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& Pain Therapy
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XXIX CONGRESSO NAZIONALE

ESRA Italian Chapter

CESENA, Cesena fiere

7-9 Novembre 2024

Presidente del congresso
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Andrea Tognù

UPDATE SUI BLOCCHI DI PARETE: È STATO GIÀ DETTO TUTTO? NELLA CHIRURGIA TORACICA

Moana Rossella Nespoli
UOC Anestesia e Terapia Intensiva
Azienda Ospedaliera dei Colli
Ospedale Monaldi - Napoli

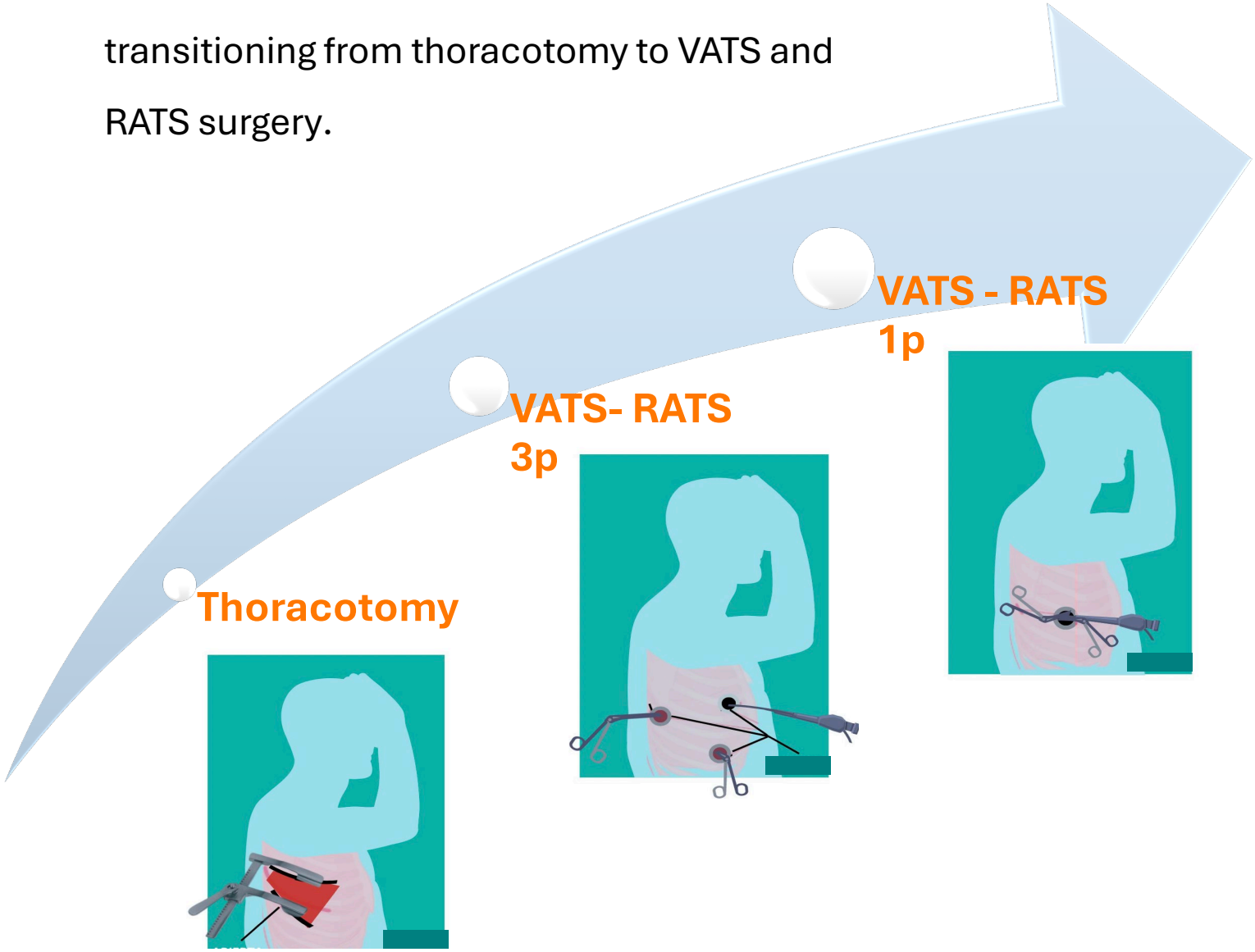
Conflict of Interest

None

Agenda

- Analysis of the most important blocks of the chest wall
- Recommendations and clinical indications
- Evaluation of the updated literature
- The new blocks
- Interindividual variability hypothesis

The mode of thoracic surgery is also gradually transitioning from thoracotomy to VATS and RATS surgery.



- 70% of lung cancer operations in the US and 55% in the UK are performed using the minimal access approach.
- Patients still have **moderate to severe pain after video-assisted thoracoscopic surgery**.
- The nerve blocks, as one of the multimodal analgesic methods, is widely used for pain management after thoracoscopic surgery.

Napolitano M.A. et al. Thorac Cardiovasc Surg 2022;70:346-54

Recommendations from the italian intersociety consensus on Perioperative Anesthesia Care in Thoracic Surgery

PACTS

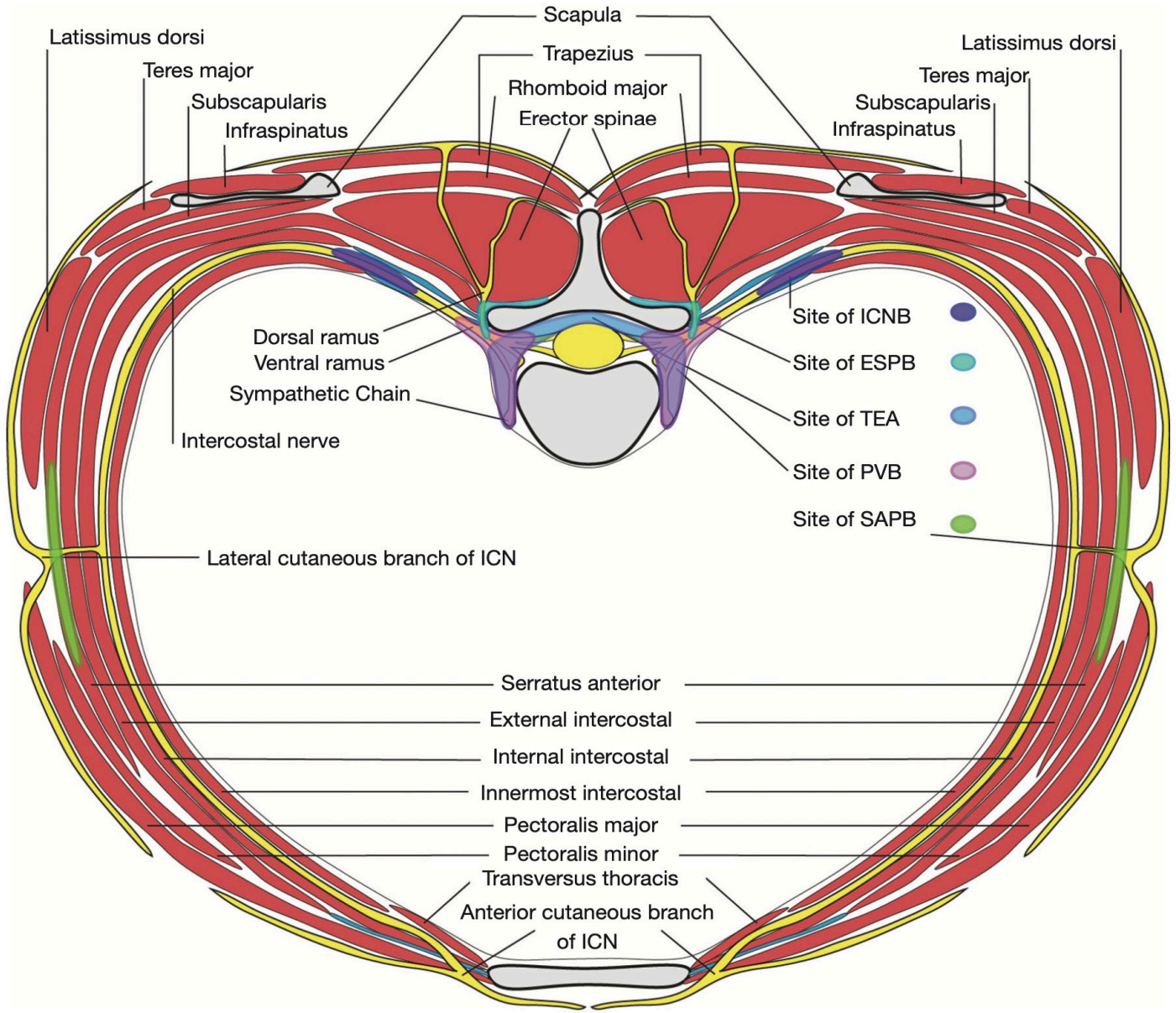
Locoregional techniques

Recommendation 29: We recommend the use of locoregional anesthesia for intraoperative and postoperative pain management.

