

INTERFASCIAL PLANE BLOCKS - THEIR ROLE IN ACUTE AND CHRONIC PAIN

PROF. RAVINDER KUMAR PANDEY



Interfascial Plane Block (IFPB)

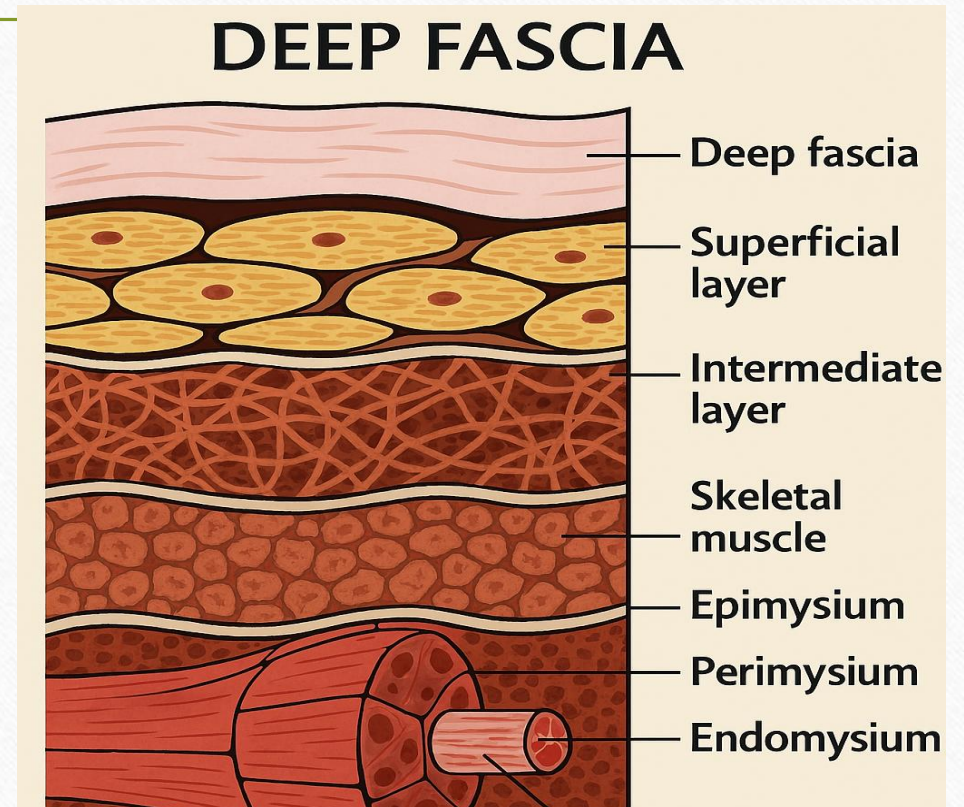
- IFPB's represent minimally invasive regional analgesia
- Used for management of acute postoperative pain & chronic neuropathic pain
- Ease of administration, rapid action, safety, low cost & less side effects than opioid analgesics & neuraxial analgesia

Deep fascia ☆

- Dense, fibrous connective tissue
- Encloses muscles, nerves, vessels, bones and organs

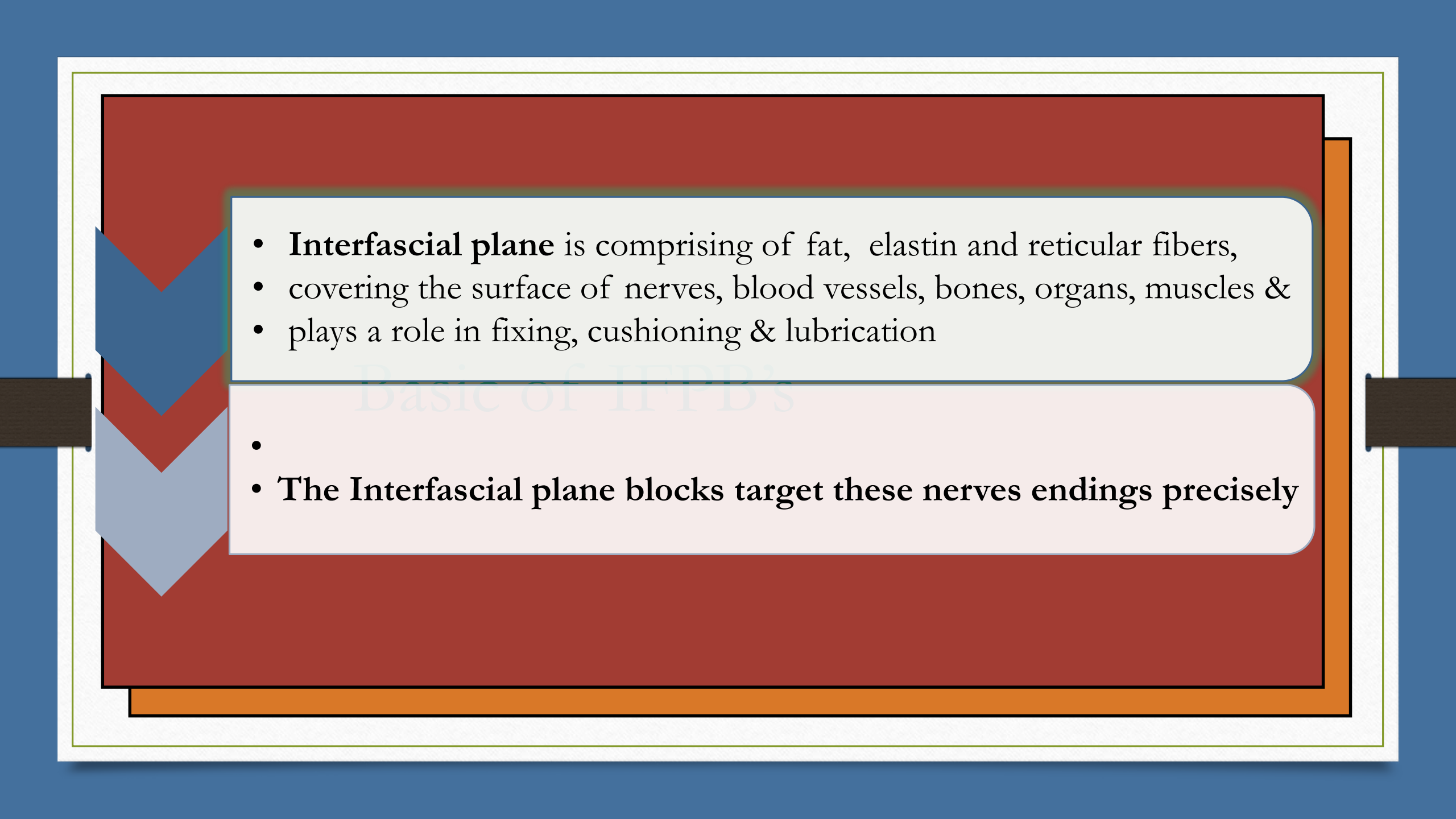
Functions

- Provides **structural integrity and movement coordination**
- Acts as a **glide system** for smooth muscle motion



Role of Deep Fascia in Chronic Musculoskeletal Pain

- DF is a potential source of pain generation in different pathologies & CPS
- Richly innervated with free nerve endings of **unmyelinated (C)** & **thinly myelinated (A-delta)** neurons
- Nociceptors , proprioceptors, mechanoreceptors - Crucial for pain sensation & proprioception. respond to **thermal, chemical** and **mechanical stimuli**
- Pathological changes in DF like densification , fibrosis , adhesions & inflammation generate nociceptive inputs
- Sustain persistent symptoms & Neurogenic sensitization - contributes to conditions like MPS & Fibromyalgia

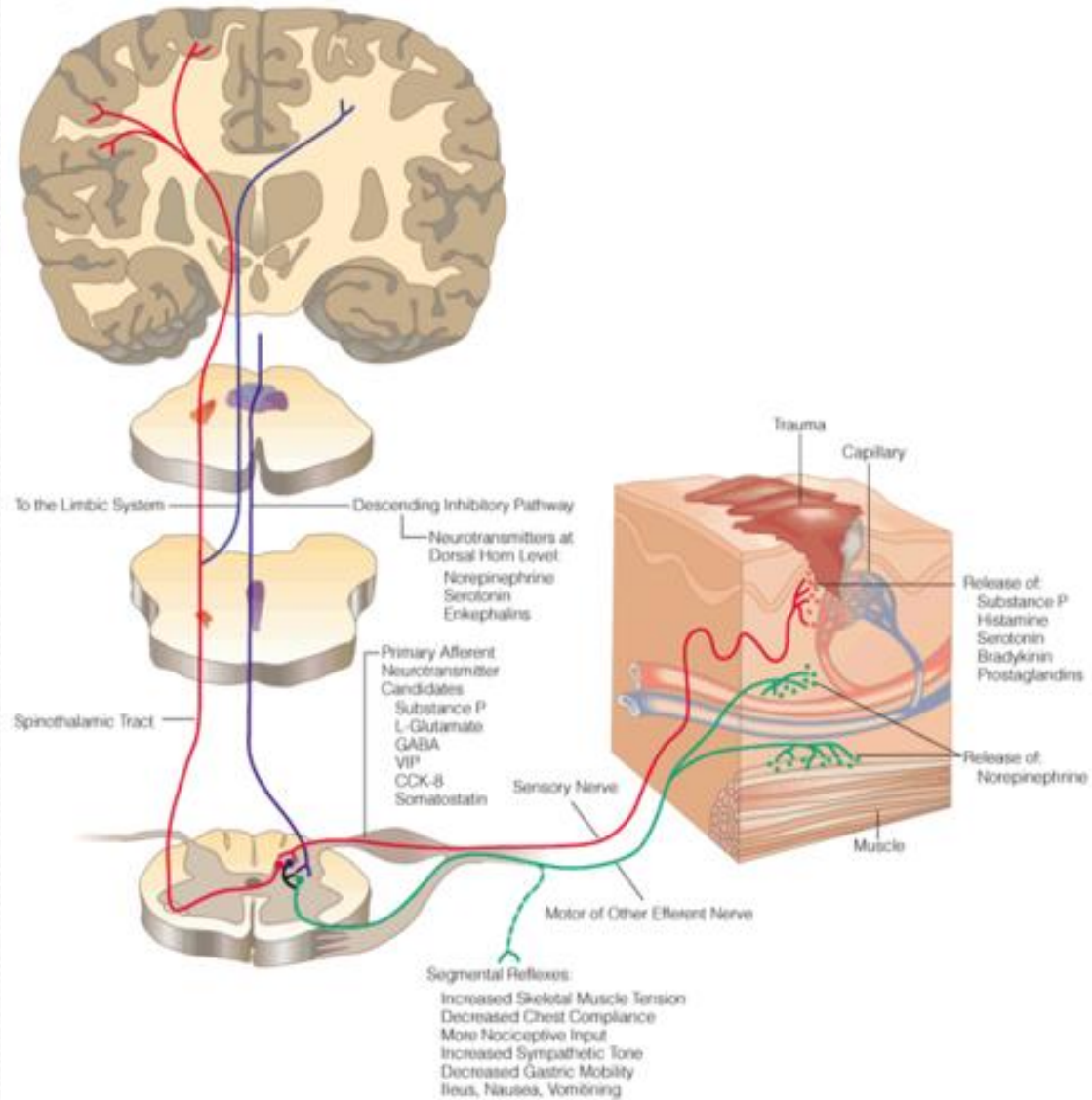
- 
- **Interfascial plane** is comprising of fat, elastin and reticular fibers,
 - covering the surface of nerves, blood vessels, bones, organs, muscles &
 - plays a role in fixing, cushioning & lubrication

