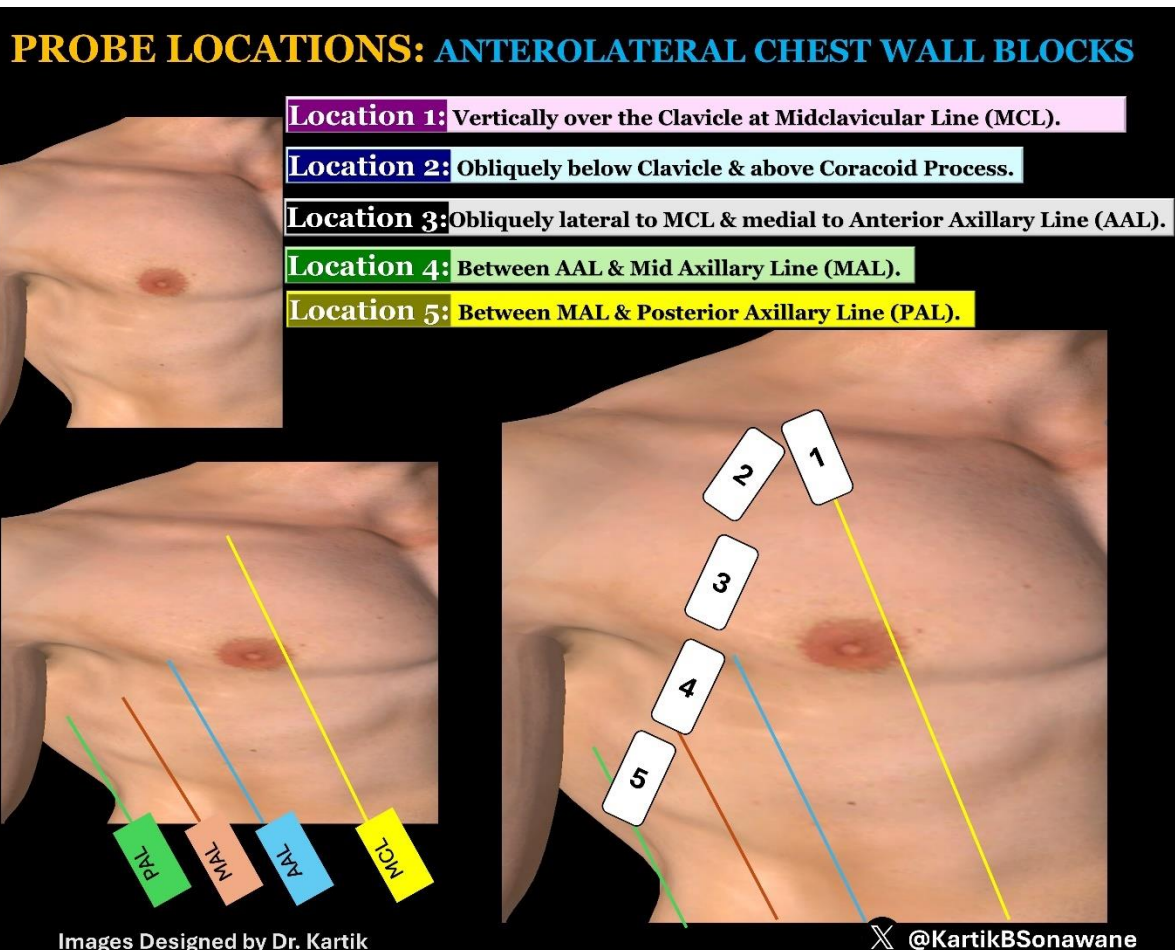
- a) **LA Type:** Bupivacaine (0.25-0.125%) / Ropivacaine (0.1-0.375%).
- b) **Adjuvants:** Dexamethasone 4-8 mg/Dexmedetomidine 25-50 mics.
- c) **Patient Factors:** Patient metabolism, tissue vascularity, and comorbidities.
- d) **Site of Injection:** the vascularity of the site affects the duration.

### D. SCOUT SCANNING:

- Anterolateral chest wall blocks are ultrasound-guided blocks. However, deeper blocks like deep SAP block can be given utilizing the LANDMARK technique by depositing LA solution above the Rib.
- PNS can be used to locate and target motor nerves (TDN, LTN).

## E. PROBE MOVEMENT AND DYNAMIC SCANNING:

- a) **Aim:** To accurately count ribs, identify muscular landmarks, and locate relevant vascular structures for effective block placement.
- b) **Probe Sliding:**
- **Initial Placement:** Position the high-frequency linear ultrasound probe vertically in the parasagittal plane over the clavicle along the midclavicular line.
  - **Identify the Clavicle:** Identify the hyperechoic shadow of the clavicle, which serves as the initial landmark.
  - **Slide Downward:** Move the Probe downwards while keeping the cranial end on the clavicle. The caudal end should lie distal to the clavicle above the coracoid process.
  - **Identify Second Rib:** The hyperechoic shadow at the cranial end represents the clavicle. The next hyperechoic shadow distally is the second Rib. The first Rib is horizontal and proximal to the clavicle, typically seen in a supraclavicular block.
  - **Directional Movement:** Move the Probe from cranial to caudal and obliquely from the midclavicular line towards the anterior axillary line. Ensure the probe orientation allows for visualization into the chest cavity, cutting across the ribs in a short axis.
  - **Further Rib Identification:** After identifying the second Rib, move the Probe distally to identify subsequent ribs.