Level of evidence: Poor

Strength of recommendation: A

Piccioni F. et al. Perioperative Medicine 2020: 9-31



Hamilton C. et al. Regional anesthesia and acute perioperative pain management in thoracic surgery: a narrative review J Thorac Dis 2022;14(6):2276-2296

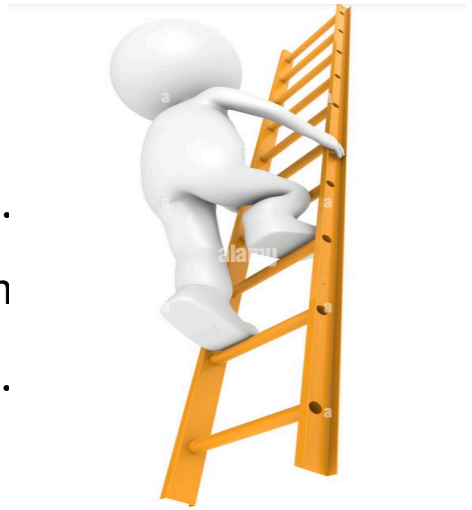
Regional anesthesia	Nerves affected	Expected effect	Thoracotomy	Thoracoscopy
Thoracic epidural analgesia	Bilateral spinal nerves (includes dorsal ramus, ventral ramus/ intercostal nerve, and visceral fibers/sympathetic chain)	Multi-level bilateral segmental somatic and visceral block, sympathectomy	Consider unless contraindicated	Likely not necessary/ advantageous over other regional approaches
Paravertebral block	Ipsilateral spinal nerve (includes dorsal ramus, ventral ramus/ intercostal nerve, and visceral fibers/sympathetic chain)	Multi-level unilateral segmental somatic and visceral	Consider continuous PVB	Strongly consider unless contraindicated
Intercostal nerve block	Intercostal nerve with lateral and anterior cutaneous branches, muscle and pleural branches	Single-level unilateral lateral and anterior somatic block	Consider if unable to use TEA or PVB	Consider, possibly in combination with other chest wall blocks
Serratus anterior plane block	Lateral cutaneous branch of intercostal nerve	Multi-level anterolateral somatic block	Consider if unable to use TEA or PVB	Consider, possibly in combination with other chest wall blocks
Erector spinae plane block	Dorsal ramus, potentially ventral ramus/intercostal nerve and visceral fibers/sympathetic chain	Multi-level unilateral posterior somatic block, potential segmental somatic and visceral block	Consider if unable to use TEA or PVB	Consider, possibly in combination with other chest wall blocks

Hamilton C. et al. Regional anesthesia and acute perioperative pain management in thoracic surgery: a narrative review J Thorac Dis 2022;14(6):2276-2296

The aim would be to reduce pain intensity to an acceptable level that would improve functionality and allow ambulation rather than achieve a certain pain score.

ERAS

The balance of benefits and risks of the analgesic intervention is assessed. Because early mobilisation is key to enhanced recovery, any recommendation must consider the effects of an analgesic intervention on ambulation.



Joshi J.P. et al. Postoperative pain management in the era of ERAS: An overview. Best Pract Res Clin Anaesthesiol. 2019 Sep;33(3):259-267

PACTS

Recommendation 35: We suggest the use of fascial pain blocks as part of multimodal analgesia for thoracic surgery, particularly for VATS.

Level of evidence: Fair

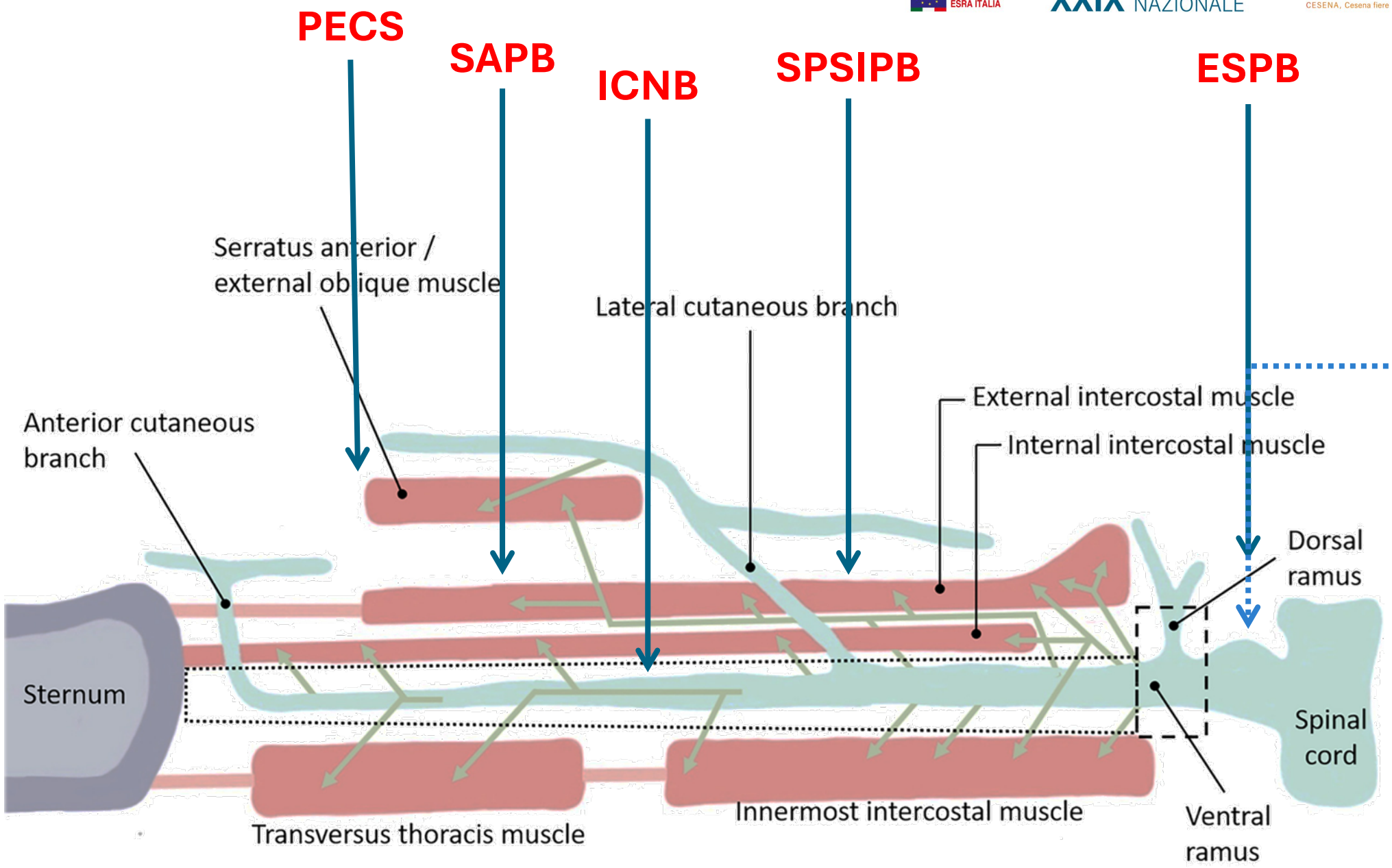
Strength of recommendation: B

Piccioni F. et al. Perioperative Medicine 2020: 9-31

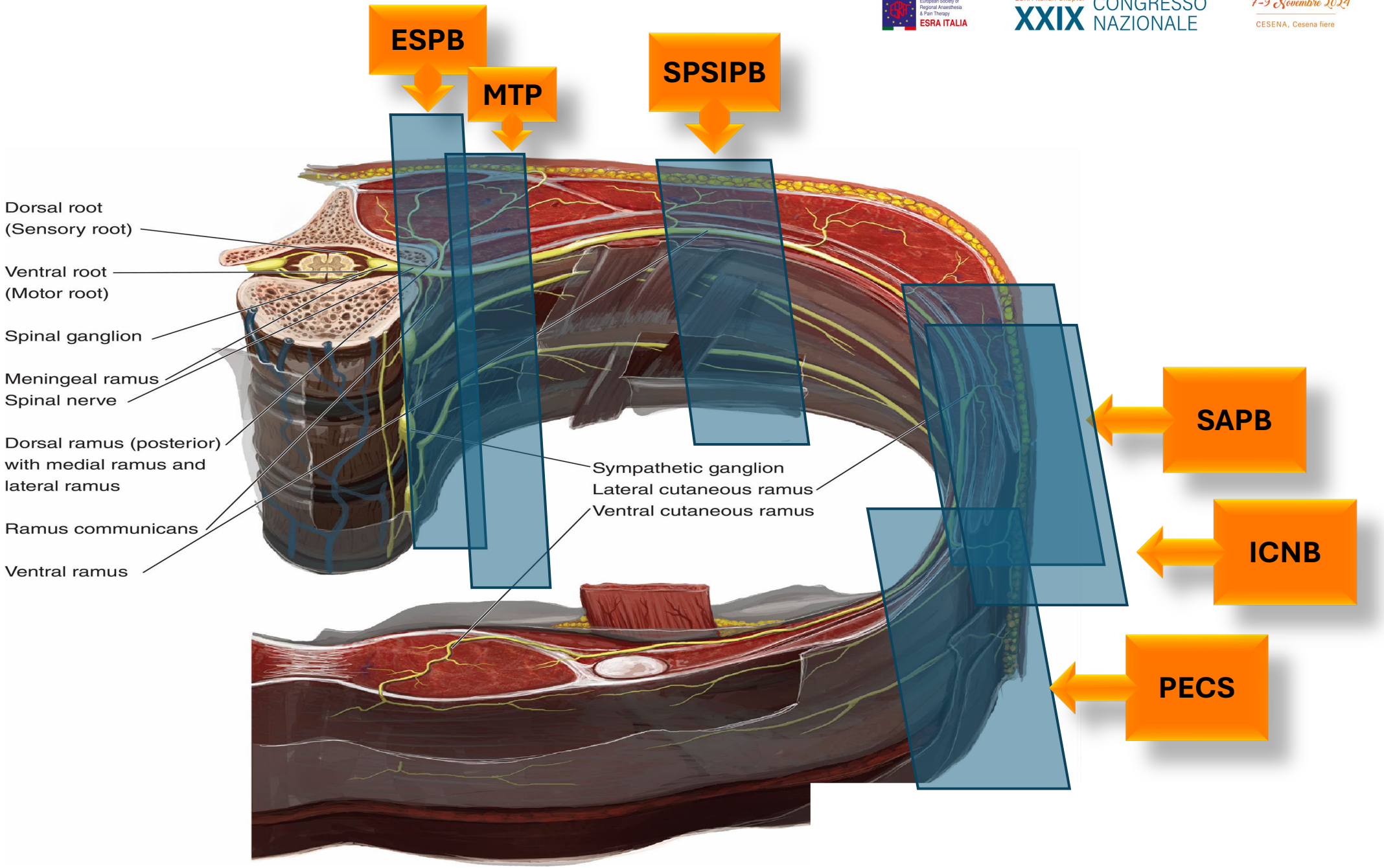
Thoracic Wall Blocks

- Interpectoral Plane Block (IPPB) - Pectoserratus Plane Block (PSPB) – PECS
- Serratus Anterior Plane Block (SAPB)
- Serratus Posterior Superior Intercostal Plane Block (SPSIPB)
- Erector Spinae Plane Block (ESPB)
- Mid-point Transverse process to Pleura Block (MTPB)
- Intercostal Nerve Block (ICNB)