- Basic of IFFB's
- - **The Interfascial plane blocks target these nerves endings precisely**

IFPB's – Mechanism of action

- Paths of these **perforating nerve branches** and **accompanying vessels** provide **potential channels** for physical spread of **LA** to reach the nerves running within the plane
- LA is also diffuses into the surrounding muscles & fascia where it may have **local effect** on **peripheral nociceptors**

Perception of Pain



IFPB's - four categories

Cervical blocks

Thoracic blocks

IFPB's

Abdominal blocks

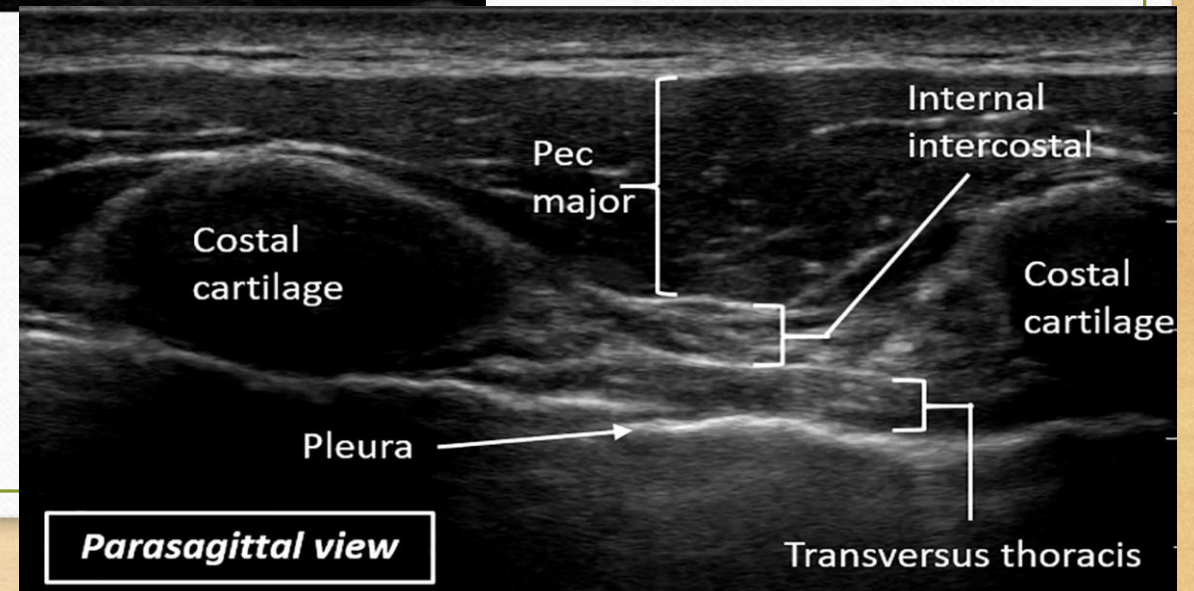
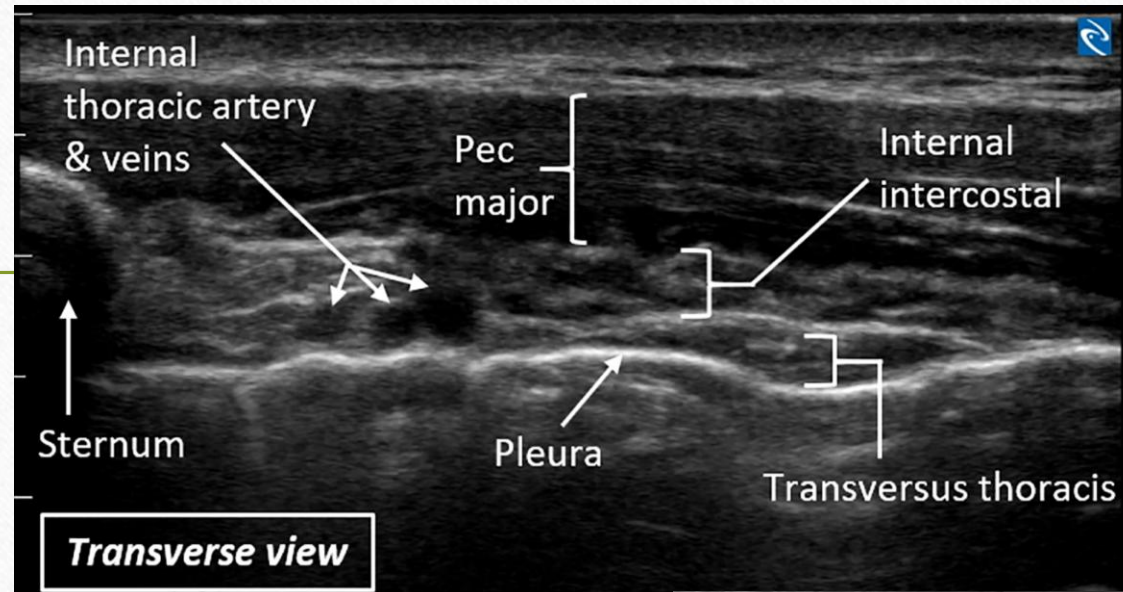
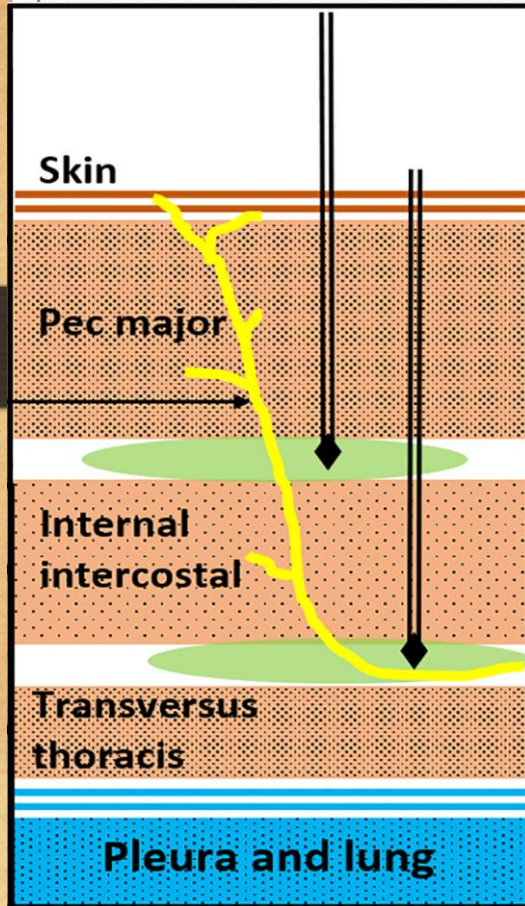
Lower limb blocks

Thoracic Fascial Plan Blocks

Anterior Chest Wall Blocks

Medial	Lateral
Transversus Thoracic Muscle Plane block (TTM)	PECS I
Pecto Intercostal Fascial Plane Block (PICF block)	PECS II
	Serratus anterior plane block (Superficial)
	Serratus anterior plane block (Deep)

Parasternal Intercostal Plane block



Anteromedial Chest Wall Blocks

Parasternal Intercostal Plane Block

Pecto – Intercostal Fascial Plane Block (PICF)	Transversus Thoracic Muscle Plane Block (TTMP)
Superficial block	Deep block
Between pectoralis major and internal intercostal muscle and ribs	Between internal intercostal muscle and transversus thoracis muscle
Anterior cutaneous branches of T2-T6 Thoracic Intercostal nerves	Anterior cutaneous branches of T2-T6 Thoracic intercostal nerves
Main advantage : Away from pleura	Complications : Pneumothorax, IMA injury, LAST

RESEARCH

Open Access



Comparison of the effects of transversus thoracic muscle plane block and pecto-intercostal fascial block on postoperative opioid consumption in patients undergoing open cardiac surgery: a prospective randomized study

TTMPB

Risk of pneumothorax

Vascular injury / hematoma

Abstract

Background There is an association exists between cardiac surgery, performed through median sternotomy, and a considerable postoperative pain.

Objectives The aim of the current study is to compare the effects of transversus thoracic muscle plane block (TTMPB) and pecto-intercostal fascial plane block (PIFB) upon postoperative opioid consumption among the patients who underwent open cardiac surgery.

Methods The present prospective, randomized, comparative study was conducted among 80 patients who underwent elective on-pump cardiac surgery with sternotomy. The subjects were randomly assigned to two groups with each group containing 40 individuals. For the TTMPB group, bilateral ultrasound-guided TTMPB was adopted in which 20 ml of 0.25% bupivacaine was used on each side. In case of PIFB group, bilateral ultrasound-guided PIFB was adopted with the application of 20 ml of 0.25% bupivacaine on each side. The researchers recorded the first time for rescue analgesia, the overall dosage of rescue analgesia administered in the first 24 h after the operation and the postoperative complications.

Results The PIFB group took significantly longer time to raise the first request for rescue analgesia (7.8 ± 1.7 h) than the TTMPB group (6.7 ± 1.4 h). Likewise, the PIFB group subjects had a remarkably lower 'overall morphine usage' in the first 24 h after the operation (4.8 ± 1.0 mg) than TTMPB group (7.8 ± 2.0 mg).

Conclusion Bilateral ultrasound-guided PIFB provided a longer time for the first analgesic demand than bilateral ultrasound-guided TTMPB in patients undergoing open cardiac surgery. In addition to this, the PIFB reported less postoperative morphine usage than the TTMPB and increases satisfaction in these patients.

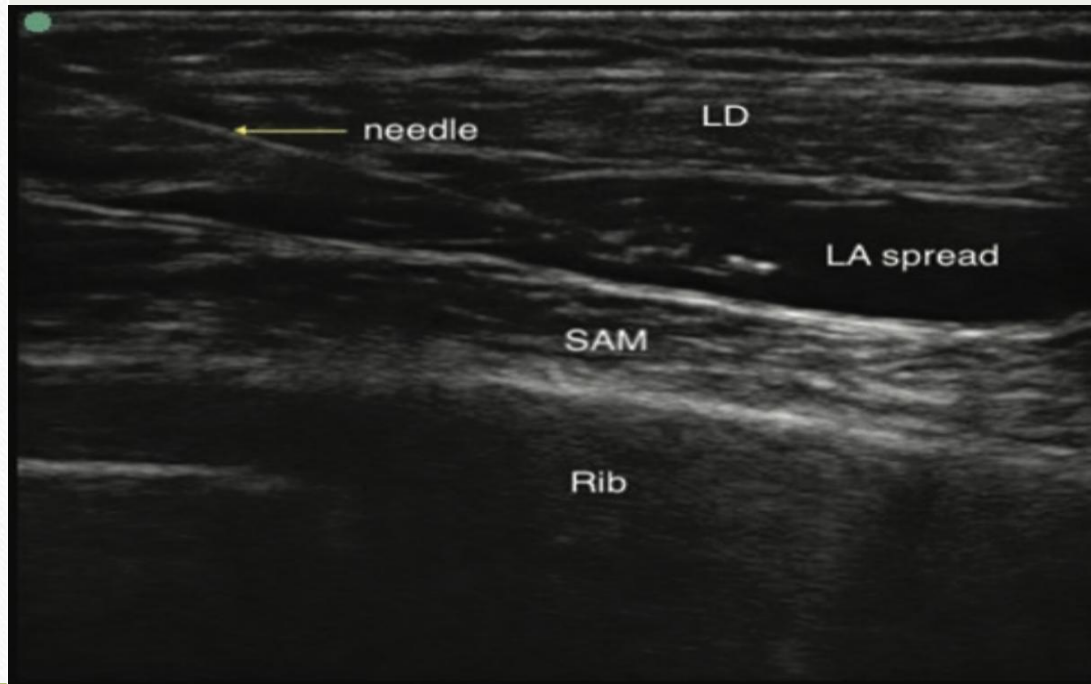
Trial registration This study was registered at Clinical Trials.gov on 28/11/2022 (registration number: NCT05627869).