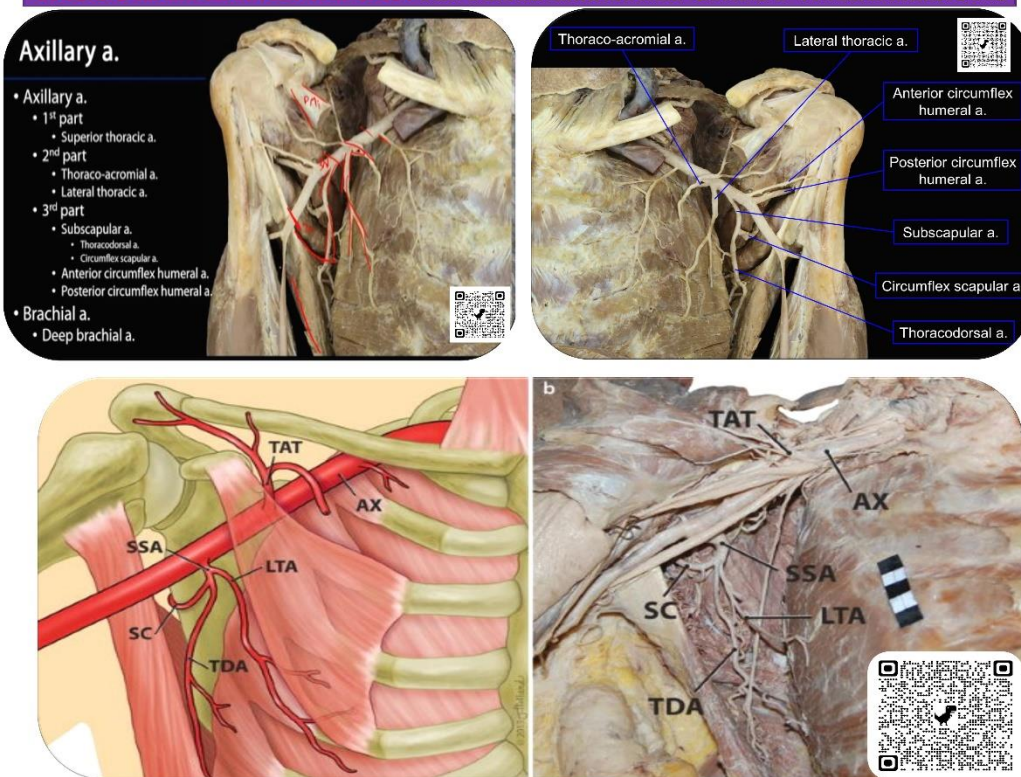




c) **Various locations of the probes for anterolateral chest wall blocks:**

- **Location 1:** Vertically over clavicle at midclavicular line.
- **Location 2:** Obliquely positioned below the clavicle and above the coracoid process, used for PECs 0 and PECs 1 blocks.
- **Location 3:** Placed obliquely lateral to the midclavicular line but medial to the anterior axillary line, utilized for PECs 2 blocks.
- **Location 4:** Situated between the anterior and mid-axillary lines, applicable for BRILMA Block.
- **Location 5:** Positioned between the mid-axillary and posterior axillary lines, appropriate for SAP Block.

**VASCULAR LANDMARKS: ANTEROLATERAL CHEST WALL BLOCKS**



d) **Important Vascular Landmarks:**

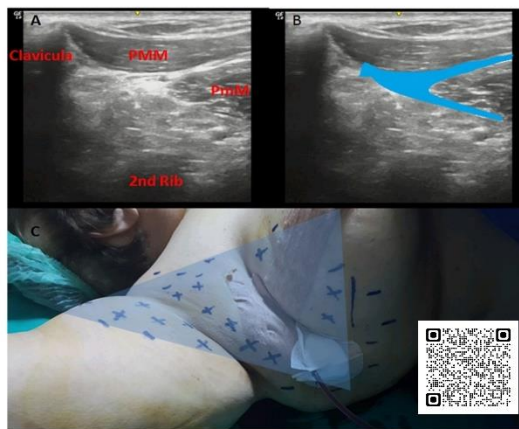
Vascular landmarks not only guide the placement of the needle but also help in avoiding vascular injury, which is critical for the safety of the block procedures.

- **PECs 1 Block:** Thoracoacromial Artery (TAA) Pectoral branch between Pectoral muscles.
- **PECs 2 Block:** Pectoral branch of TAA between Pectoral muscles.
- **SAP1 Block:** Lateral Thoracic Artery along the lateral edge of the pectoralis minor and into the serratus anterior muscle. This artery helps define the plane above the serratus anterior muscle where the Block is performed.
- **SAP 2 Block:** Lateral thoracic artery on the plane beneath the SAM.

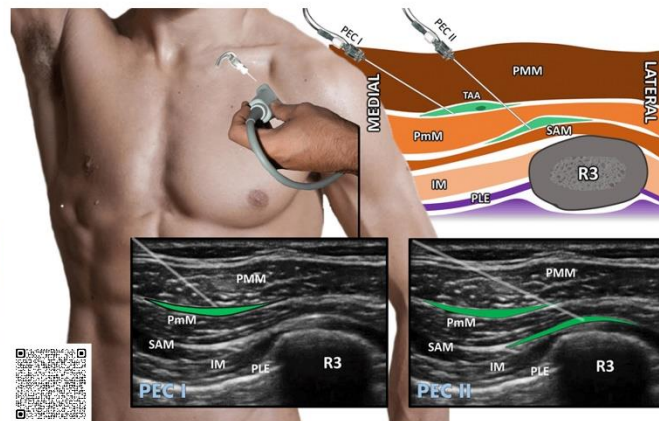
### e) Location of Target Nerves:

- **PECs 1 Block:** MPN can be located medial to LPN, between the pectoral muscles adjacent to TAA.
- **PECs 2 Block:** Intercostobrachial nerve can be seen in the superficial plane in the axillary region. LTN can be located above the SAM.
- **SAP Block:** LTN can be located above the SAM, and TDN can be located below the SAM adjacent to the thoracodorsal artery.