} Fascial Plane Blocks (FPBs)



Chin KJ. Et al. Ultrasound-guided fascial plane blocks of the chest wall: a state-of-the-art review. Anaesthesia. 2021 Jan;76 Suppl 1:110-126


ESPB
MTP
SPSIPB
SAPB
ICNB
PECS
Dorsal root
(Sensory root)
Ventral root
(Motor root)
Spinal ganglion
Meningeal ramus
Spinal nerve
Dorsal ramus (posterior)
with medial ramus and
lateral ramus
Ramus communicans
Ventral ramus
Sympathetic ganglion
Lateral cutaneous ramus
Ventral cutaneous ramus

JAMA Network Open

Original Investigation | Anesthesiology

Assessment of Intercostal Nerve Block Analgesia for Thoracic Surgery
A Systematic Review and Meta-analysis

Carlos E. Guerra-Londono, MD; Ann Privorotskiy, BA; Crispiana Cozowicz, MD; Rachel S. Hicklen, MS; Stavros G. Memtsoudis, MD, PhD, MBA; Edward R. Mariano, MD, MAS; Juan P. Cata, MD

Single-injection **ICNB** was associated with a reduction in pain during the first 24 hours after thoracic surgery.

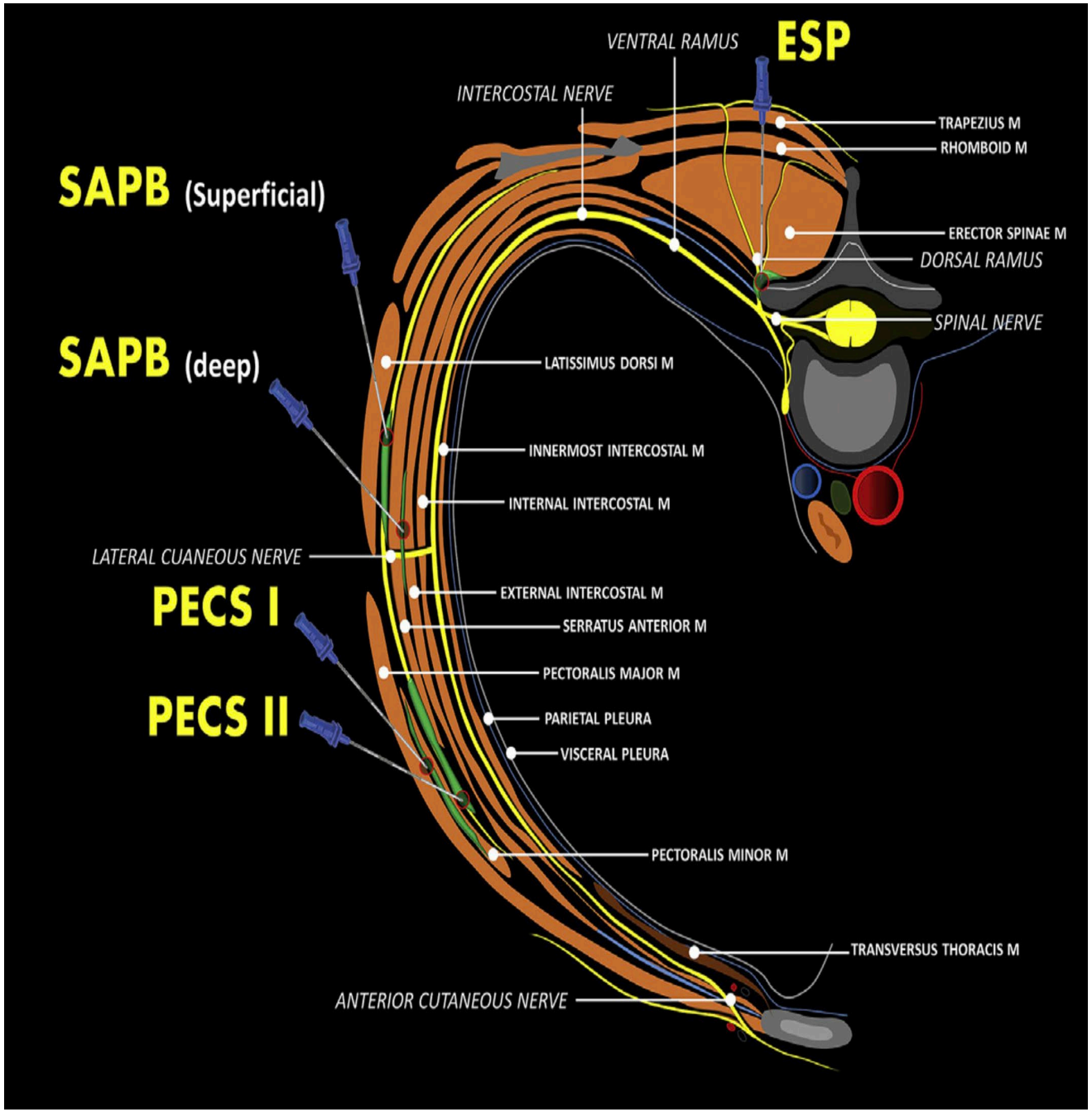
Intercostal nerve block analgesia had opioid-sparing effects; however, TEA and PVB were associated with larger decreases in postoperative MMEs, suggesting that ICNB may be most beneficial for cases in which TEA and PVB are not indicated.

PACTS

Recommendation 33: We suggest that intercostal nerve blockade should be considered only as a second choice for analgesia after thoracic surgical procedures.

Level of evidence: Good

Strength of recommendation: C



For minimally invasive thoracic surgery, where due to risk-benefit considerations epidural anaesthesia is omitted, thoracic wall blocks can be utilized in a single shot or a continuous, catheter-based approach.

The anterolateral blocks are supplementary blocks in an opiate sparing, multimodal anaesthesia concept, whereas the dorsal procedures, as they include visceral anaesthesia, are an alternative to neuraxial anaesthesia, as they have a comparable analgetic potency.

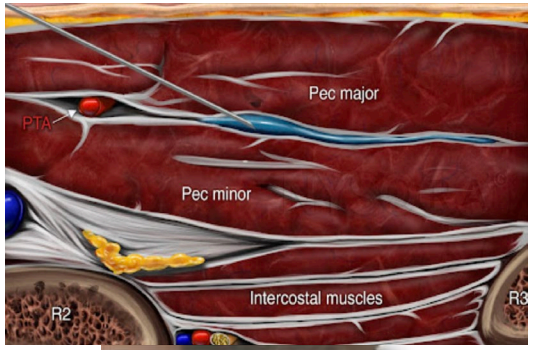
Ki Jinn Chin et al. Untrasound-guided fascial plane blocks of the thorax. Anaesthesia 2021 Jan:76 Suppl 1:110-126

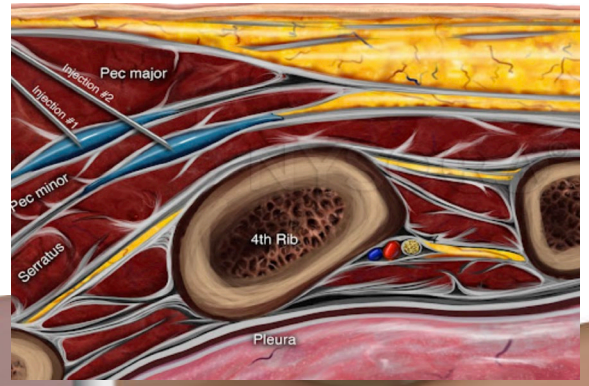
The role of serratus anterior plane and pectoral nerves blocks in cardiac surgery, thoracic surgery and trauma: a qualitative systematic review

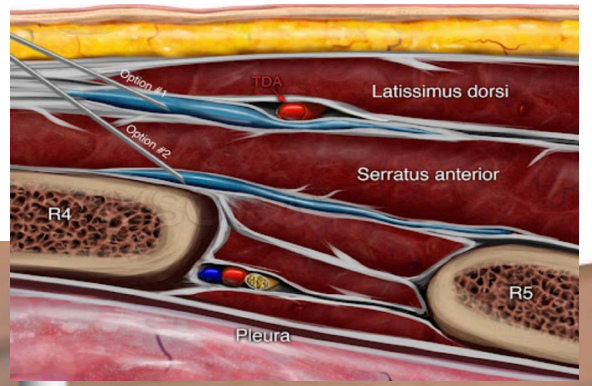
Table 2 Summary of studies and the highest level of evidence according to the Oxford Centre for Evidence-Based Medicine Levels of Evidence [12] for pectoral nerves blocks (PECS).