Keywords TTMPB, PIFB, Open cardiac surgery, Postoperative pain

Serratus Anterior Plane Block (SAP)

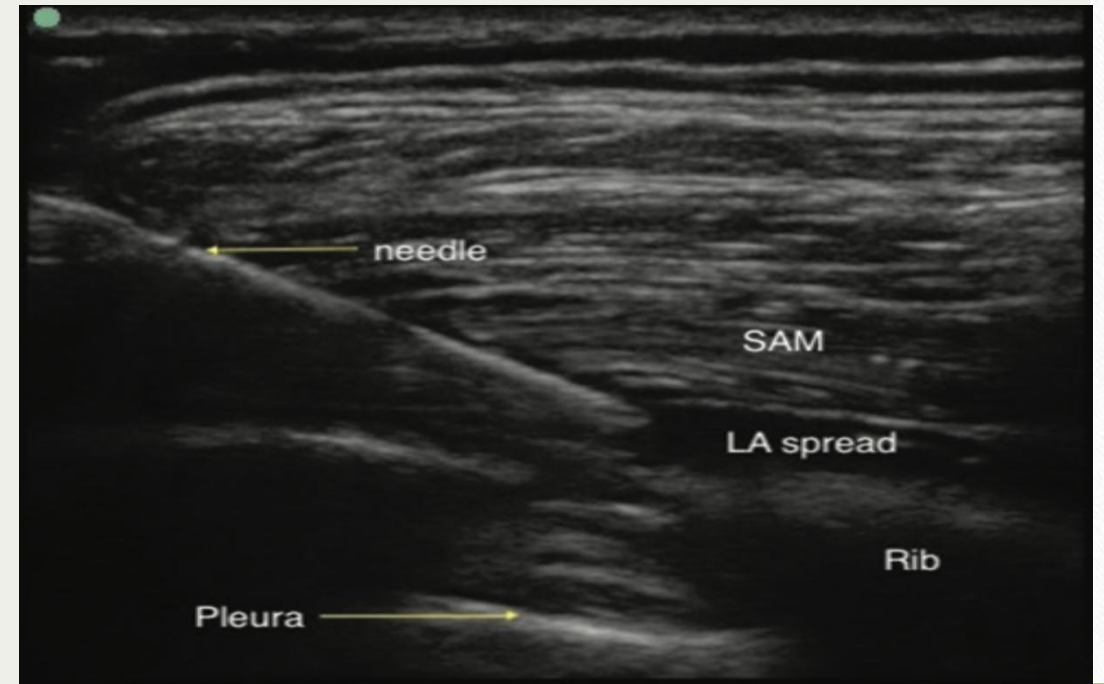
SAP superficial

LA is injected superficial to serratus anterior muscle



SAP deep

LA is injected deep to serratus anterior muscle and superficial to ribs and intercostal muscles.



Serratus Anterior Plane block

SAP superficial

SAP deep

Lateral cutaneous branches of T2-T7 Thoracic intercostal nerves.
Intercostobrachial nerve

Long thoracic nerve
Thoracodorsal nerve

Main trunk of Intercostal nerves may also
be reached

Disadvantage – blockade of motor nerves
Thoracodorsal artery

Pneumothorax

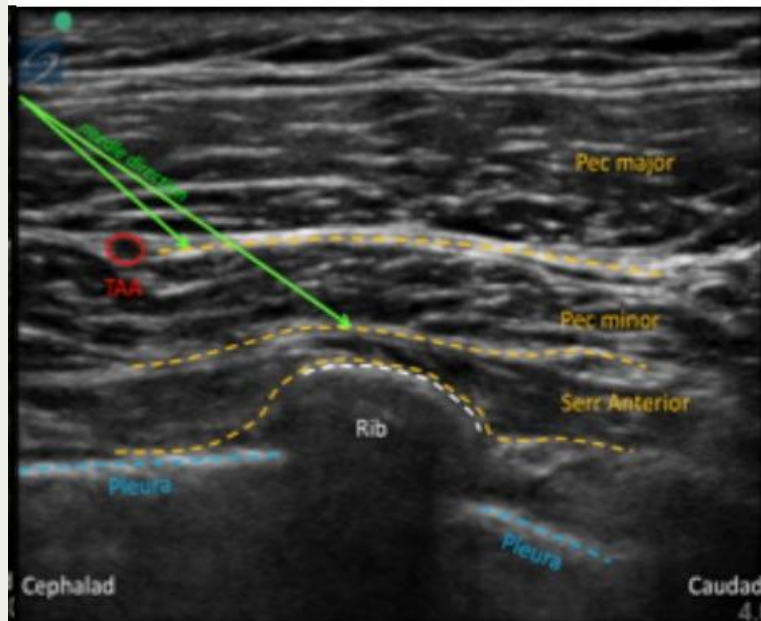
Indications in chronic pain

Postmastectomy Pain syndrome
Post Thoracotomy Pain Syndrome
Post ICD pain
Radiation fibrosis pain

Pectoral Nerve block

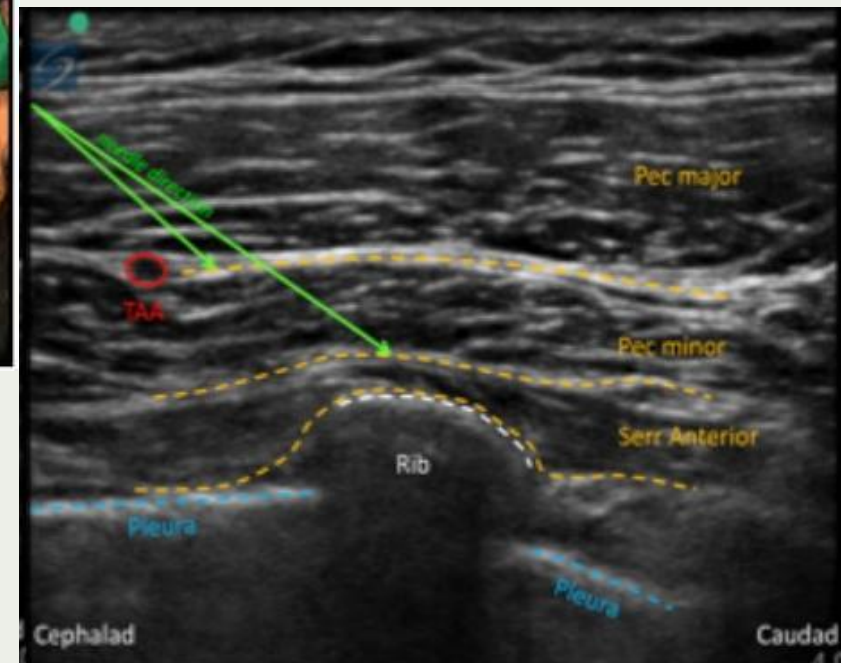
PECS I

LA injection between pectoralis major and minor muscles



PECS II

PECS I block plus a second injection deep to pectoralis minor and superficial to serratus anterior muscle.



Pectoral Nerve Block

PECS I	PECS II
Targets Lateral and medial pectoral nerves As a part of PECS II Block	Targets long thoracic nerve, inter-costo brachial nerve Lateral cutaneous branches of T2-T6 Thoracic intercostal nerves. Used for extensive surgeries

PECS block in chronic pain

Interventional Treatment Options for Post-mastectomy Pain

Aarthi Murugappan¹ · Ashish Khanna²

Accepted: 8 June 2023 / Published online: 30 August 2023

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- Post mastectomy pain
- Post reconstruction – pectoral muscles stretched and expanded – spasm and pain
- Post radiation – radiation fibrosis of muscle and nerves in that area is painful

Costochondritis vs Tietze syndrome

	Costochondritis	Tietze syndrome
	More common	Rare
Age	Less than 50 yrs	Above 50 yrs
No. of sites affected	More than one	One
CC Junction m/c affected	2nd to 5th B/L CC or CS junction B/L pain aggravated by coughing & deep breathing	2nd or 3rd CC junction
Local swelling	Absent	Tender tumour like swelling present at CC junction

Costochondritis & Tietze syndrome - Treatment

Physical therapy	Interventional management
Stretching	Corticosteroid injection
Local application of heat	Fascial Plane Block (PICF , TTM block)
Pharmacotherapy	Costochondritis: Rapid Evidence Review Timothy Mott, MD; Gregory Jones, MD; and Kimberly Roman, MD South Baldwin Regional Medical Center Family Medicine Residency Program, Foley, Alabama
NSAIDs	
Capsaicin, diclofenac gel	



Contents lists available at ScienceDirect

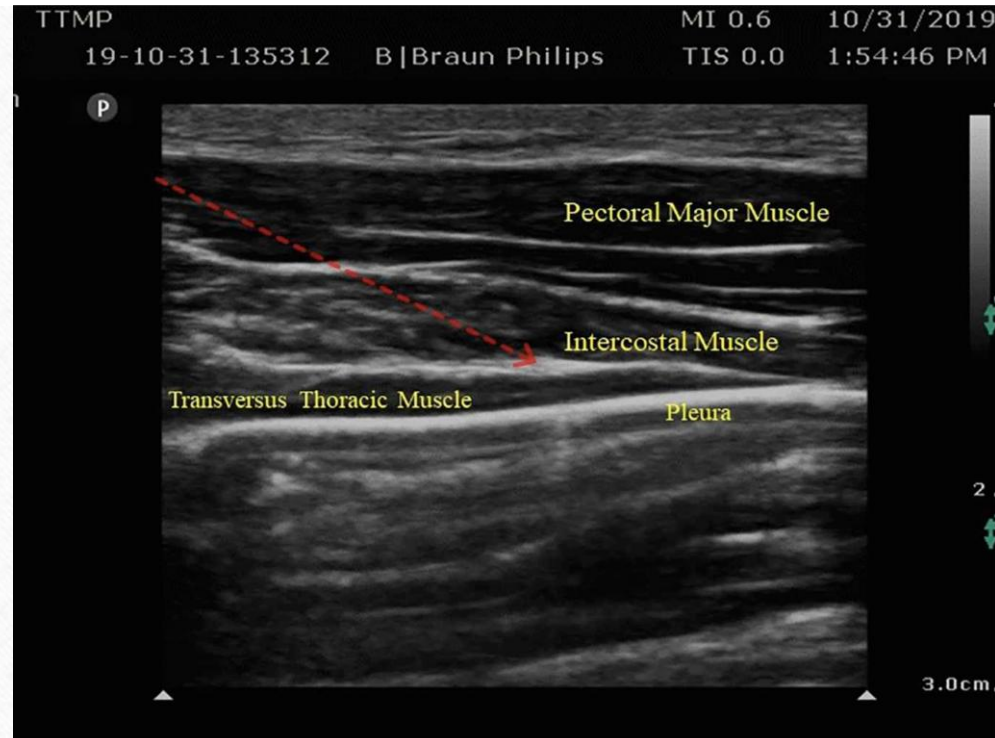
Journal of Clinical Anesthesia

journal homepage: www.elsevier.com/locate/jclinane



Correspondence

Transversus thoracic muscle plane block for persistent parasternal pain: The Tietze syndrome



Posterior Chest Wall Blocks

Posterior chest wall blocks

Posterior wall	
Retrolaminar block	
Erector spinae plane block	ESPB
Paraspinal Intercostal plane block	
Rhomboid Intercostal Subserratus plane block	RISS
Serratus posterior superior Intercostal plane block	SPSIP

“Mauricio Forero” - 2016 Described ESP Block “A Novel Analgesic Technique In Thoracic Neuropathic Pain”