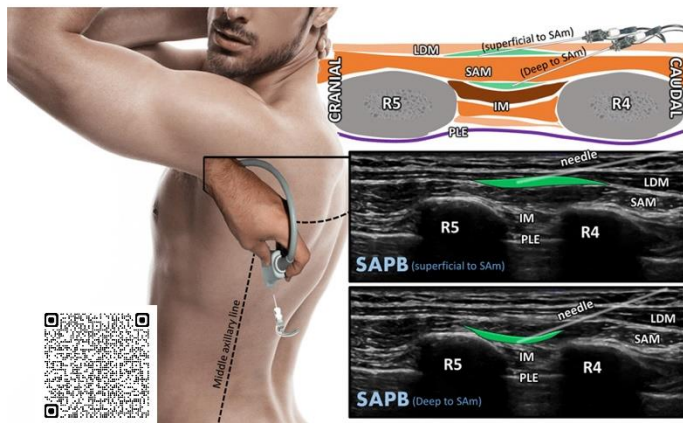
## PECTORAL NERVE (PECs) AND SERRATUS ANTERIOR PLANE (SAP) BLOCKS



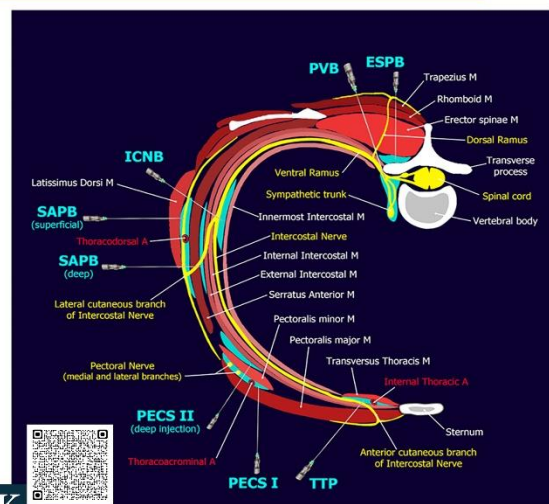
**PECs ZERO BLOCK**



**PECs 1 (IPPB) & PECs 2 (PSPB)**



**SAP 1 (Superficial) & SAP 2 (Deep) BLOCK**



## 6. PECs Zero Block [Modified Clavipectoral Fascial Plane Block]

### a) Indications:

- This modified block technique is particularly suited for cases where conventional pectoral blocks might not be feasible due to altered anatomy or prior surgical interventions.
- This Block is executed at a cephalic level comparable to the PECs II block, aiming for similar analgesic effects.

### b) Patient position: Supine.

### c) Probe: Linear, high frequency.

### d) Anatomy: The clavipectoral fascia enwraps the clavicle and the subclavius muscle, merging the caudal to these structures. Thereafter, the fascia splits and enwraps the pectoralis minor muscle.

### e) Probe Position: Location 2 i.e. Probe placed vertically between the clavicle (proximally) and 2<sup>nd</sup> Rib (distally).

### f) Vascular Landmark: Acromion branch of Thoracoacromial Artery (TAA).

### g) Sonoanatomy: Key sonographic landmarks include the hyperechoic clavicle, hypoechoic subclavius muscle, axillary vessels, PMM and PMnM, and the clavipectoral fascia between the subclavius and pectoralis minor muscles.

### h) Injection Plane: Above and below pectoralis minor muscle.

### i) Rib Level: Between Clavicle-2<sup>nd</sup> Rib.

### j) Needle-22G, 5 cm short bevel

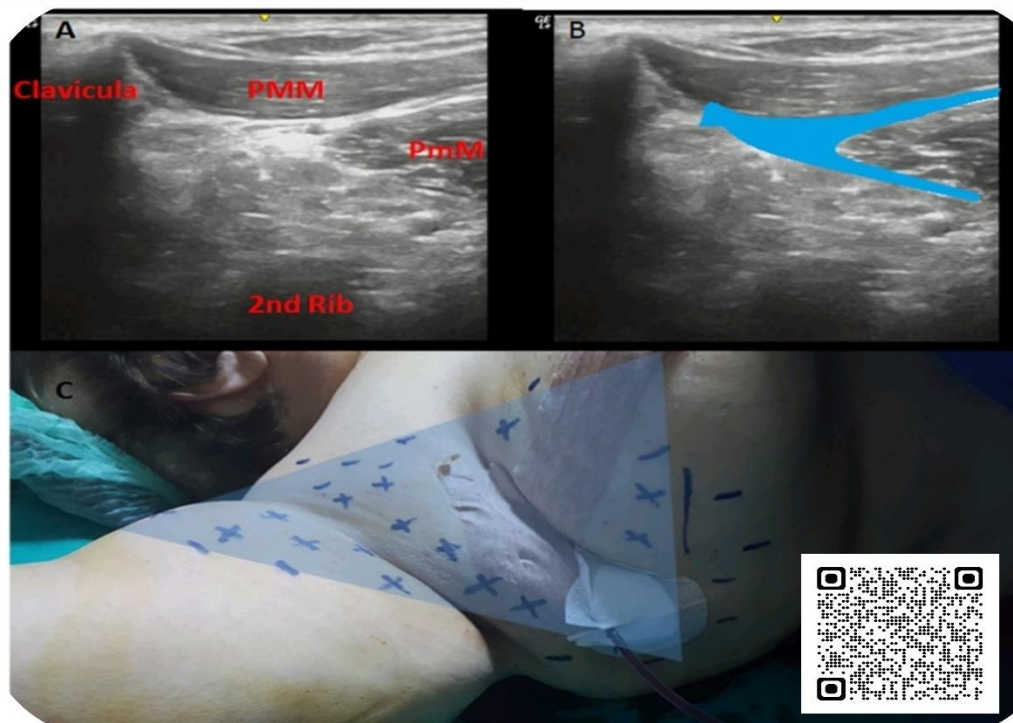
### k) Needle direction: In-plane from cranial to caudal direction.