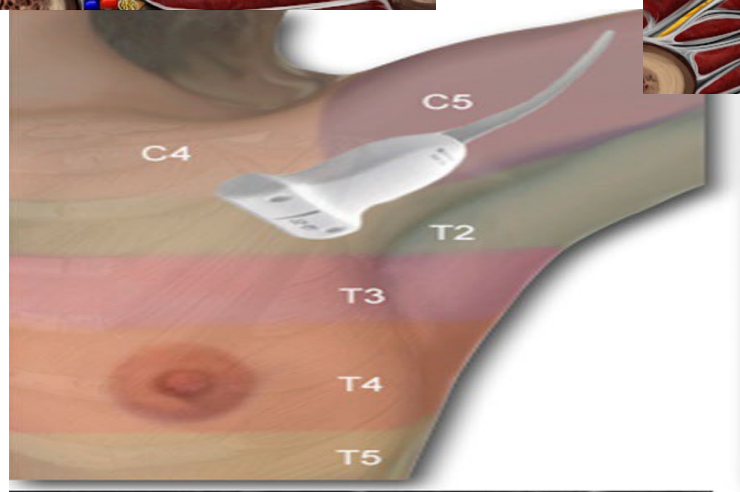
Indication	Comparator	Highest level of evidence	Available studies	Outcomes with intervention
Thoracotomy	Intercostal nerve blocks (five-level single-injection)	Level 2	one RCT (n = 108) [19]	Lower pain scores and opioid requirements with PECS blocks
	SAPB	Level 2	one RCT (n = 108) [19]	Comparable pain scores and opioid requirements between PECS blocks and SAPB
Video-assisted thoracoscopic surgery	Not applicable	Level 4	one case series (n = 10) [35]	Analgesic benefit lasting 18–24 h with pain scores < 6, > 50% required no opioids [35]

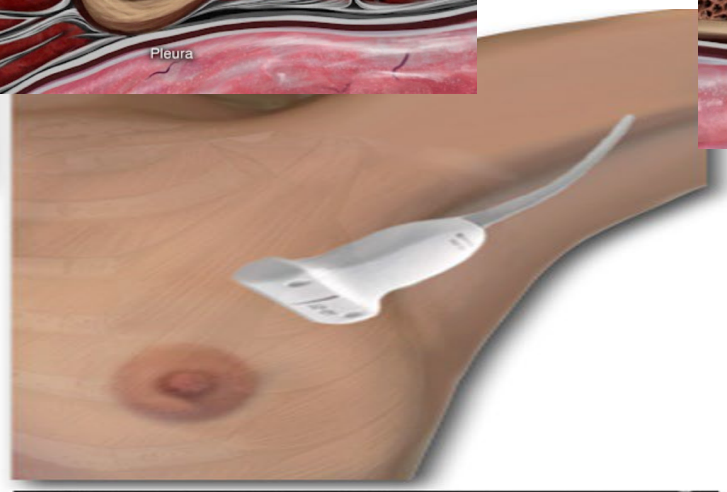
Jack J.M. et al. Anaesthesia 2020,75:1372-1385