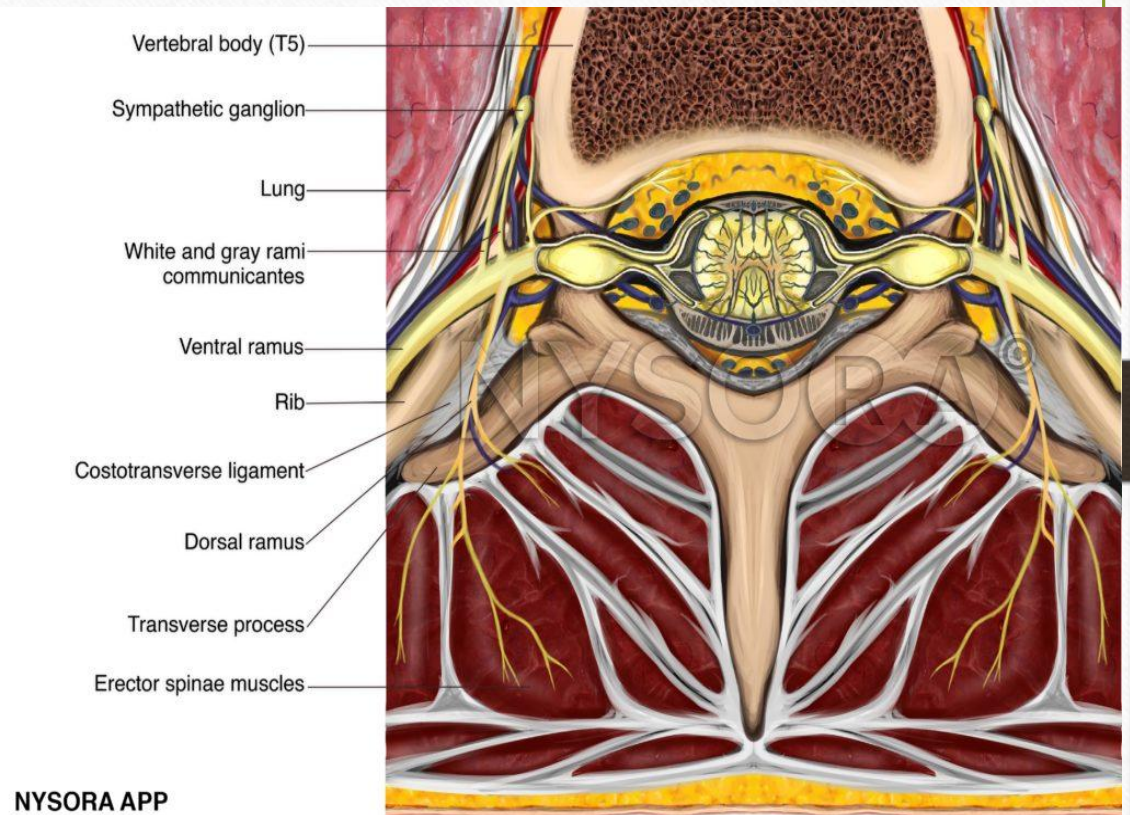
The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain

Mauricio Forero, MD, FIPP^{*}, Sanjib D. Adhikary, MD[†], Hector Lopez, MD[‡], Calvin Tsui, BMS[§] and Ki Jinn Chin, MBBS (Hons), MMed, FRCPC^{||}

Address correspondence to: Ki Jinn Chin, MBBS (Hons), MMed, FRCPC, Department of Anesthesia, University of Toronto, Toronto Western Hospital, McL 2-405, 399 Bathurst St, Toronto, Ontario, Canada M5T 2S8 (e-mail: gasgenie@gmail.com).

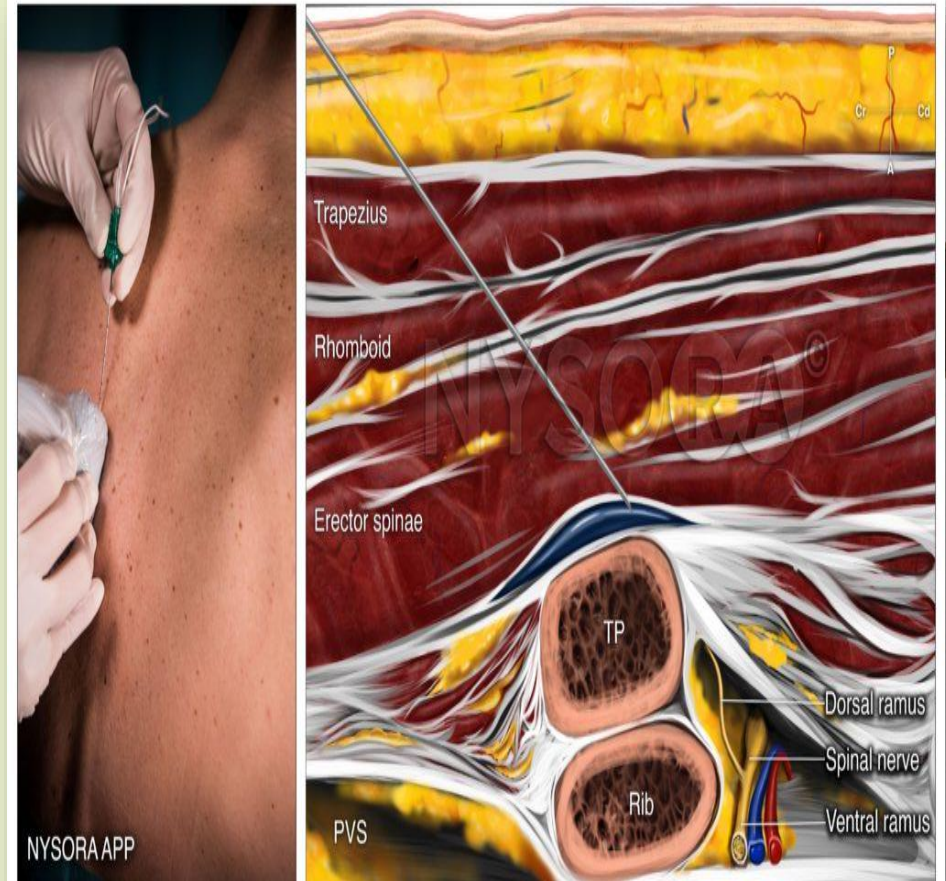
C.S of a Thoracic Vertebra

- Sensory innervation of upper posterior thorax up to lumbar region arises from ***Dorsal rami*** of ***C1 to L5 spinal N***
- **Ventral rami** of the thoracic spinal nerves from **T1-T12** continue as **intercostal nerves** innervating the anterolateral chest and abdominal wall.



Erector Spinae Plane Block

- **Paraspinal Interfascial Plane Block - ESM & TP**
- **Blocks - both *Dorsal & Ventral Rami***
 - Extensive somatic & visceral analgesia
- When performed at
 - T4- T6 Level** – Thoracic region
 - T8-T10 level** – Renal, abdominal
 - L3 level** - Lumbar

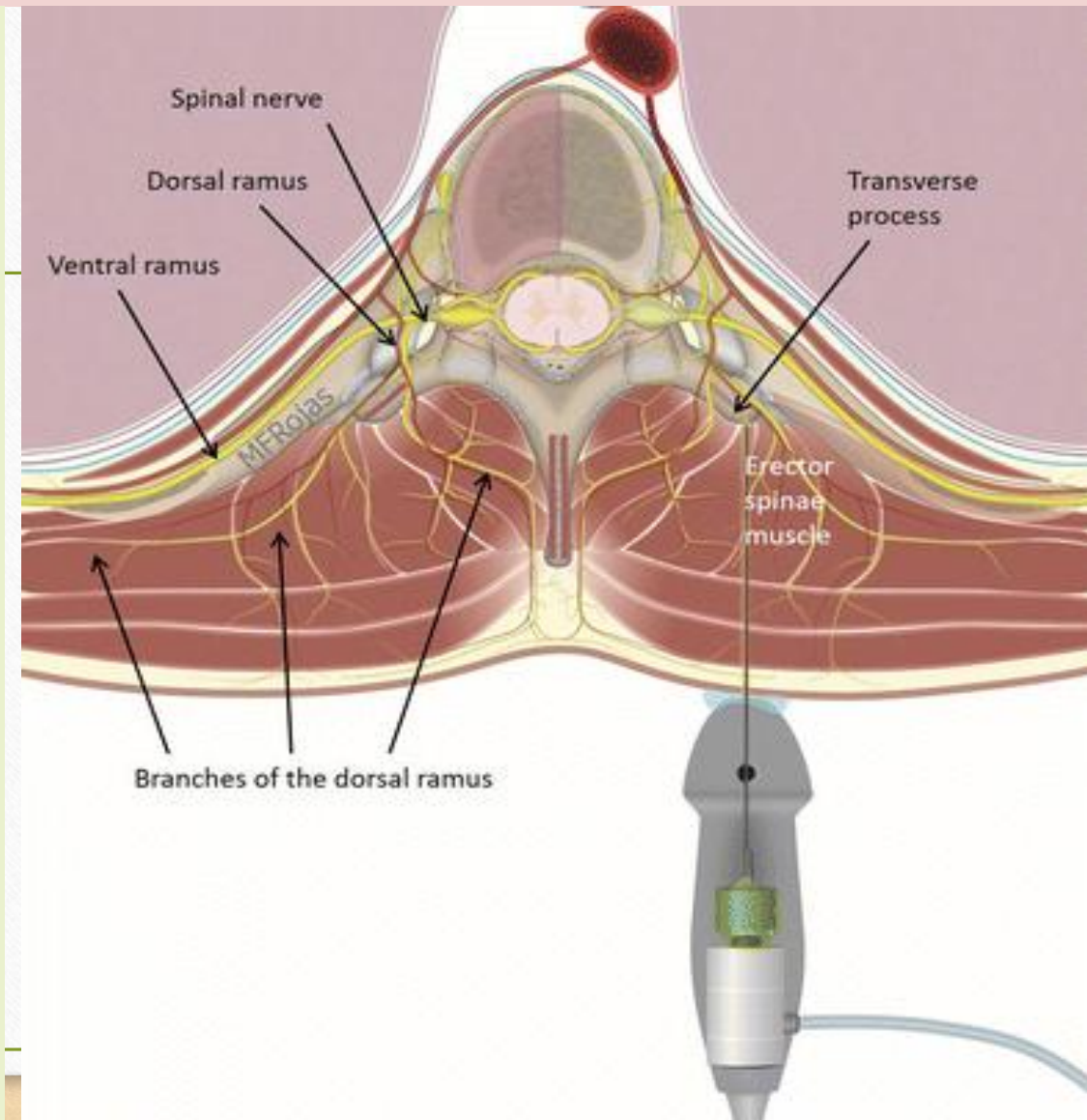


Advantages

- ESMs - encased in a **Thoracolumbar fascia** along its whole length
- **A single LA injection causes significant cranial-caudal spread**
 - additional advantage in multiple rib fractures
- Easy to perform relative to Thoracic epidural or Thoracic Paravertebral block
- Needle tip is away from pleura, major blood vessels & spinal cord

Mechanism of Analgesic Action of ESPB

- LA diffuses anteriorly to block dorsal & ventral rami, also **rami communicants** that contain sympathetic nerves resulting **effective somatic & visceral analgesia**.
- LA diffuses into **Para Vertebral space** through the **costotransverse foramen**
- Also, anteriorly **intercostal spaces**, and in some cases in **epidural space**.