### l) LA Spread: Spread of the LA occurs to both the upper and deep interfascial planes of the pectoralis minor muscle.

### m) Coverage: Same as PECs 2 Block.

### n) Limitation: Just one case report; more cadaveric dye studies and RCTs are needed to establish its benefit.

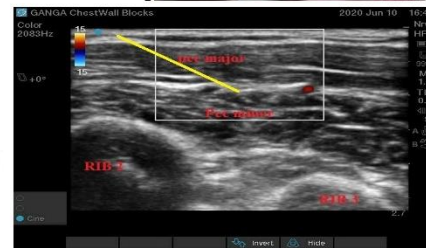
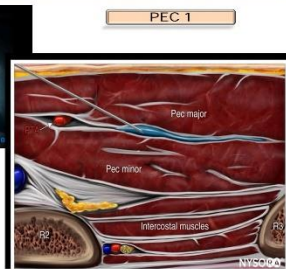
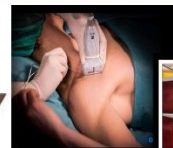
## PECs ZERO (Modified Clavipectoral Fascial Plane) BLOCK





Also known as **PECs 1** block.

- Position –supine ( rib 2 ) , midclavicular line
- Probe – High frequency linear probe
- Depth – usually 1-3cm
- Needle –22G 50 mm
- Needle approach –In plane
- Injection-0.25%bupivacaine or 0.2% ropivacaine ; min volume 10 ml -15 ml
- Blocks – MPN and LPN



**a) Indications:**

- Insertion of breast expander and submuscular prosthesis.
- Portacaths/Pacemaker insertion.
- Anterior thoracotomies.
- Shoulder surgeries involving deltopectoral groove

**b) Patient position:** Supine

c) **Probe:** Linear, high frequency

**d) Probe Position: Location 3, i.e.** Probe is placed on the clavicle in a parasagittal plane along the midclavicular line, medial to Coracoid process like in the infraclavicular Block. The distal end of the ultrasound probe is given a slight lateral rotation to align it towards the axilla.

**e) Sonoanatomy:**

- The hyperechoic clavicle is noticed.
- Hypoechoic Subclavius muscle can be identified under the clavicle shadow.
- Anechoic axillary vessels can be seen under the Subclavius muscle.
- A little further caudally, the pectoralis major and the minor muscles are observed.
- The fascial plane between the two is confirmed by the presence of the pectoral branch of the TAA.

**f) Injection Plane:** Interfascial plane between the PMM and PMnM.

**g) Needle-22G, 5 cm short bevel.**

**h) Rib level:** At rib 2 or between 2<sup>nd</sup>-3<sup>rd</sup> Rib.

**i) Needle Direction:** In-plane from cranial to caudal direction.

j) **LA volume:** 10- 15 ml.

**k) Coverage:** MPN (C8-T1) and LPN (C5-C7).

## 8. PECs 2 block (IPPB + PSPB)

Also known as **Modified PECS block** or **InterPectoral Plane (IPP) + PectoSerratus Plane (PSP) Block**.

**a) Indications:**

- Tumor resection.
- Mastectomies.
- Sentinel lymph node biopsy
- Axillary clearance.

**b) Patient position:** Supine with the arm abducted 90 degrees.

**c) Probe Position: Location 3.** i.e., below the clavicle in the anterior axillary line, Sagittal oblique plane.

**d) Sonoanatomy:** The ultrasound probe is positioned as described for PECs 1. Once the PECs 1 is completed, the Probe is moved a little further laterally and inferiorly towards the axilla and positioned on the anterior axillary line over the fourth Rib. The upper slips of the serratus anterior start to appear from the third Rib, and the fascial plane between the serratus anterior and pectoralis minor is identified.

**e) Vascular Landmark:** Pectoral branch of TAA between Pectoral muscles.

**f) Injection Plane:** It involves **TWO** injections:

- **First Injection:** Between PMM and PMnM (like PECs 1 Block).
- **Second Injection:** Between PMnM and SAM.