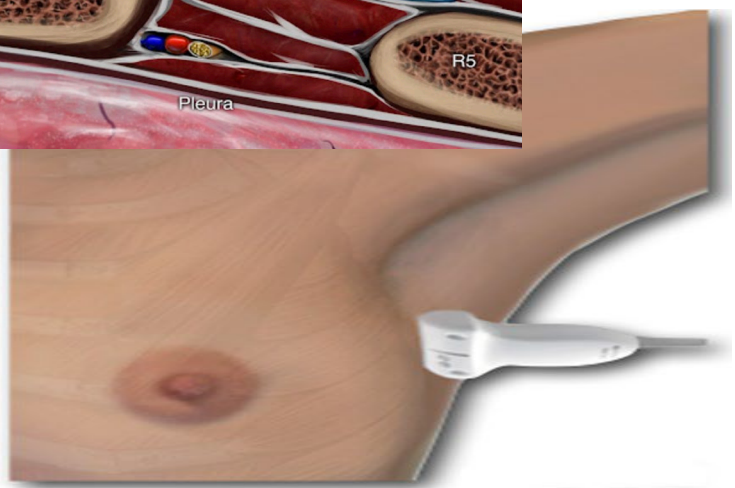


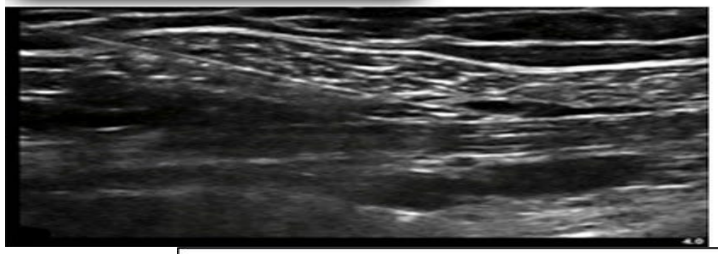


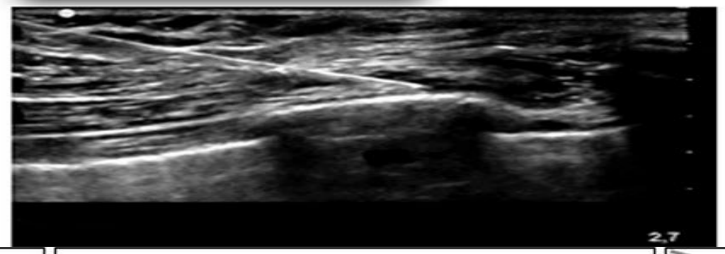


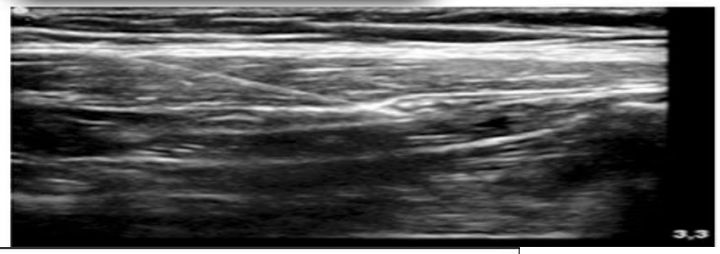


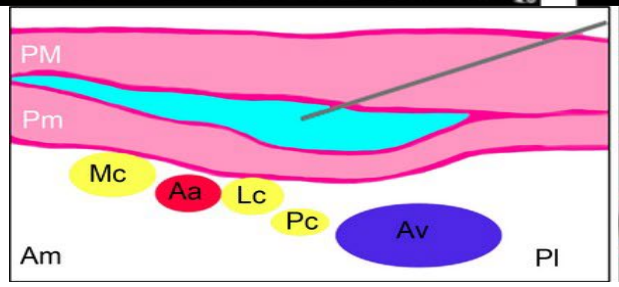


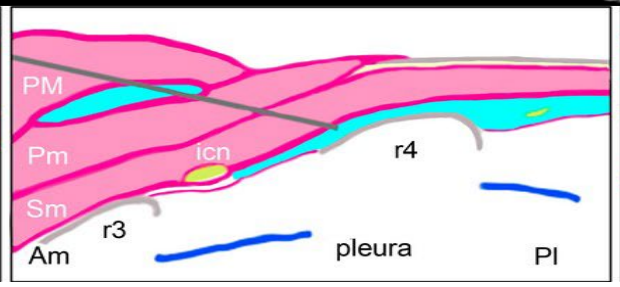


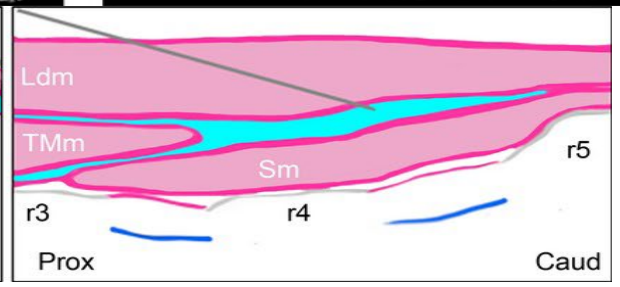






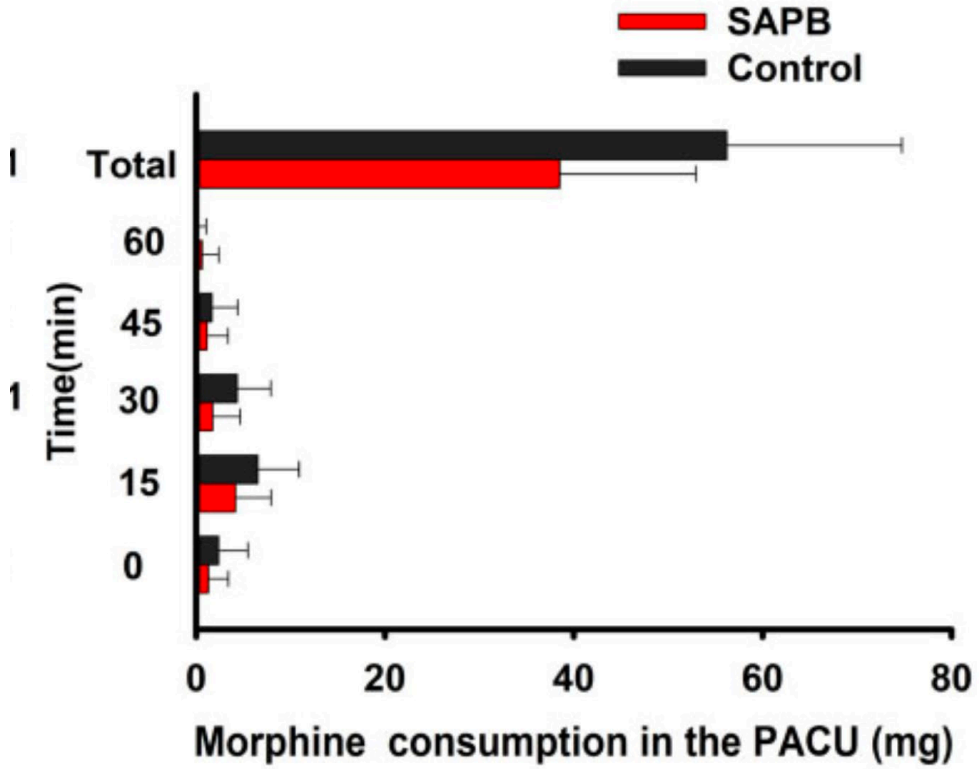


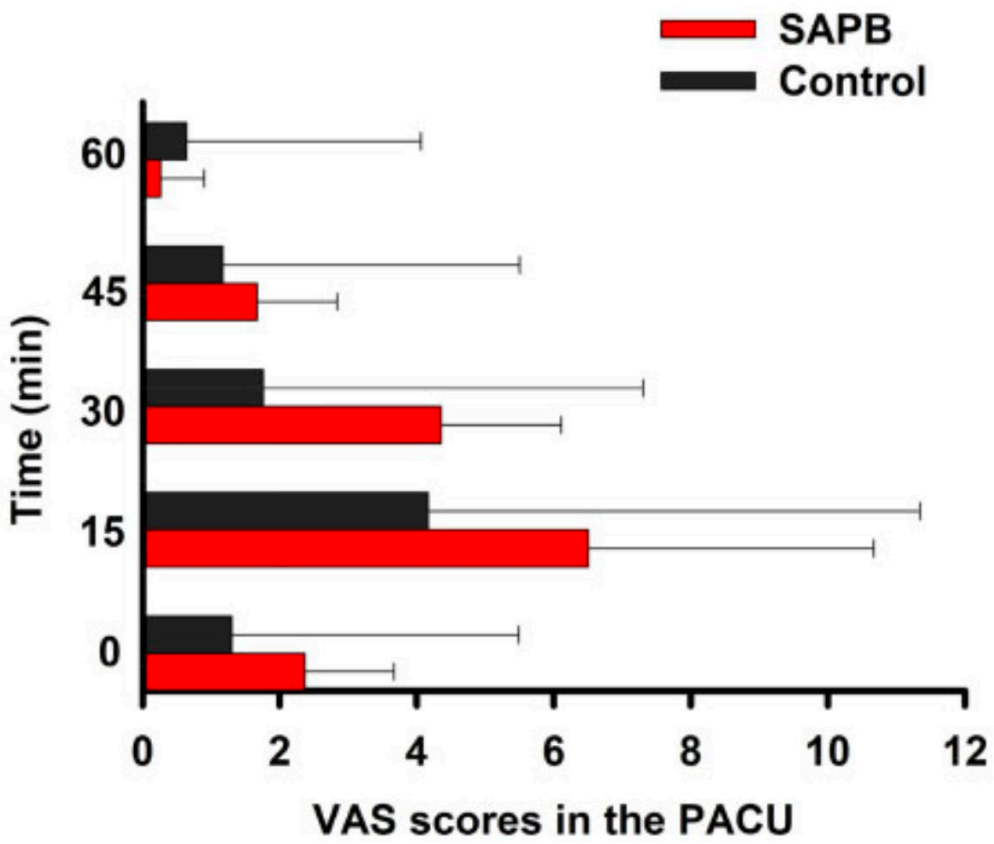




Blanco R. et al Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. Anaesthesia 2013, 68:1107-1113

Analgesic Effectiveness of Perioperative Ultrasound-Guided Serratus Anterior Plane Block Combined with General Anesthesia in Patients Undergoing Video-Assisted Thoracoscopic Surgery: A Systematic Review and Meta-analysis





Zang X. Et al. Pain Med 2020, 1-11

Serratus anterior plane block for video-assisted thoracoscopic surgery

A meta-analysis of randomised controlled trials

Reference	No of subjects	Local anaesthetic used	Level	Comparator
Chen *et al.*[23]	40	0.4 ml kg^{-1} of 0.25% ropivacaine	T5 to T6	Wound infiltration
Lee and Kim[21]	46	20 ml of 0.375% ropivacaine	T5	General anaesthesia care
Kim *et al.*[22]	85	0.4 ml kg^{-1} of 0.375% ropivacaine	T5	0.4 ml kg^{-1} of 0.45% sodium chloride
Ökmen and Metin Ökmen[20]	40	20 ml of 0.25% bupivacaine	T5	General anaesthesia care
Park *et al.*[9]	84	30 ml of 0.375% ropivacaine	T5 and T7	General anaesthesia care
Semyonov *et al.*[19]	104	2 mg kg^{-1} of 0.25% bupivacaine and dexamethasone 8 mg	T4 to T5	General anaesthesia care
Viti *et al.*[18]	90	30 ml of 0.3% ropivacaine	T5	General anaesthesia care

Our meta-analysis suggests that SAPB decreases perioperative pain in patients undergoing VATS.

The effect is more remarkable in the early phase (6th hour) of recovery from surgery rather than later on (24th hour), which is consistent with the single-shot mode of administration and the pharmacokinetic characteristics of the local anaesthetics used.