Indications – ESP Block

Initially ESP block was described for management of pain

- For 3 or > rib fractures (unilateral or bilateral)
- Analgesia for breast surgeries

Recently for postoperative analgesia

- Orthopaedic surgeries - Spine surgeries , Hip arthroplasty
- Cardiothoracic surgery
- Nephrectomy, pyeloplasty , radical cystectomy
- Organ transplant , cholecystectomy, elective LSCS
- Various neuropathies, MPS, Fibromyalgia

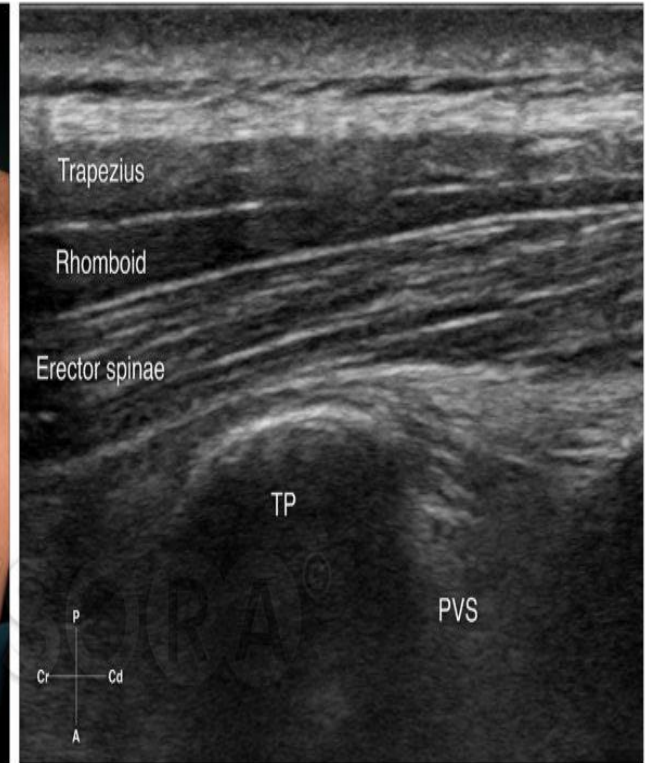
Other concerns

- ESP block may be performed in patients with
 - *Pre-existing thoracic spine disease* or thoracic vertebra fractures
 - *Coagulopathy or anticoagulants or antiplatelets are not absolute C/I*
 - Pleural puncture & pneumothorax are not significant concerns - injection is away from pleura
 - Risk of significant haemorrhage or hematoma is very low.

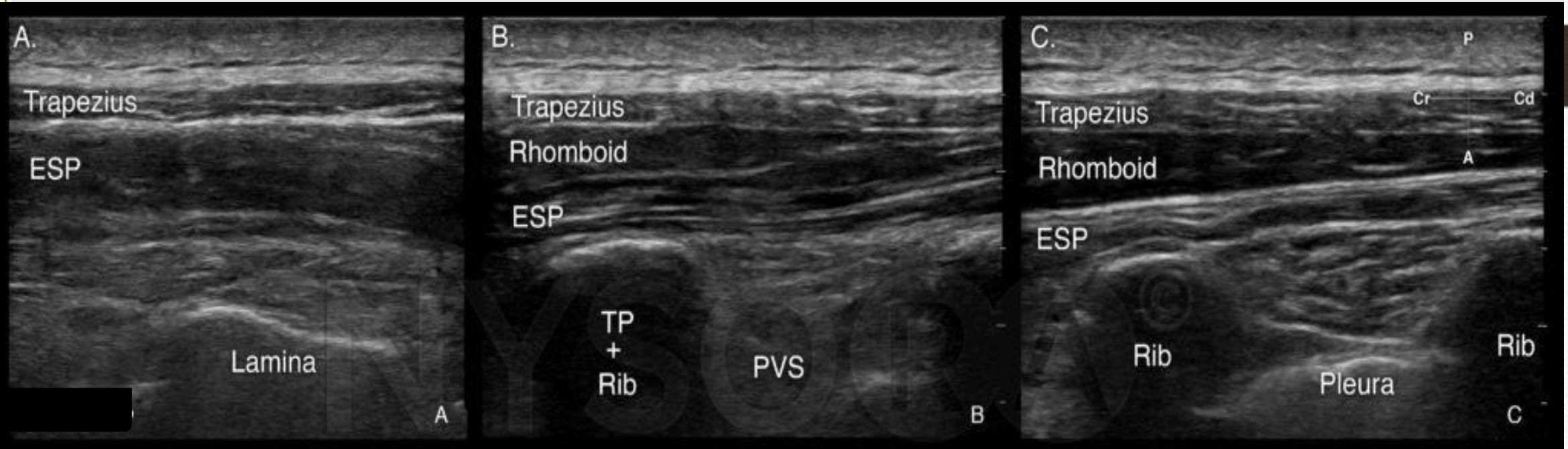


Scanning Technique

- Select the target TP
- **TP** are visualized like flat squared **hyperechoic** line with an acoustic shadow below
- At higher thoracic levels, e.g., above T5; trapezius, rhomboid major and erector spinae muscles can be identified
- In the lower and mid-thoracic levels, only the trapezius and erector spinae muscles can be seen.

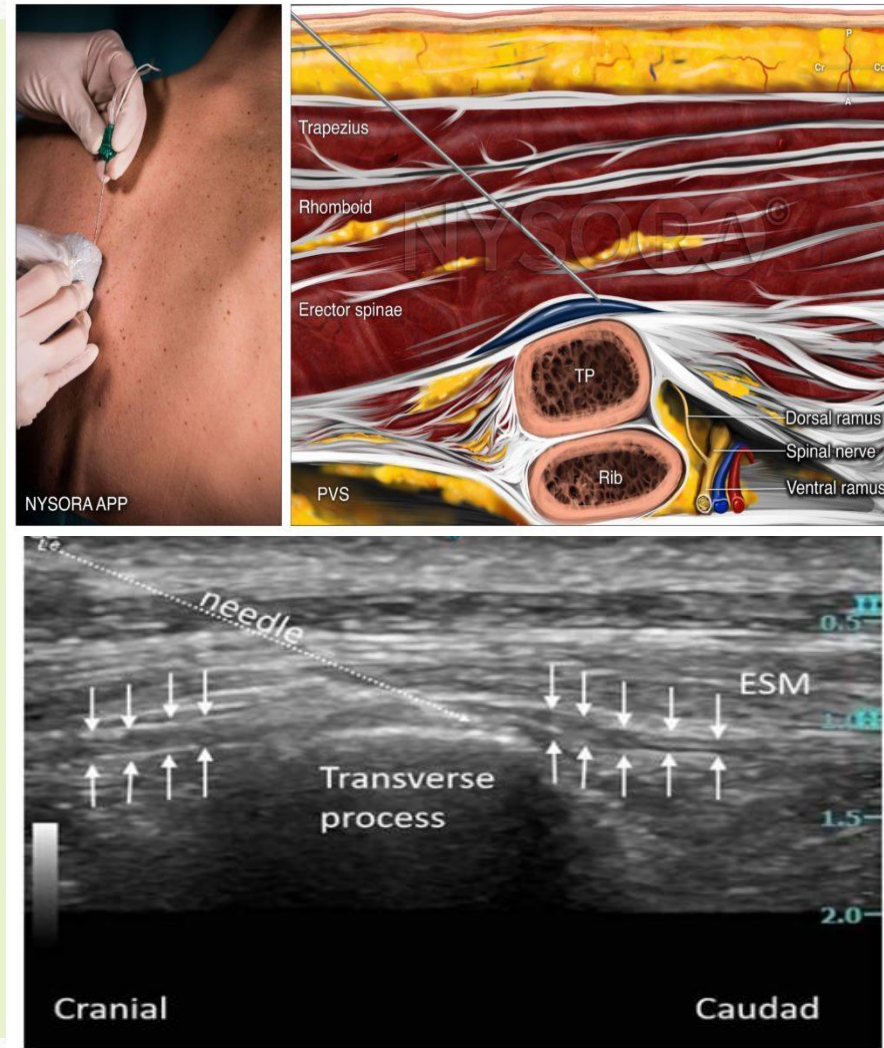


Ultrasound imaging for an ESPB. A. transducer is placed too medial. the thoracic laminae (flat hyperechoic lines) will be visualized. To fix: slowly slide the transducer laterally. **B. adequate transducer position for an ESP Block** **C. transducer placed too lateral,** with an intervening hyperechoic pleural line .To fix: slowly slide the transducer medially the ribs will be visualized as rounded acoustic shadows
 ESP, erector spinae; TP, transverse process; PVS, paravertebral space. cr, cranial, cd, caudad; A, anterior; P, posterior.



Injection procedure

1. Insert needle in-plane from a cranial to caudad until its tip touches TP.
2. Inject 1-3 mL of saline to confirm proper injection plane , complete the block with **20-30 mL** of LA
3. linear fluid spread lifting ESM above the tip of TP



Complications of ESPB BLOCK

- Despite being a relatively safe technique, ESPB can be associated with complications like
 - LA toxicity due to **vascular puncture**,
 - **Pneumothorax** due to accidental pleural puncture,
 - Hematomas,
 - Epidural or paravertebral injection.

Original Article: Clinical Investigation

Comparative evaluation of the analgesic efficacy of ultrasound-guided erector spinae plane block *versus* intrathecal morphine in patients undergoing percutaneous nephrolithotomy surgery: A prospective randomized pilot study

Madhurjya Baishya,¹ Ravinder Kumar Pandey,¹  Ankur Sharma,² Jyotsna Punj,¹ Vanlal Darlong,¹ Vimi Rewari,¹ Renu Sinha,¹ Maya Dehran,¹ Devalina Goswami,¹ Debesh Bhoi,¹ Prabhjot Singh,³ Souvik Maitra,¹ Kanil Ranjith,¹ Brusabhanu Nayak³ and Preeti Yadav¹

¹Department of Anaesthesiology, Pain Medicine and Critical Care, All India Institute of Medical Sciences, New Delhi, ²Department of Anaesthesiology, All India Institute of Medical Sciences, Jodhpur and ³Department of Urology, All India Institute of Medical Sciences, New Delhi, India

ESP Block

ESP in chronic pain management

Post Herpetic Neuralgia

Post Thoracotomy Pain Syndrome (PTPS)

Myofascial Pain Syndrome (MPS)

Metastatic rib cancer pain

Journal of Ultrasound (2024) 27:1–11
<https://doi.org/10.1007/s40477-023-00825-0>

REVIEW PAPER

Ultrasound-guided procedures for the management of chronic thoracic back pain: a technical review

- Main contributor of this MPS pain is Entrapment of cutaneous branches of the dorsal rami in the Deep fascia surrounding the back muscles
- ESP block might hydro-dissect these points of entrapment and block these nerves

Intercostal neuralgia

- **Neuropathic pain in the distribution of affected ICN**
 - Sharp, aching, radiating, burning, or stabbing pain
 - Paresthesia
 - Intermittent or constant
 - **Band like pain** wrapping around the chest
 - Symptoms typically sensory
- **Most Common causes**
 - Post thoracotomy pain syndrome PTPS
Herpes zoster HZ / PHN
Post ICD
Post surgery
 - Intercostal neuropraxia

Intercostal neuralgia – Interventional Procedures

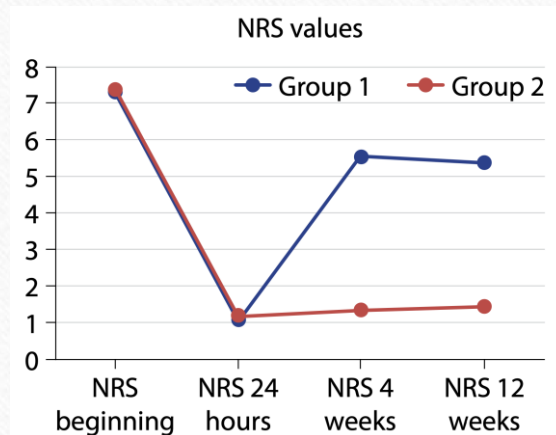


Agri 2020;32(4):208–218
doi: 10.14744/agri.2020.87523



ORIGINAL ARTICLE

Evaluation of the efficacy of erector spinae plane block and intercostal nerve block in the postherpetic neuralgia