**g) Needle-**22G, 5 cm short bevel

**h) Rib level:** At Rib3/ 4.

**i) Needle Direction:** **In-plane** Cephalic to inferolaterally.

**j) LA Volume:**

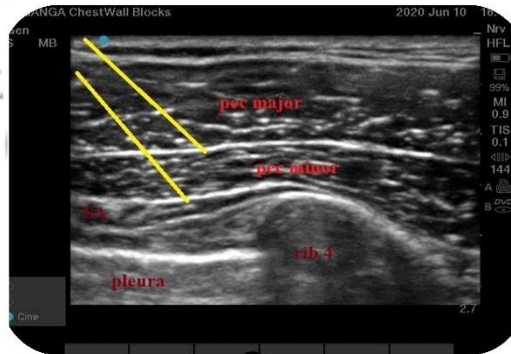
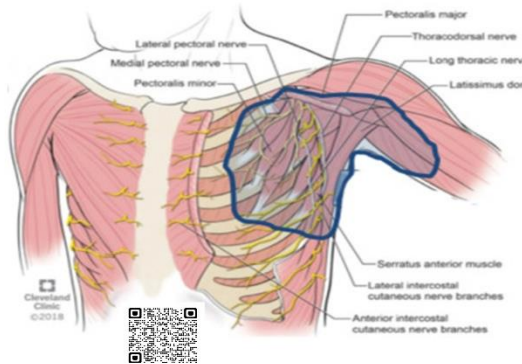
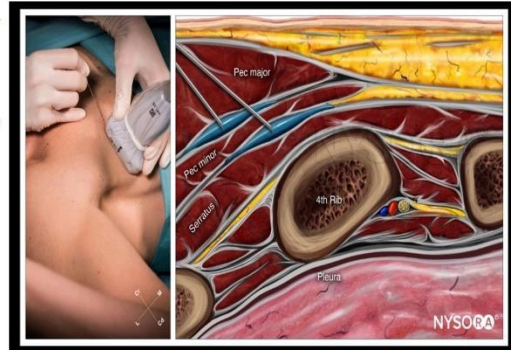
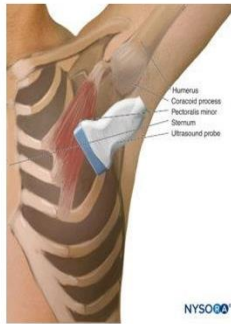
- First Injection -5 to 10 ml
- Second Injection- 15 to 20 ml

**k) Coverage:** MPN, LPN, ICN T2-T6, LTN.

## Pectoral Nerves 2 (PECs 2) Block (IPPB+PSPB)

Position – Supine with arm abducted to 90 degrees ; rib 3/4 ( anterior axillary line )  
 Probe – High frequency linear probe  
 Depth – 1-3 cm for 1<sup>st</sup> Injection ; 3-6cm for 2<sup>nd</sup> Injection  
 Needle – 22G ; 50 mm  
 Needle approach – In plane  
 Injection 1- 10 ml  
 Injection 2 – 15-20 ml

Blocks – LPN , MPN , T2-T6  
 intercostal



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## Serratus Anterior Plane (SAP) Block

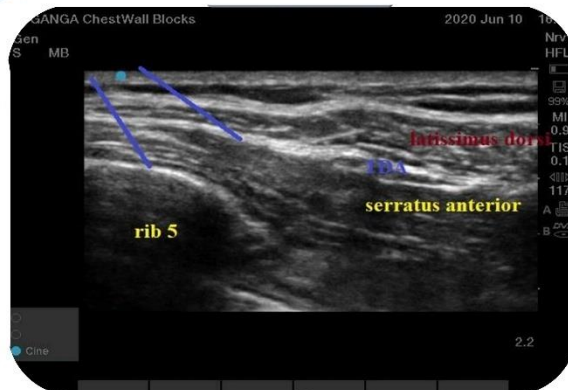
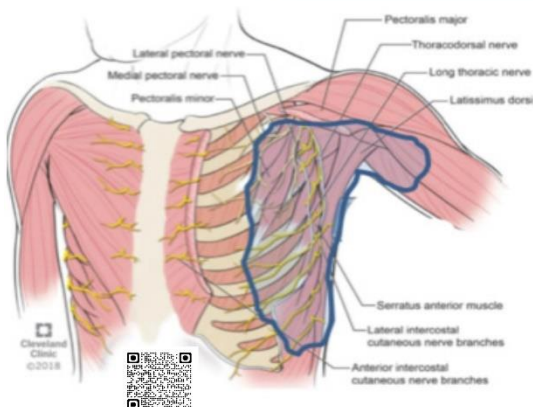
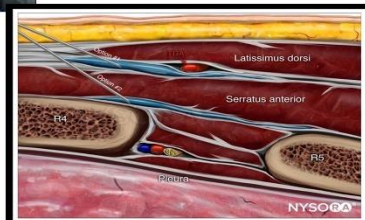


**Goal** – Drug in compartment between Serratus anterior and Latissimus dorsi ( superficial )  
 Between serratus anterior and intercostal muscles/rib ( deep )  
**Position**- Lying by side , Supine with arms brought forwards , 4/5 rib between posterior and midaxillary line  
**Transducer**- Linear transducer 6- 13 Hz  
**Needle**- 22G ; 50-100mm ; In plane  
 Volume-0.4 ml/kg ( 20 ml )  
**Nerves blocked**-  
 • Intercostobrachial N  
 • lateral cutaneous branch of Intercostal Nerve ( T3- T9 ) ,  
 • Long Thoracic Nerve  
 • Thoracodorsal Nerve

**Artery of Interest** – Thoracodorsal artery



Serratus plane block



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## 9. SAP BLOCK

SAP Block is placed more lateral and posterior than the PECs blocks.

**Muscles involved:** SAM (anterior to midaxillary line), LDM & SAM (posterior to midaxillary line) above the ribs.

**a) Indications:**

- Breast surgeries (Mainly WLE/Axillary clearance/ Sentinel lymph node biopsy).
- Breast reconstruction surgery (Latissimus dorsi flap).
- AV fistula surgery.
- Rib fractures (anterolateral > Posterolateral > Posterior).
- Esophagectomy and anastomoses.
- Thoracoscopy/ Thoracotomy.
- Shoulder surgery (involving armpit).