De Cassai A. et al. European Journal of Anaesthesiology 2021, 38:106-114

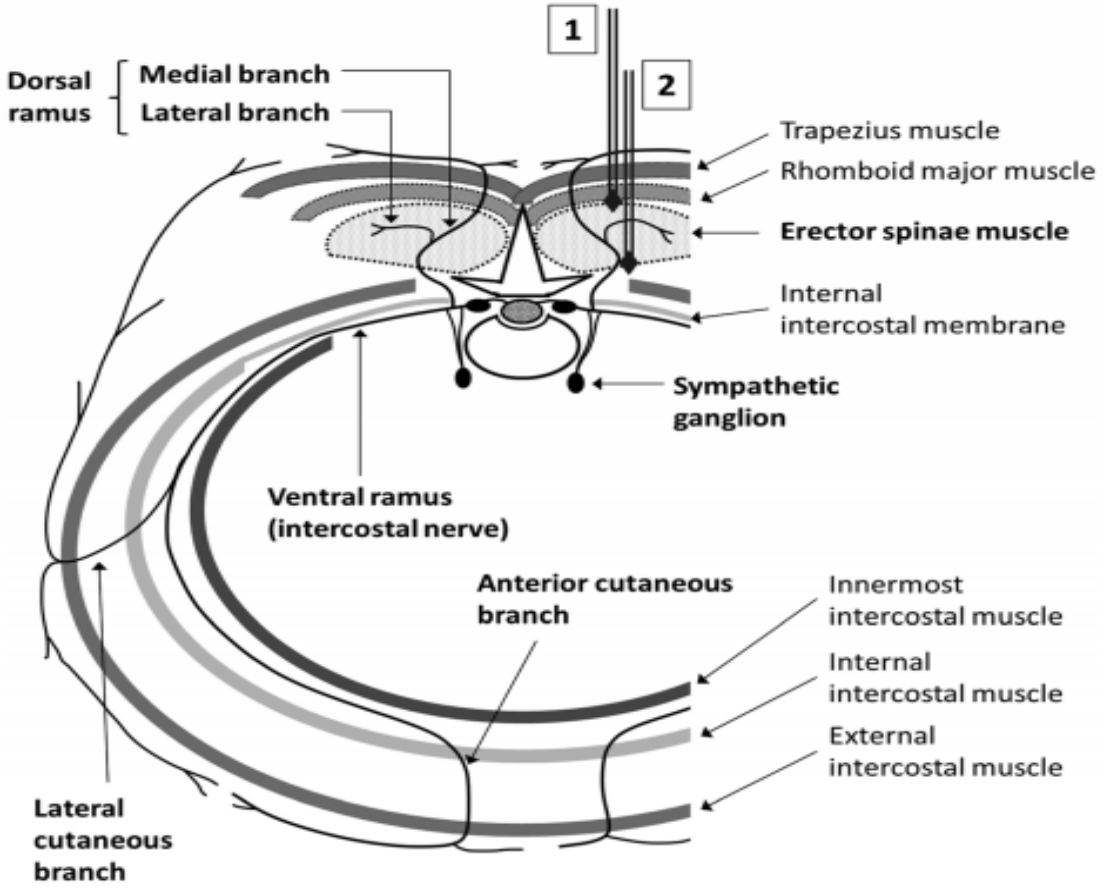
CHRONIC AND INTERVENTIONAL PAIN

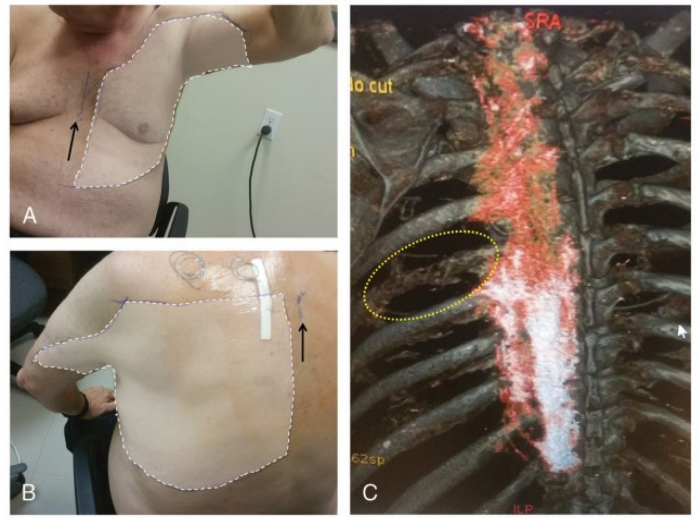
BRIEF TECHNICAL REPORT

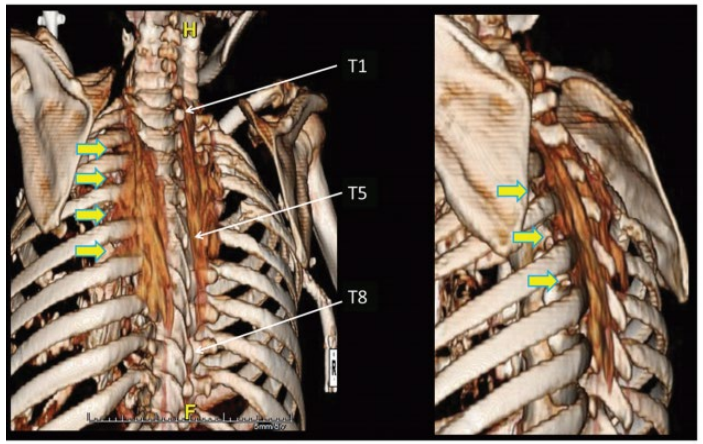
The Erector Spinae Plane Block

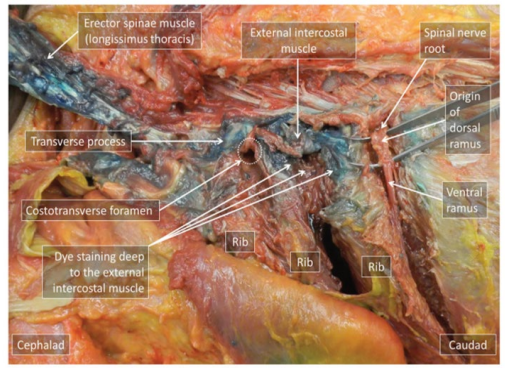
A Novel Analgesic Technique in Thoracic Neuropathic Pain

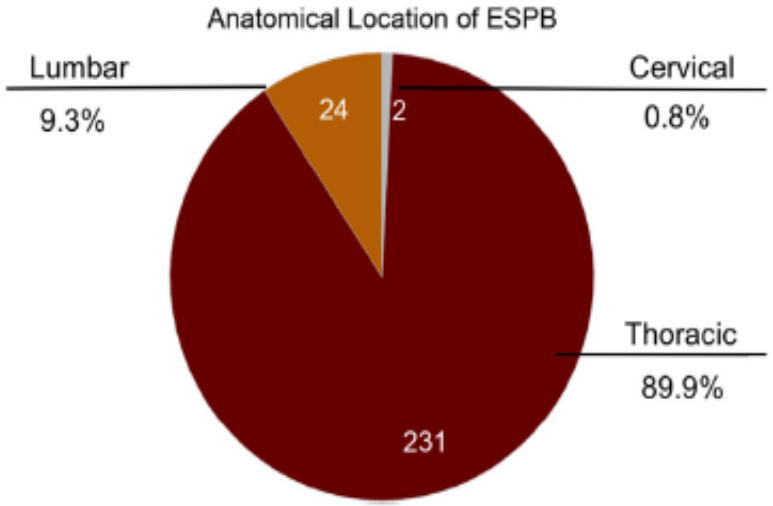
Mauricio Forero, MD, FIPP, Sanjib D. Adhikary, MD,† Hector Lopez, MD,‡ Calvin Tsui, BMSc,§ and Ki Jinn Chin, MBBS (Hons), MMed, FRCPC||*