ICN block

Multiple injections

Increases vascularity & increased drug metabolism and shorter duration of action

Spread is limited

Complications –
Pneumothorax, LAST

ESP block

Single

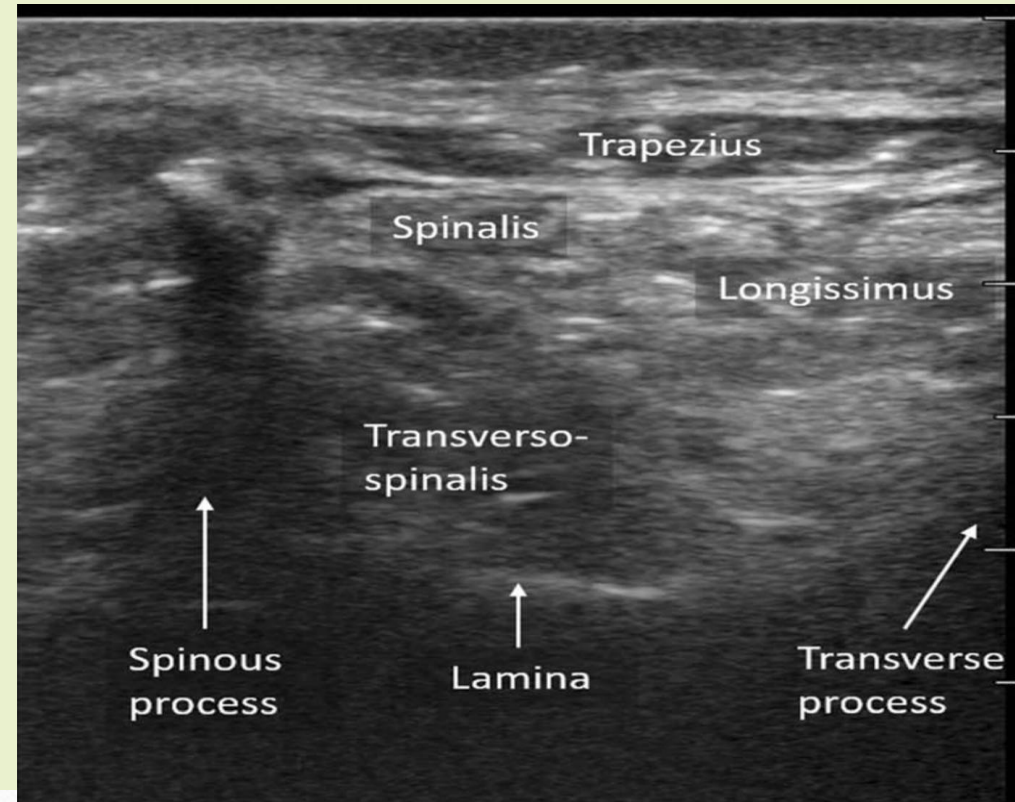
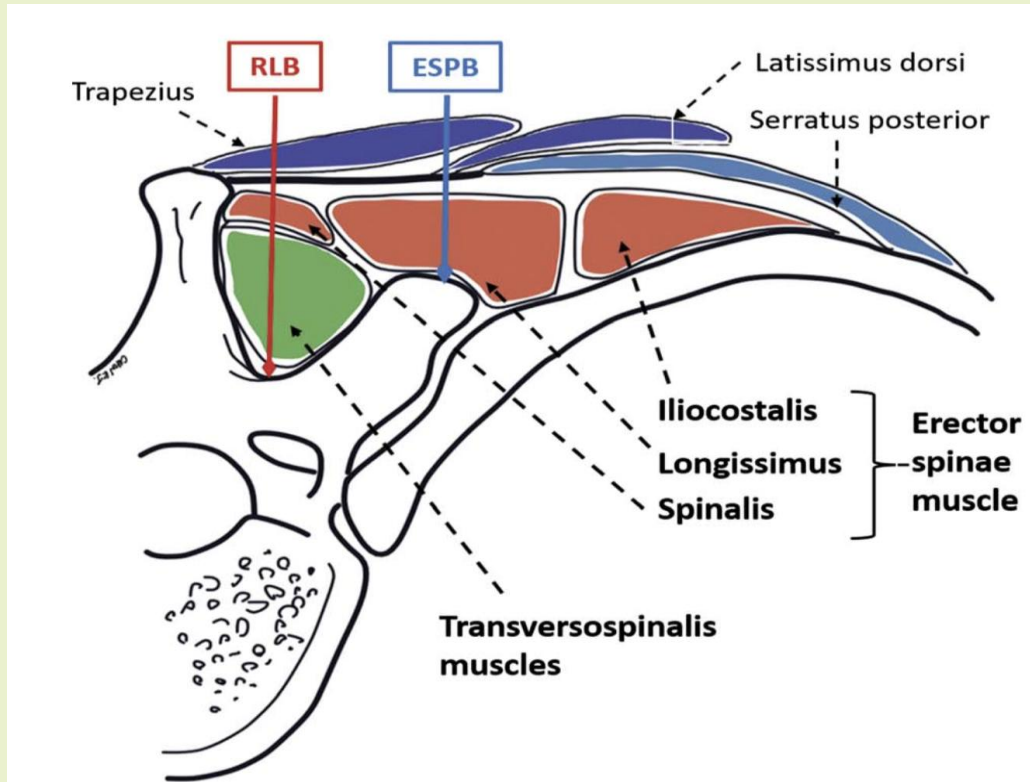
Avascular plane, low absorption rates

Ventral & dorsal rami, paravertebral, intercostal space

Rare

Retrolaminar Plane Block

- Injection in the plane between the vertebral lamina and the overlying muscle (Transverso-spinalis and Erector spinae muscle groups).

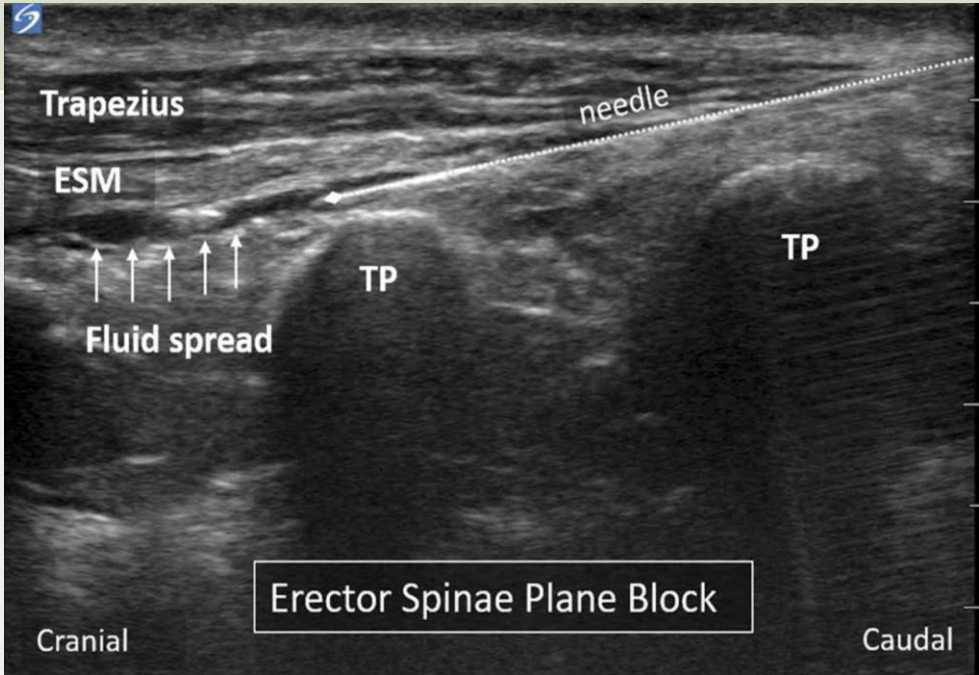
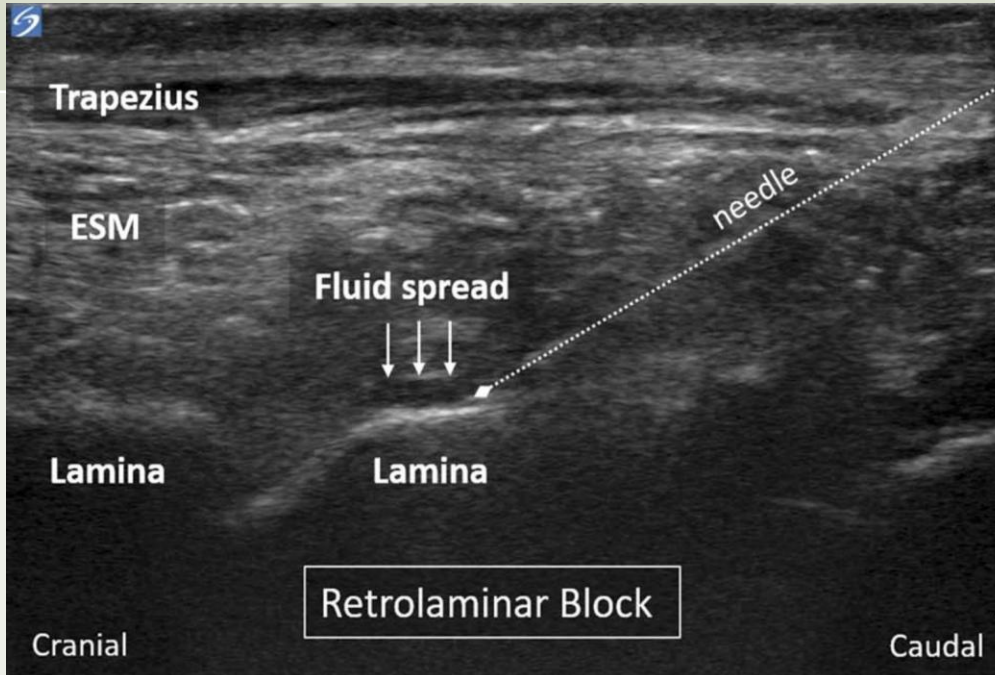


BRIEF TECHNICAL REPORT

Erector Spinae Plane Block Versus Retrolaminar Block

A Magnetic Resonance Imaging and Anatomical Study

Sanjib Das Adhikary, MD, Stephanie Bernard, MD,† Hector Lopez, MD,‡ and Ki Jinn Chin, FRCPC§*