**b) Patient Position:** Supine/Lateral with the ipsilateral arm abducted.

**c) Probe Position: Location 5:** Between mid-axillary to posterior axillary lines, at the nipple level in the transverse oblique plane.

**d) Sonoanatomy:**

- Identify SAM appearing from rib 3, such as for PECs 2 Block.
- Upon crossing the anterior axillary line, only SAM can be seen over the Ribs as PMM and PMnM disappear.
- The transducer is rotated into the coronal plane in the midaxillary line, and a slight posterior sliding and tilting shows hyperechoic LDM aponeurosis above the SAM, which turns into hypoechoic bulky muscle lying above SAM upon tracing posteriorly.
- An anechoic and pulsating Thoracodorsal Artery can be seen in this plane.

**e) Vascular Landmark:** Thoracodorsal Artery below LDM.

**f) Injection plane:** The SAP block can be divided into 3 approaches as per the injection planes:

- **SAP 1/ Superficial SAP (Blanco's Approach):** Above SAM i.e, Between SAM-LDM.
- **SAP 2/ Deep SAP (Gaur's Approach):** Below SAM i.e, Between SAM and ICMs/Ribs.
- **Modified SAP:** Combination of SAP 1 + SAP 2.

**g) Needle-**22G, 5 cm short bevel

**h) Rib Levels:** Rib 4/5.

**i) Needle Direction:** Superoanterior to Posteroinferior.

**j) LA Volume:**

- 20-30 ml (For SAP 1 and SAP 2)
- 10-15 ml in SAP 2 plane + 20-30 ml in SAP 1 Plane (For Modified SAP Block)

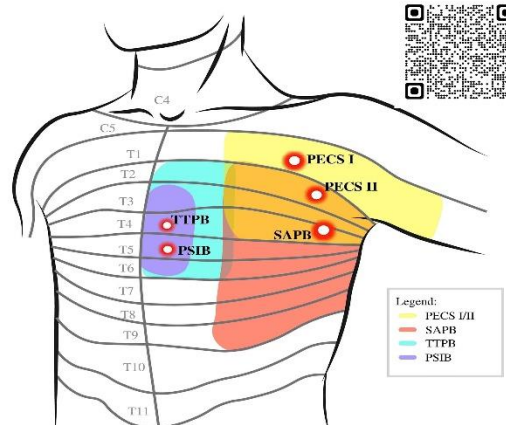
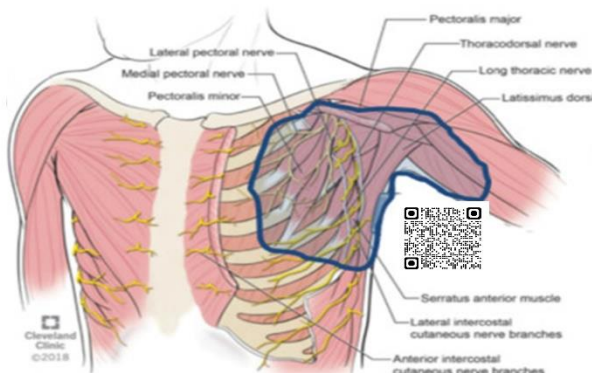
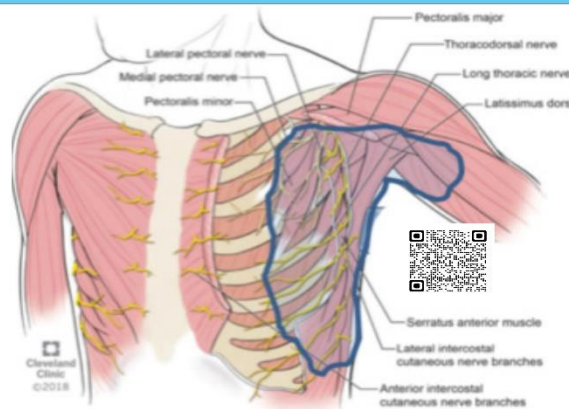
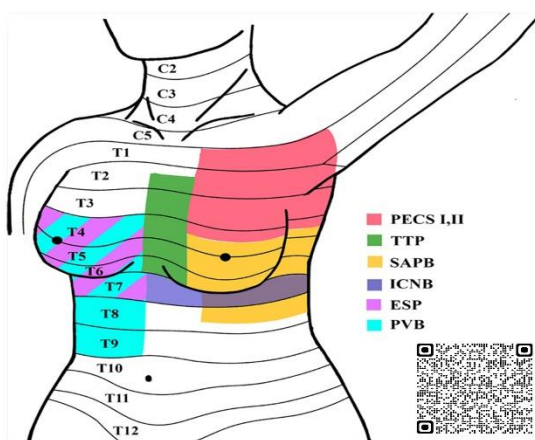
**k) Coverage:** ICBN, LCBs of ICNs 3-9, TDN, LTN.

## 10. COMPARISONSs

### A. PECs 1 vs PECs 2:

- PECs blocks are known for potentially avoiding hypotension and minimizing nerve and pleural injury compared to PVBs.
- A combination of Modified PECs block + Thoracic PVB is suitable for awake breast surgery.
- PECs 1 focuses on superficial structures of the chest, whereas PECs 2 provides broader and deeper analgesia, influencing choices based on the surgical site and extent.
- Both blocks enhance postoperative recovery by targeting specific areas to reduce pain and minimize opioid use.
- A PECs 1 + SAP block combination is better for more extensive lateral coverage.