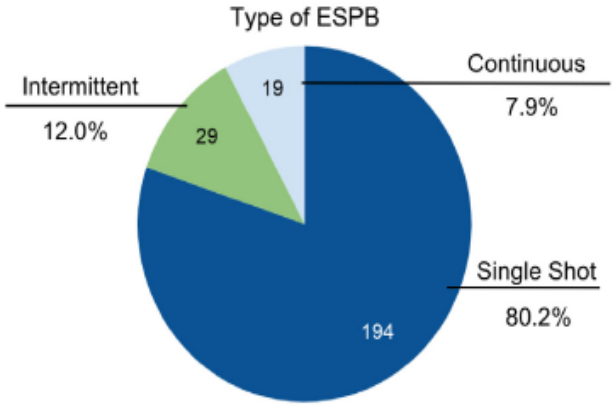


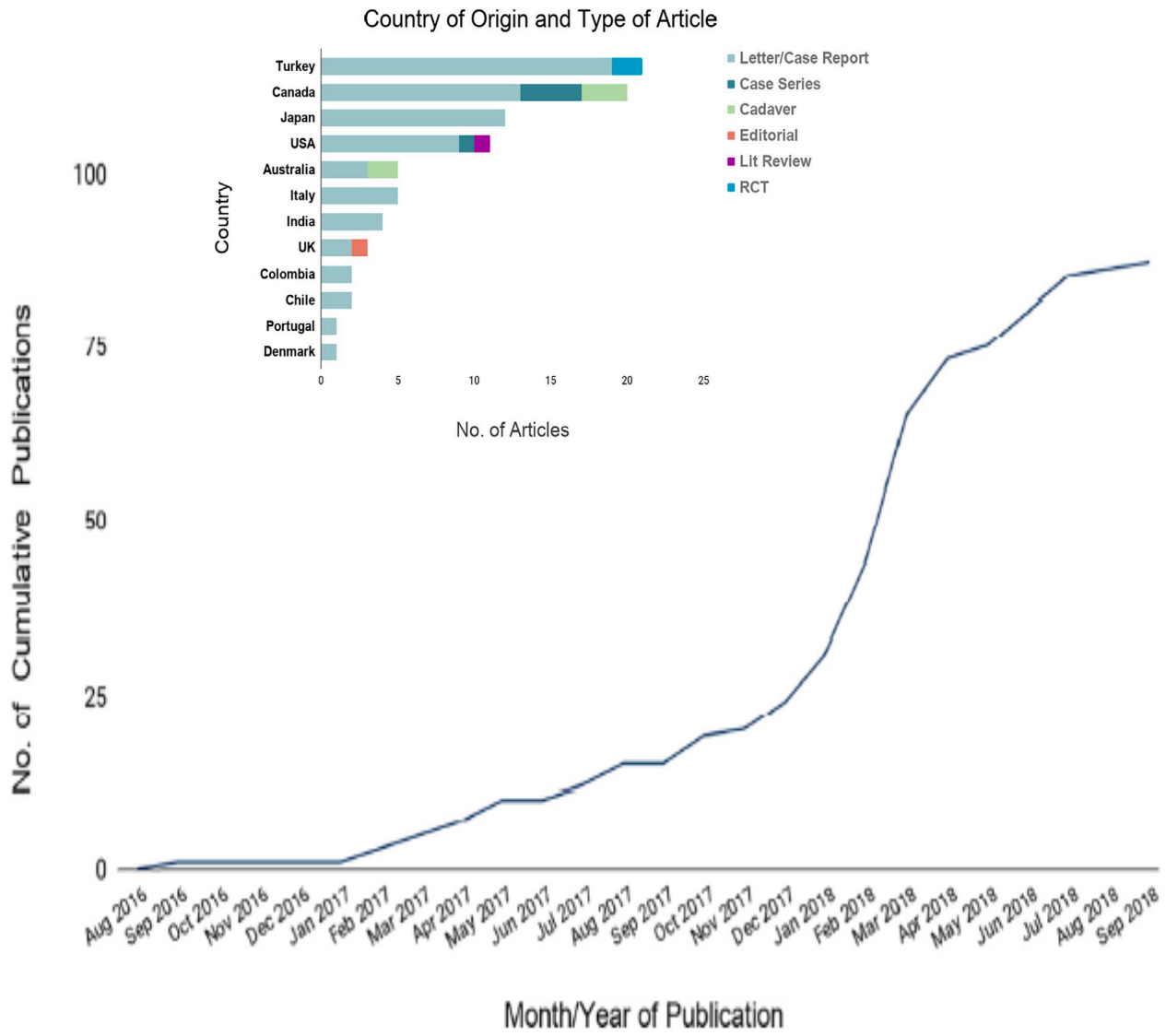




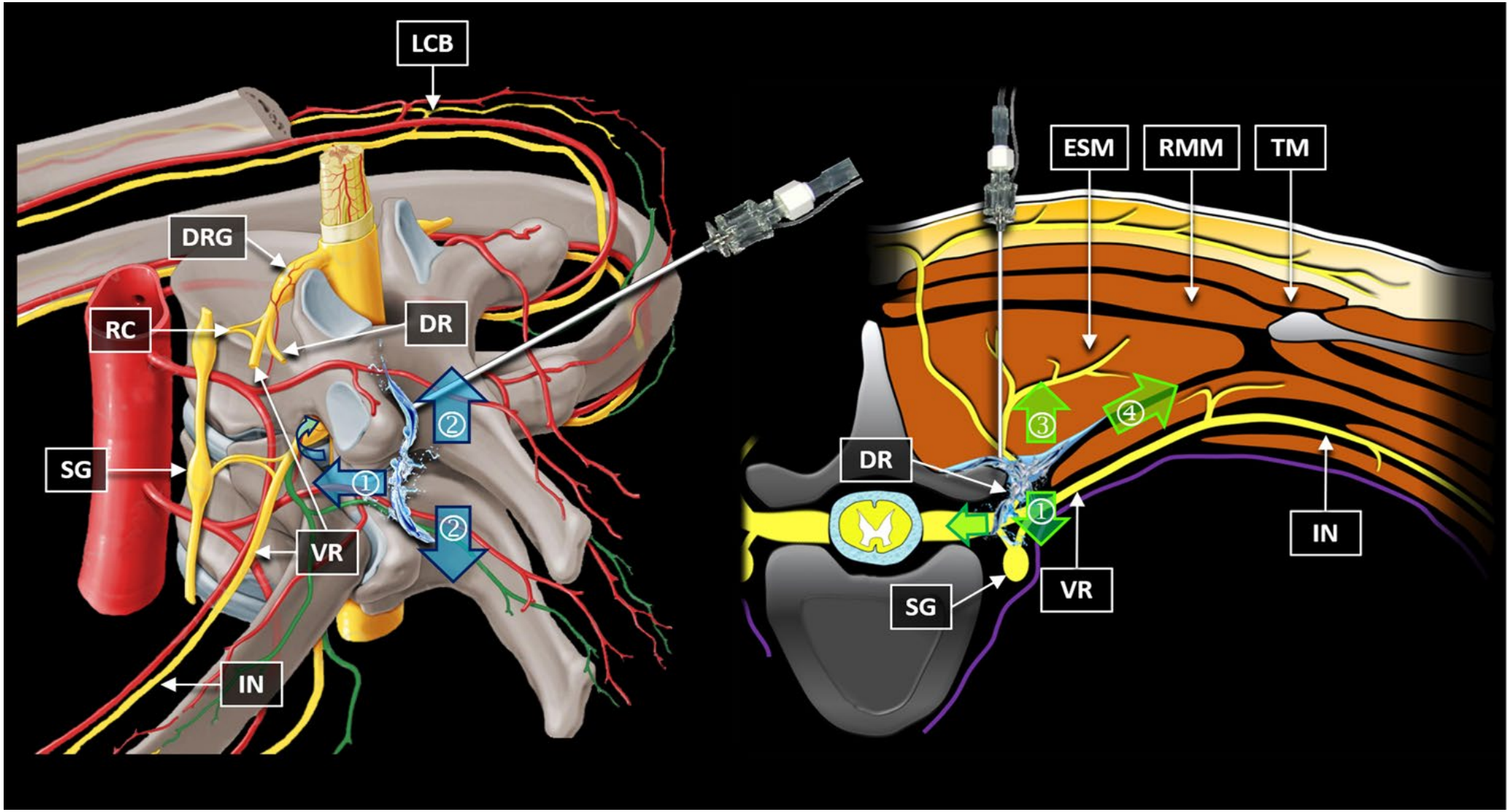








Tsui B.C.H. et al The erector spinae plane block: a poled review of 242 cases. Journal of Clinical Anesthesia 2019, 53:29-34



Chin KJ. Et. Al. Mechanisms of action of the erector spinae plane (ESP) block: a narrative review. Can J Anesth (2021) 68:387-408

The effect of preoperative erector spinae plane vs. paravertebral blocks on patient-controlled oxycodone consumption after video-assisted thoracic surgery: A prospective randomized, blinded, non-inferiority study

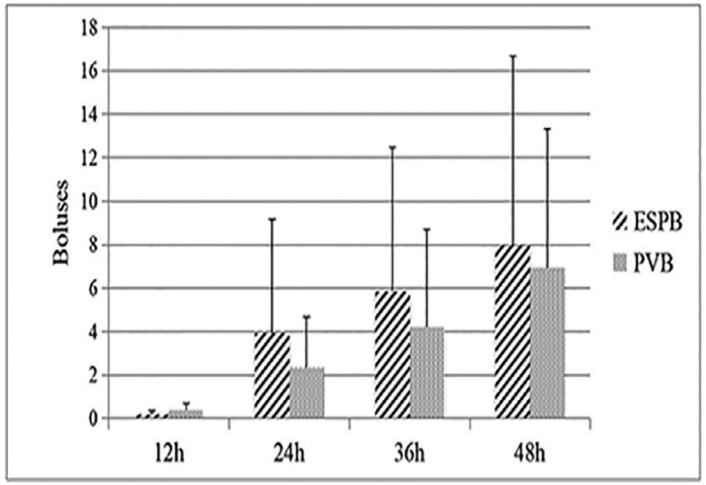


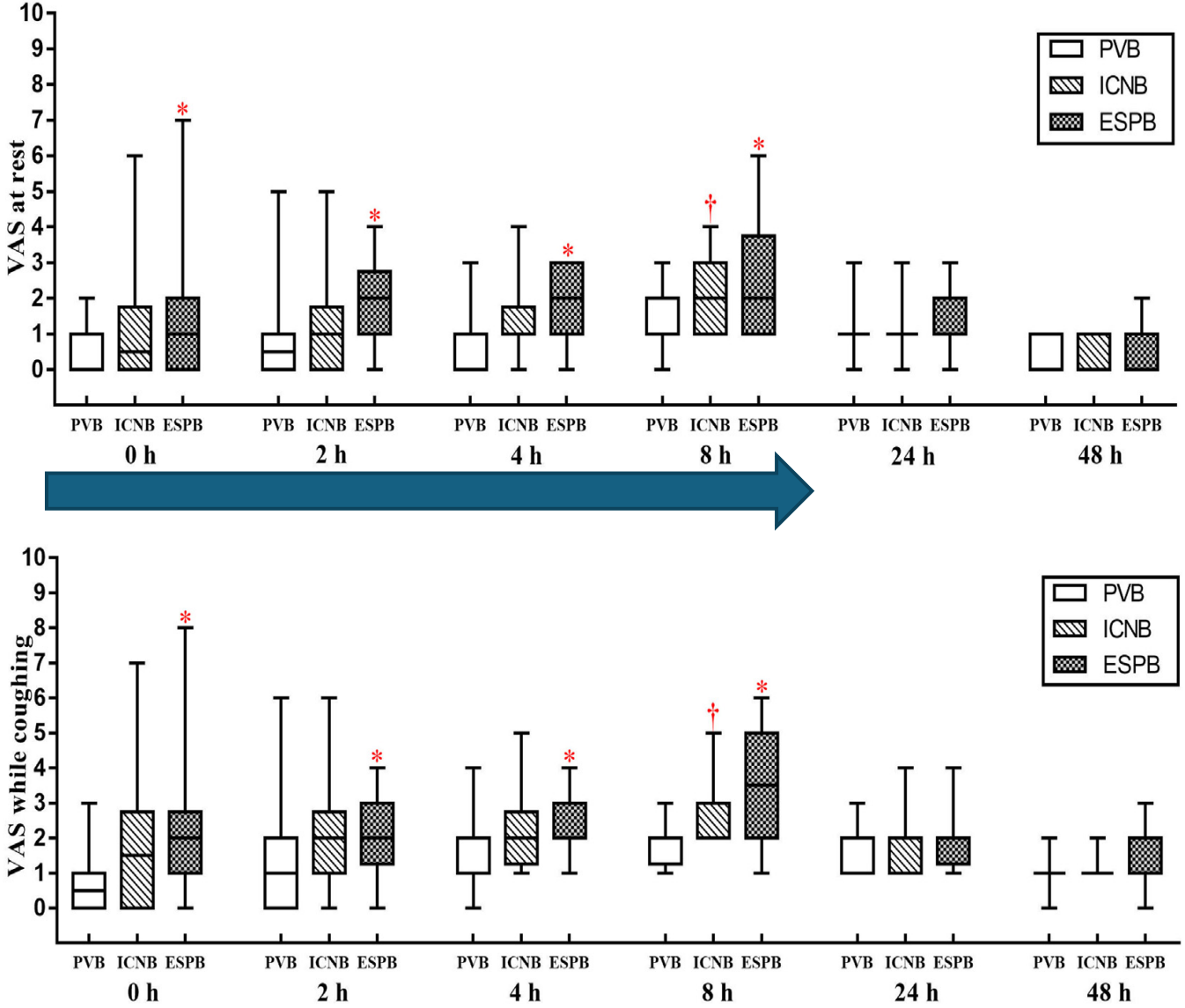
Fig. 3. Cumulative oxycodone rescue boluses after surgery.

	Group ESP (n = 33)	Group PVB (n = 33)	Statistical value	P value
Left lung surgery (n (%))	10 (30.3%)	15 (45.5%)	0.310	0.155
Surgical Procedure (n (%))			0.364	0.182
Wedge resection	9 (27.3%)	10 (48.5%)		
Segment	6 (18.2%)	6 (18.2%)		
Lobectomy	18 (54.4%)	17 (51.5%)		
Sufentanil Dose (ug)	31.1 ± 8.0	33.6 ± 6.3	1.910	0.172
Remifentanil Dose (ug)	562 ± 298	525 ± 172	0.618	0.539
Duration of surgery (min)	121 ± 58	107 ± 30	1.25	0.218
Duration of anesthesia (min)	152 ± 58	133 ± 30	1.608	0.115
Extubation time (min)	20.2 ± 13.6	21.8 ± 11.8	−0.53	0.598
Patients received > two doses of Vasopressors	5	10	2.157	0.142
Blood loss (mL)	30 (50, 300)	50 (50, 400)	480	0.399
Urine Output (mL)	300 (100, 500)	200 (100, 550)	460	0.307
Infusion volume (mL)	1200 (800,2000)	1100(900, 2000)	451	0.229
Resting pain score at 24 h	2.5 ± 0.7	2.2 ± 1.0	1.412	0.163
Coughing pain score at 24 h	2.8 ± 0.8	2.6 ± 0.8	1.016	0.323
Oxycodone rescue at 24 h	3.9 ± 5.2	2.3 ± 2.3	1.616	0.111
Resting pain score at 48 h	1.6 ± 1.0	1.8 ± 0.9	−0.854	0.396
Coughing pain score at 48 h	2.0 ± 0.7	2.4 ± 1.0	−1.882	0.065
Oxycodone rescue at 48 h	7.9 ± 8.7	6.9 ± 6.3	0.535	0.594
Time to first pain rescue (h)	16.1 ± 5.3	15.8 ± 8.7	0.169	0.866
Chest tube drainage (days)	2.6 ± 0.6	2.9 ± 1.1	−1.375	0.174
Hospital stay (days)	3.8 ± 0.8	4.1 ± 1.2	−1.195	0.236
QoR24h	111 ± 8	116 ± 6.8	−1.151	0.250
QoR48h	136 ± 7	132 ± 7	2.368	0.021

Group ESPB = Group Erector Spinae Plane block, Group PVB = Group Paravertebral Block. Data shown by mean ± SD or numbers (%).