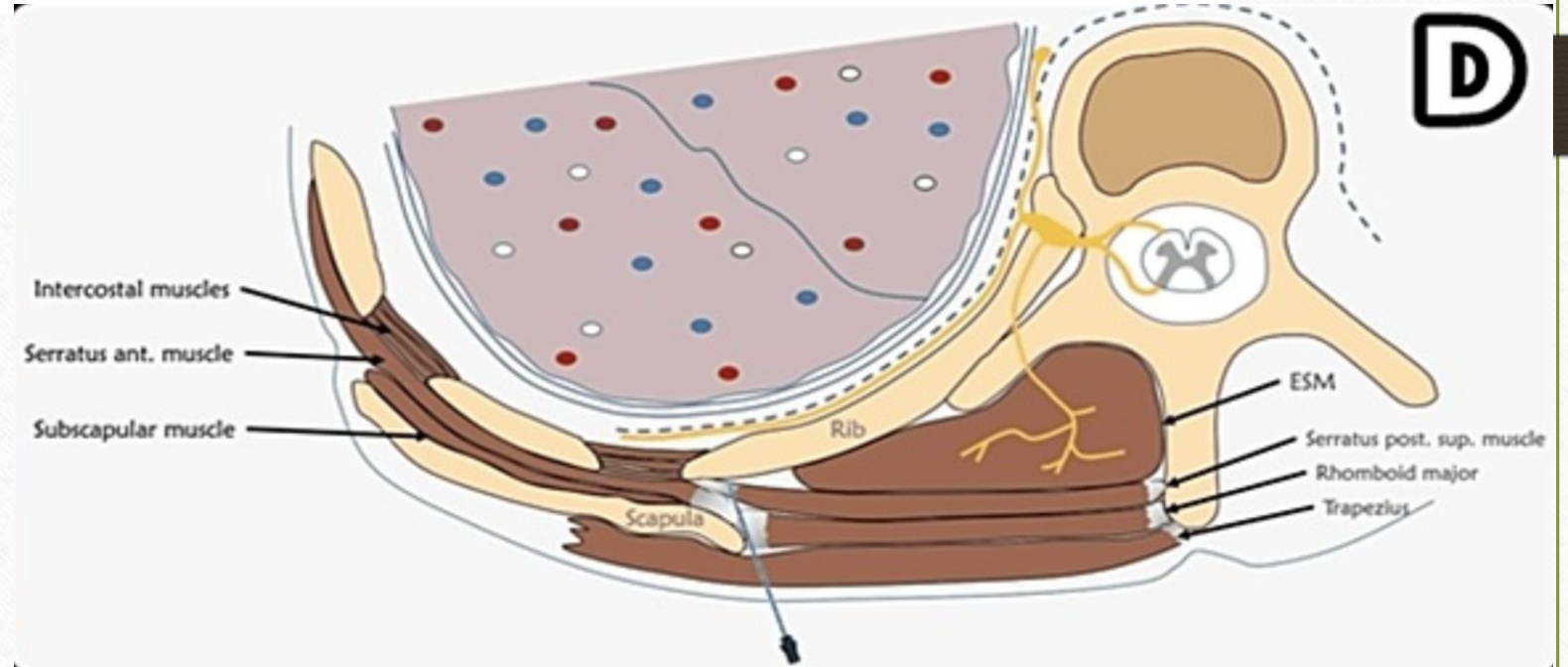
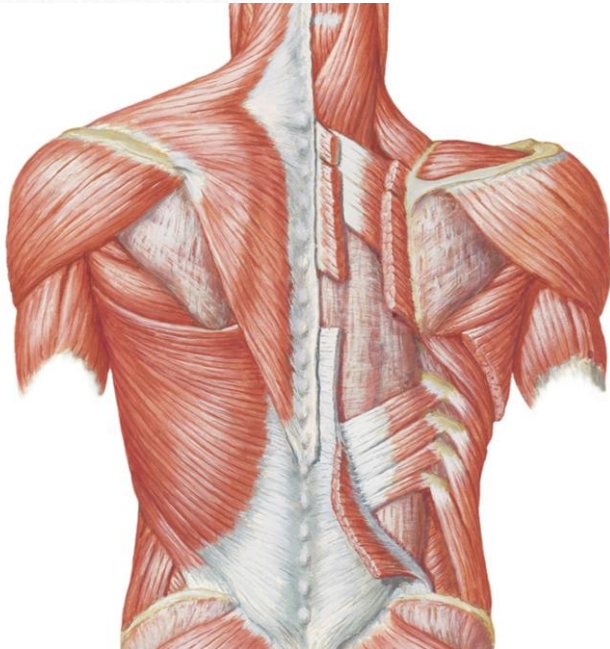
	ESP	RLP
Target	tip of transverse process	laminae
		

	ESP	RLP
Spread	1. Neural foramina 2. Epidural space (basis for somatic and visceral analgesia) • Confirms the existence of anatomical pathways for anterior spread of LA • Perforations in the intertransverse connective tissues through which the dorsal rami of spinal nerves emerge	
Cranio – caudal spread	9 to 14 vertebral levels	6 to 9
Advantage	Also spread to intercostal spaces. Analgesia of anterolateral thoracic and abdominal wall	No lateral distribution. Due to more medial site of injection. Target plane is deep to thick layer of muscle which is more adherent to underlying lamin

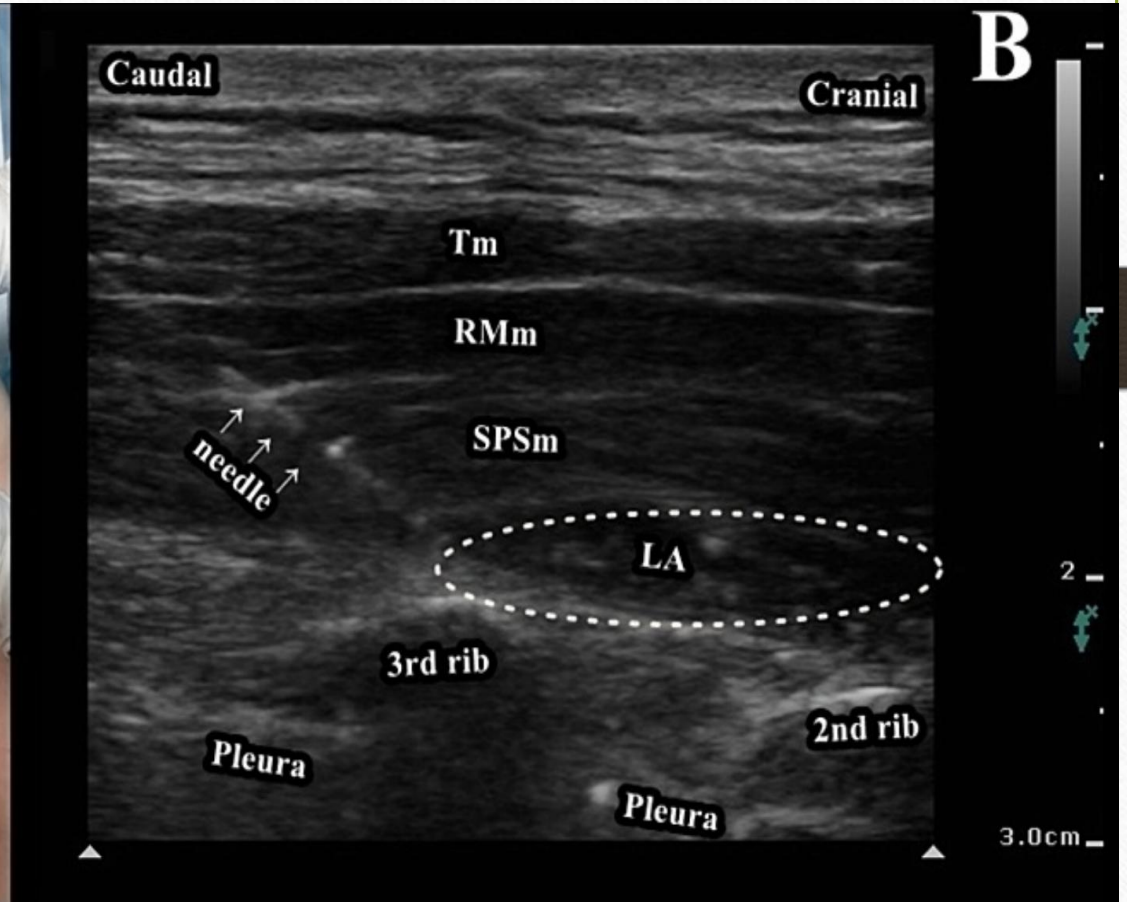
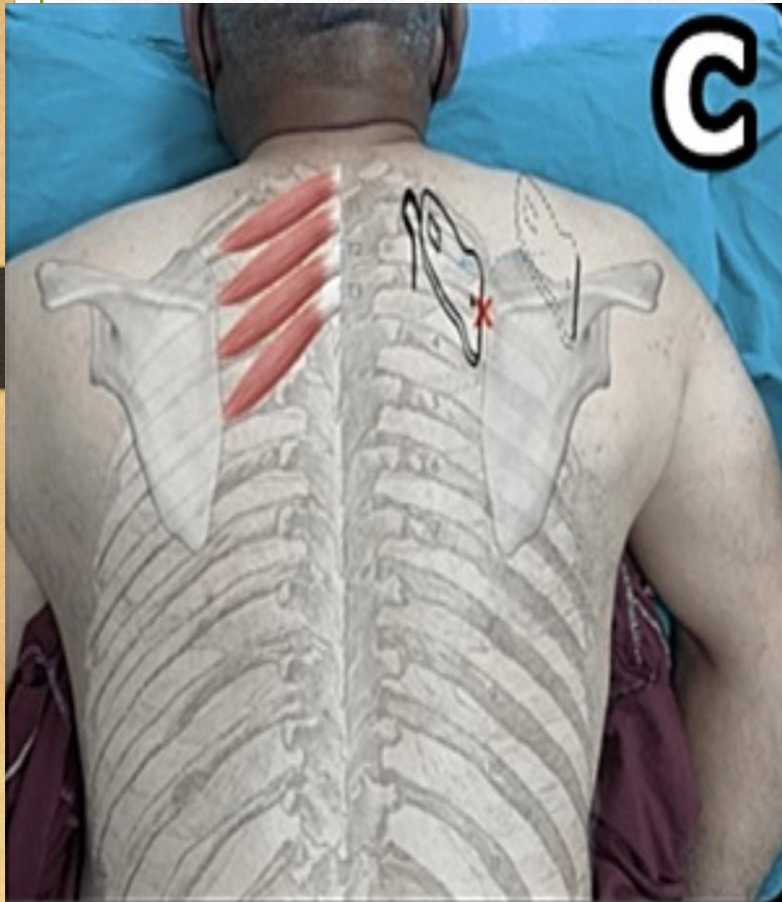
Serratus Posterior -Superior Intercostal Plane B

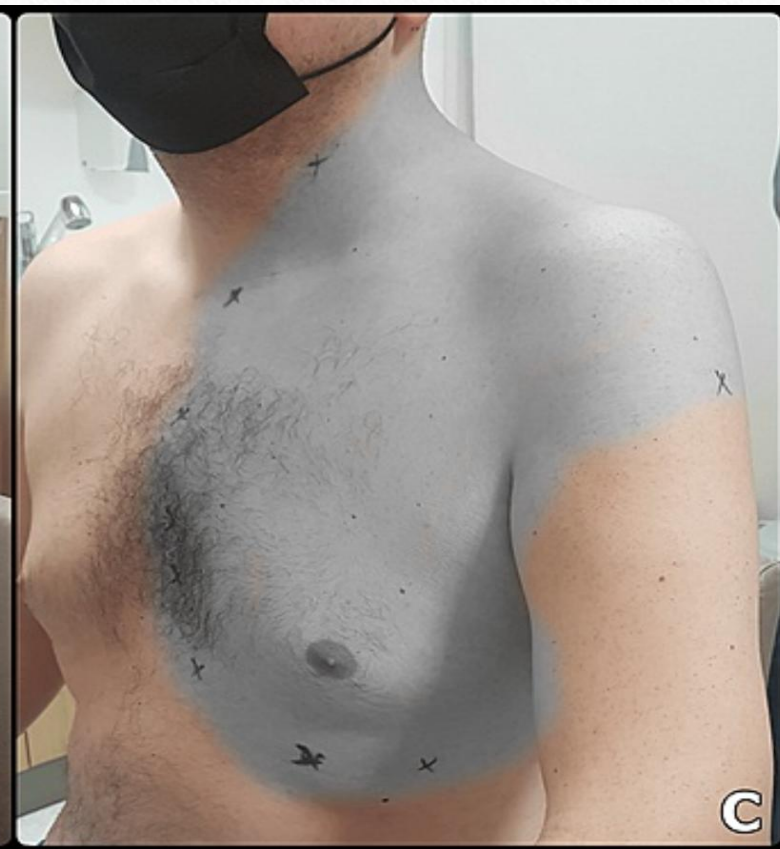
2023 Cureus

Serratus Posterior Superior Intercostal Plane Block: A Technical Report on the Description of a Novel Periparavertebral Block for Thoracic Pain