## Analgesic Coverage: Anterolateral Chest Wall Blocks



## B. Superficial vs Deep SAP:

- a) **Target:** Superficial SAP targets LCB of ICN after its division into anterior and posterior branches, whereas Deep SAP targets ICN before its division.
- b) **Nerves Preservation:** Deep SAP can be considered when a blockade of LTN and TDN (involved in superficial SAP) is unnecessary.
- c) **Onset:** Higher pressure under the SAM in the Deep SAP block enhances anesthetic diffusion, providing more immediate pain relief, especially in patients with rib fractures. However, increased vascularity under SAM reduces its duration compared to SAP-1.
- d) **Duration:** Injected LA above the SAM in the Superficial SAP block offers broader anesthetic dispersal, creating a less dense block with prolonged duration due to lower vascularity. Meanwhile, a deep SAP block involves LA deposition in a relatively confined anatomical space beneath the SAM, creating what is referred to as a “**tight compartment.**” This tighter compartment restricts the lateral and vertical spread of the anesthetic, potentially resulting in a more concentrated and localized analgesic effect compared to the SAP1 block.
- e) **Obscured Planes:** Deep SAP (SAP 2) involving LA deposition above the Rib under the SAM can be considered in patients whose plane between LDM and SAM gets obscured following radical mastectomy, irradiation, or in obese patients.
- f) **Which and When?** These anatomical and pharmacological differences between the blocks make SAP-2 particularly beneficial for surgeries requiring targeted, deep, and sustained pain management, while SAP-1 might be preferred for broader coverage with less specificity.
- g) **Combine both: Modified SAP** combines SAP-1 for prolonged duration and SAP-2 for faster onset. Tailored for surgeries needing targeted, deep, and sustained pain management. Provides flexibility based on surgical pain relief needs.

## USEFUL VIDEO LINKS

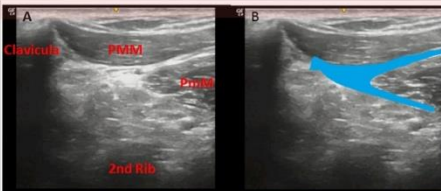
- **Understanding Intercostal Nerves:** <https://youtu.be/AB0akSUzc80>
- **Anterior Chest Wall Muscle:** [https://youtu.be/gOQhPDvZx\\_o](https://youtu.be/gOQhPDvZx_o)
- **PECs Block Technique:** <https://www.youtube.com/watch?v=example1>
  - <https://www.youtube.com/watch?v=YFWneF4pwOA&pp=ygUKcGVjcyBibG9jaw%3D%3D>
  - <https://www.youtube.com/watch?v=9p2efjT5JHU&pp=ygUKcGVjcyBibG9jaw%3D%3D>
- **SAP Block Technique:** <https://www.youtube.com/watch?v=example2>
  - <https://www.youtube.com/watch?v=9ytynz33NjA&pp=ygUKcGVjcyBibG9jaw%3D%3D>
  - <https://www.youtube.com/watch?v=vQSW-K-Fw5Y&t=71s&pp=ygUKcGVjcyBibG9jaw%3D%3D>
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## SUMMARY

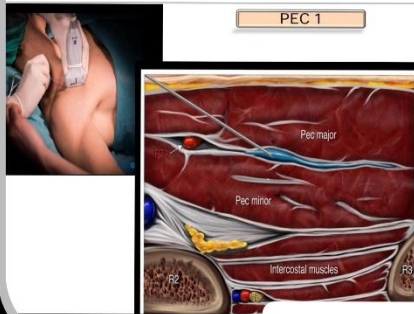
# Anterolateral Chest wall Blocks

- Position –supine (rib 2) , midclavicular line
- Probe – High frequency linear probe
- Depth – usually 1-3cm
- Needle – 22G 50 mm
- Needle approach –In plane
- Injection-0.25%bupivacaine or 0.2% ropivacaine ; min volume 10 ml -15 ml
- Blocks – MPN and LPN



- Position –Supine with arm abducted to 90 degrees ,rib 3/4 ( anterior axillary line )
- Probe – High frequency linear probe
- Depth – 1-3 cm for 1<sup>st</sup> Injection ;3-6cm for 2<sup>nd</sup> Injection
- Needle – 22G ,50 mm
- Needle approach – In plane
- Injection 1- 10 ml
- Injection 2 – 15-20 ml

Blocks – LPN , MPN ,T2-T6 intercostal

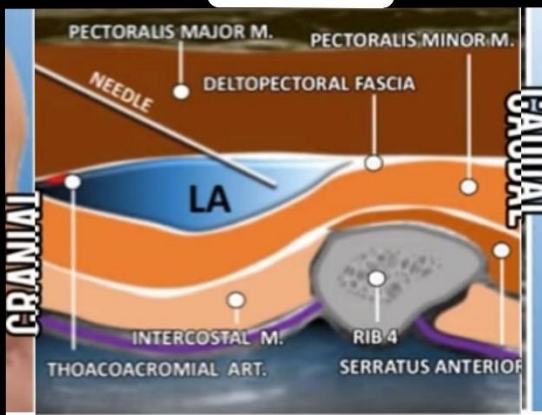


**PEC 1**

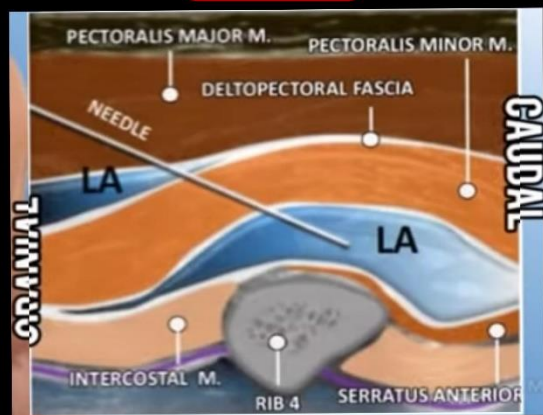
**PEC zero**  
(Aka Modified Clavipectoral Fascial Plane Block)