Serratus Posterior Superior Intercostal Plane Block





Serratus Posterior Superior Intercostal Plane Block

- **Fascial plane between the serratus posterior - superior-intercostal muscles** allows for transition between fascial compartments in transverse and craniocaudal directions
- *Taketa Y et al: Ultrasound guided serratus posterior superior muscle block relieves interscapular myofascial pain. J Clin Anesth. 2018, for treatment of interscapular myofascial pain)*
- Spinal accessory nerve
- Dorsal scapular artery (DSA) and the dorsal scapular nerve (DSN)

Rhomboid Intercostal and Subserratus plane block (RISS)

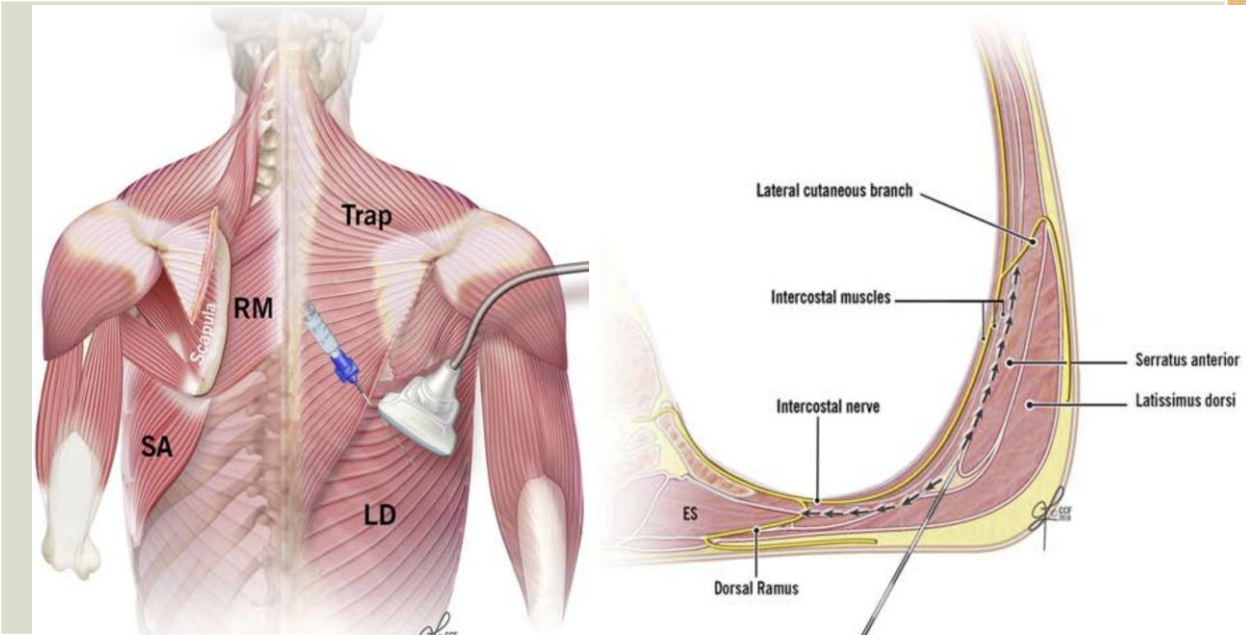
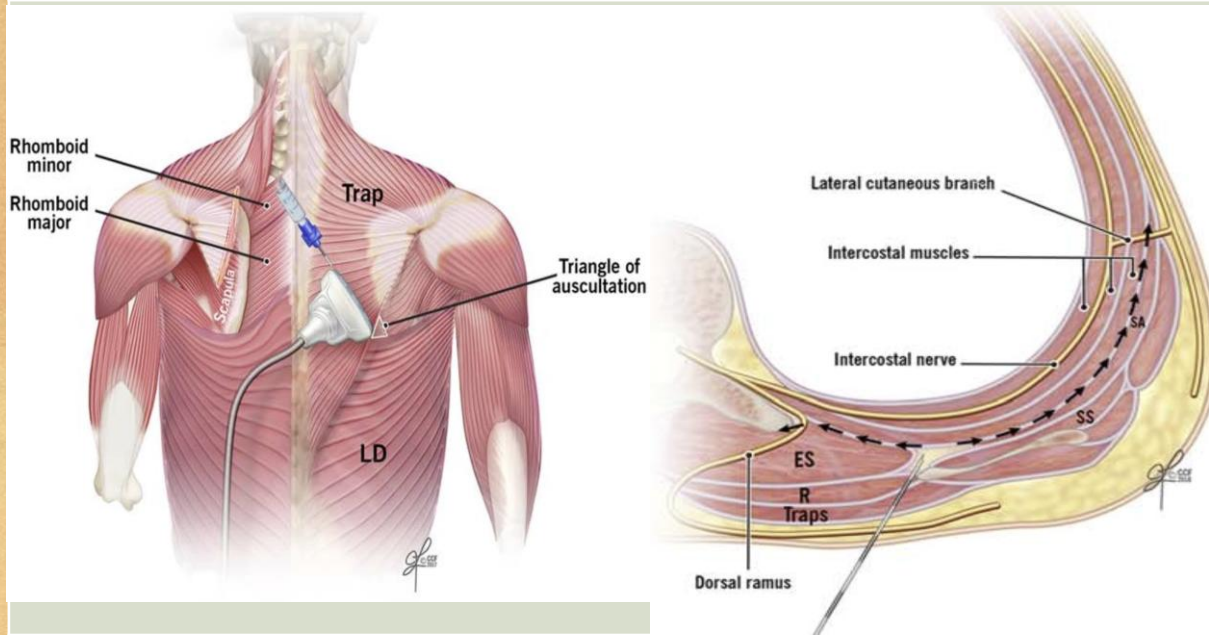
Rhomboid Intercostal Plane

Plane between the bony ribs plus intercostal muscles and the overlying rhomboid major muscle plus erector spinae muscle

Subserratus Plane

same plane at a site that is more lateral and more inferior, where the overlying muscle layer is now serratus anterior muscle

Lateral cutaneous branches of **T2-T7 intercostal nerves**, with potential extension as far as the T10 dermatome.

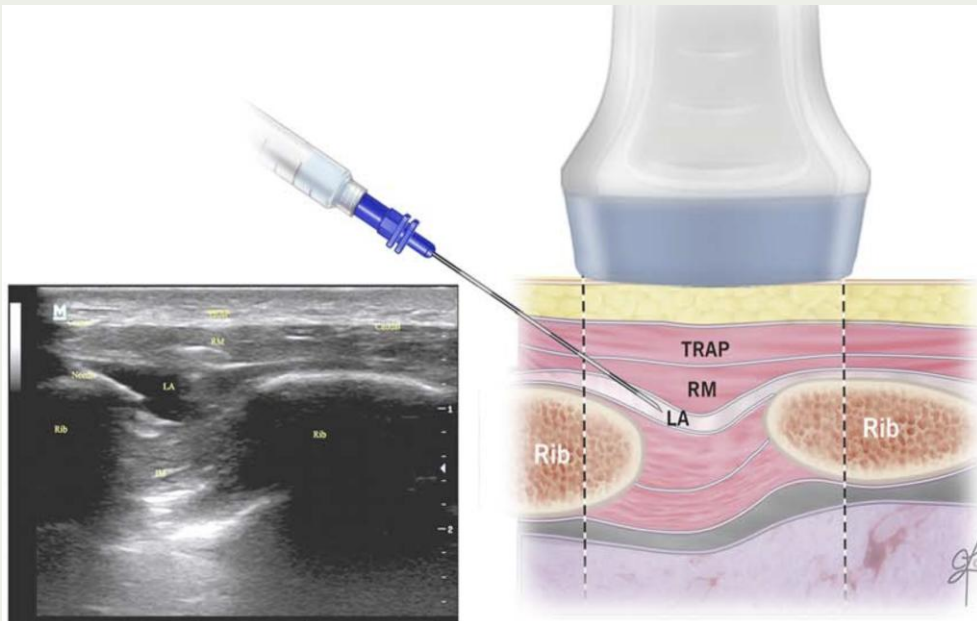


RISS Block

Rhomboid Intercostal Plane

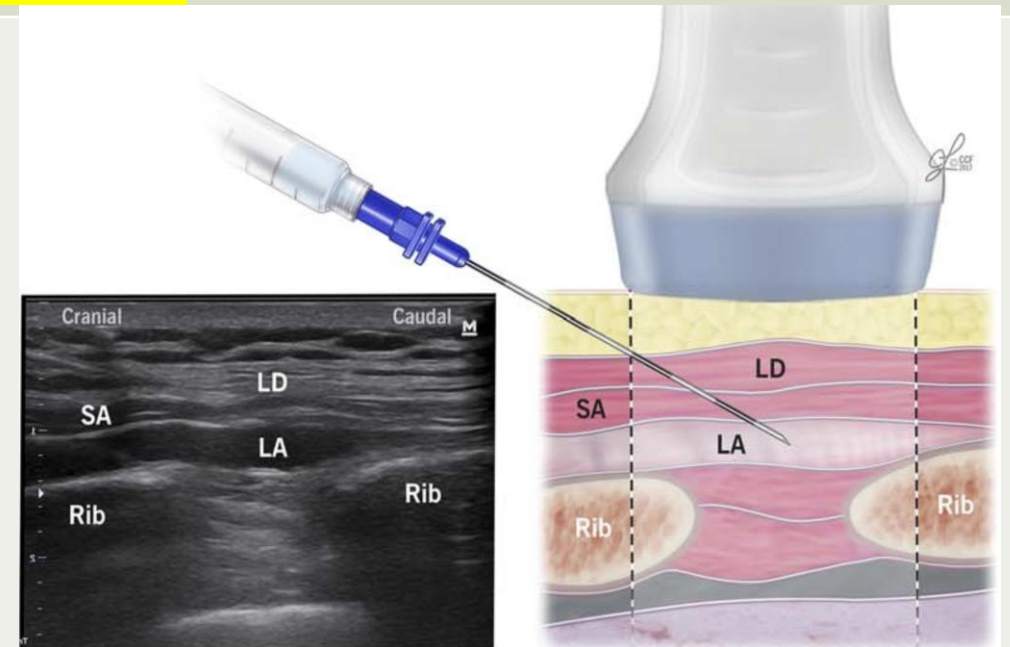
Block location

T3 – T6



Subserratus Plane

T4 – T10



2018

Rhomboid Intercostal and Subserratus Plane Block *A Cadaveric and Clinical Evaluation*

- 6 cadavers (30 ml) and 15 patients (10 + 10 ml)
- Staining of lateral branches of ICN from T2 to T10
- Reaching posterior primary rami deep to ES muscle
- Tissue plane deep to ESM, RM, SAM, LD and upper part of external oblique is continuous
- No extension to ICN
- Sparing of thoracodorsal and long thoracic nerves

RISS block

- Dermatomal analgesic coverage of thorax, upper abdomen
- **Indications in chronic pain**
PTPS
Cancer pain
Post ICD
- **Disadvantages – no analgesic effect on:**
Axilla
anterior cutaneous branches
midline anteriorly and posteriorly
ICN

Thank you