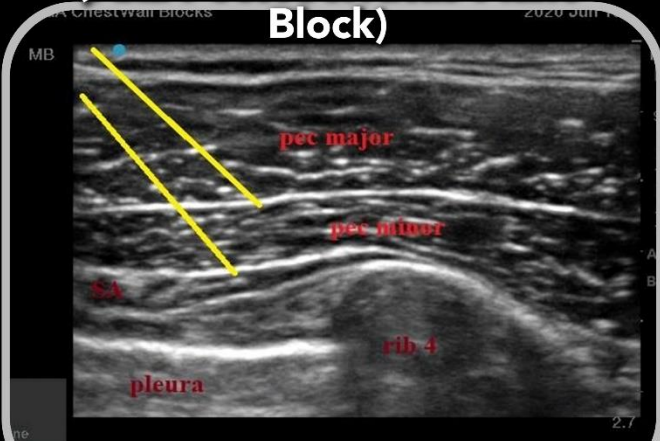
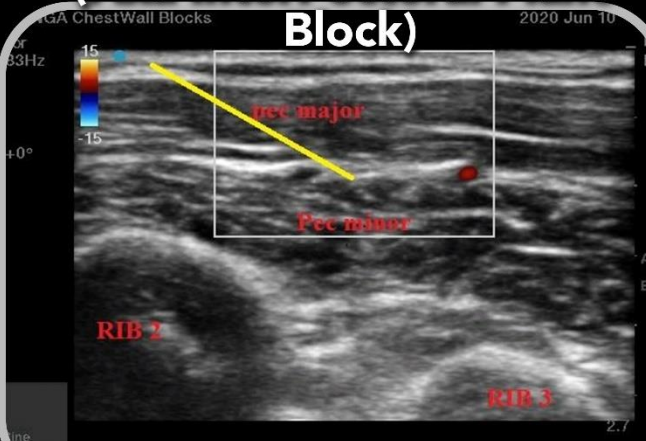
**PEC 2**



(Aka InterPectoral Plane Block)

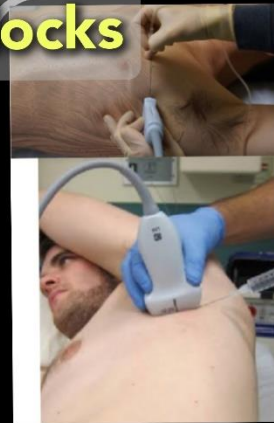
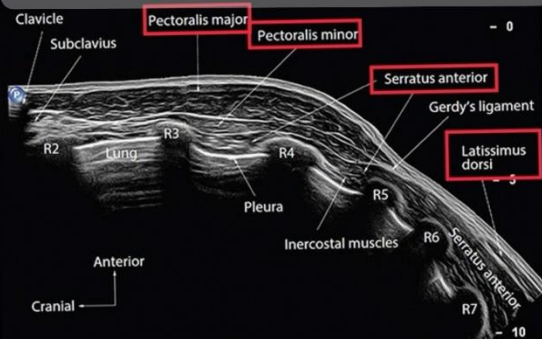


(Aka PectoSerratus Plane Block)



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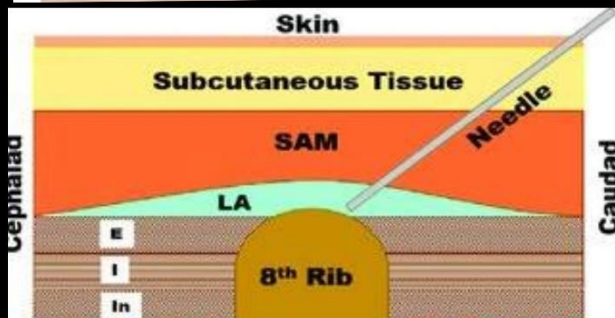
# Lateral Chest Wall Blocks



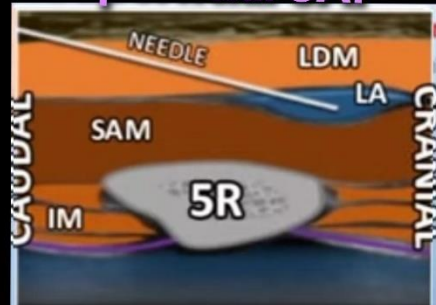
## BRILMA Block



## SAP Block



## Superficial SAP



**Goal** – Drug in compartment between Serratus anterior and Latissimus dorsi ( superficial )  
 Between serratus anterior and intercostal muscles/rib ( deep )  
**Position**- Lying by side . Supine with arms brought forwards . 4/5 rib between posterior and midaxillary line  
**Transducer**- Linear transducer 6- 13 Hz  
**Needle**- 22G ; 50-100mm ; In plane  
**Volume**- 0.4 ml/kg ( 20 ml )  
**Nerves blocked**-  
 • Intercostobrachial N  
 • lateral cutaneous branch of Intercostal Nerve ( T3- T9 ) ,  
 • Long Thoracic Nerve  
 • Thoracodorsal Nerve

**Artery of Interest** – Thoracodorsal artery

## Deep SAP



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## ACKNOWLEDGMENT

I am grateful to all sources for the copyrighted images used in this article. They are included solely for educational purposes, with no commercial interest. Your contributions greatly enhance the understanding and application of the Anterolateral Chest wall Blocks.

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