Zhao H. et al. Journal of Clinical Anesthesia 2020, 62:109737

The effect of ultrasound-guided intercostal nerve block, single-injection erector spinae plane block and multiple-injection paravertebral block on postoperative analgesia in thoracoscopic surgery: A randomized, double-blinded, clinical trial☆



Ultrasound-guided ICNB and single-injection ESPB both provided inferior analgesia to multiple-injection PVB for thoracoscopic surgery, while no difference was found in postoperative analgesic effect between ICNB and single-injection ESPB. Besides, ICNB or single-injection ESPB in combination with PCA is also simple, safe and effective regimen for pain control after thoracoscopic surgery and can be used as a valid option especially when anesthesiologists have little experience in PVB or when PVB is contraindicated or failed. On the other hand, further studies are needed to determine the optimal volume and concentration of local anesthetics for ESPB.

Chen N. et al. Journal of Clinical Anesthesia 2020, 59:106-111

PACTS

Recommendation 34: We suggest erector spinae plane block as part of a multimodal analgesia for thoracic surgery, especially for VATS.

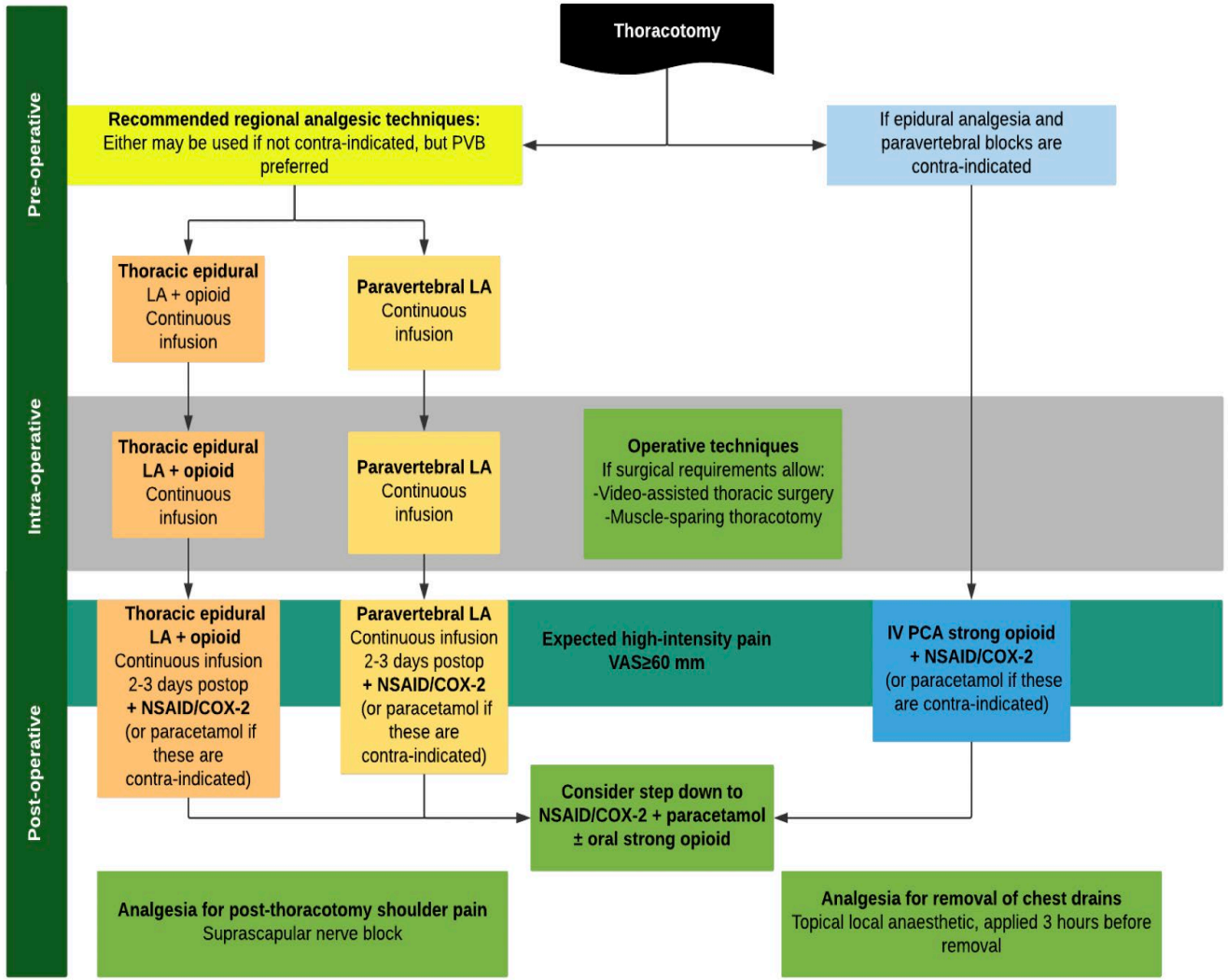
Level of evidence: Poor

Strength of recommendation: B

Piccioni F. et al. Perioperative Medicine 2020: 9-31

prospect
procedure specific postoperative pain management

State of the Art Safety Standards in RA
THE EUROPEAN SOCIETY OF REGIONAL ANAESTHESIA & PAIN THERAPY



Thoracotomy

Regional analgesia

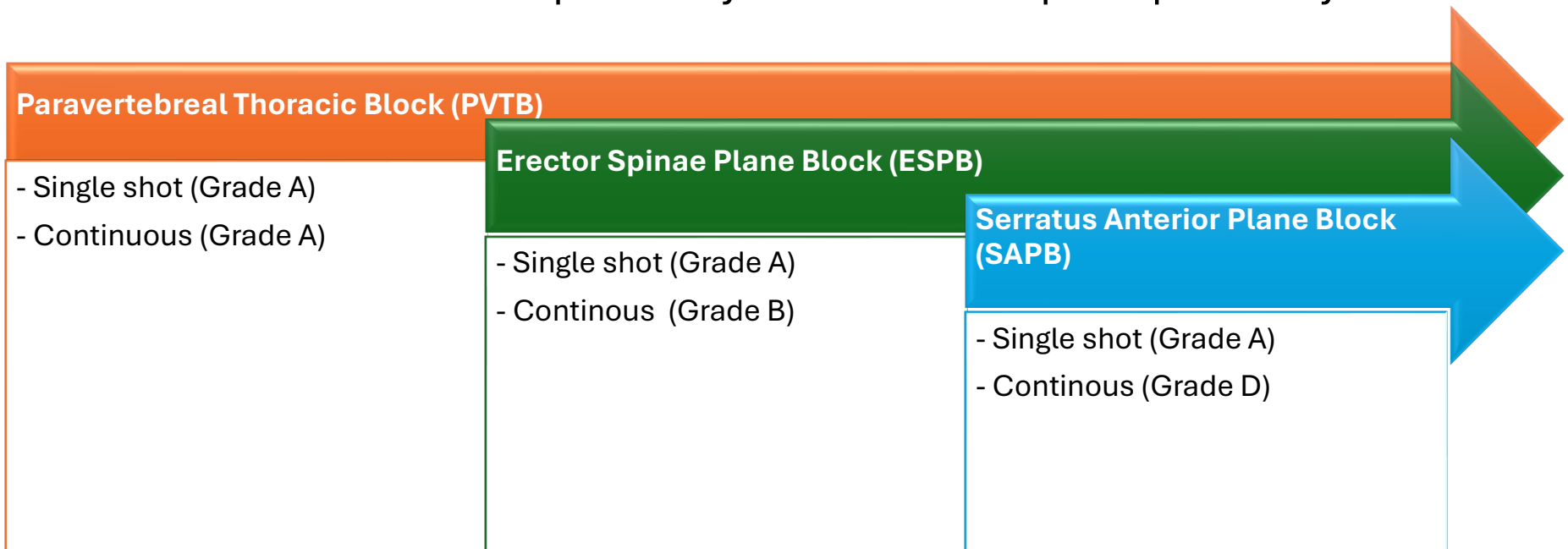
- **Paravertebral block** with LA (bolus pre-operatively or at the end of surgery, followed by continuous infusion), as the first choice compared to thoracic epidural analgesia due to lower complications rate (GoR A)
- **Thoracic epidural** LA + strong opioid as a bolus before surgery (GoR A), continued as an infusion is also recommended, if PVB not used.

prospect
procedure specific postoperative pain management

State of the Art Safety Standards in RA
THE EUROPEAN SOCIETY OF REGIONAL ANAESTHESIA & PAIN THERAPY

Video Assisted Thoracoscopic Surgery

- Regional analgesic techniques such as **paravertebral block** and **erector spinae plane block** are recommended. **Serratus anterior plane block** can be used as a second choice.
- Systemic analgesia should include **paracetamol** and **non-steroidal anti-inflammatory drugs** or cyclo-oxygenase-2-specific inhibitors administered pre-operatively or intra-operatively and continued postoperatively.



PROSPECT guidelines for video-assisted thoracoscopic surgery: a systematic review and procedure-specific postoperative pain management recommendations

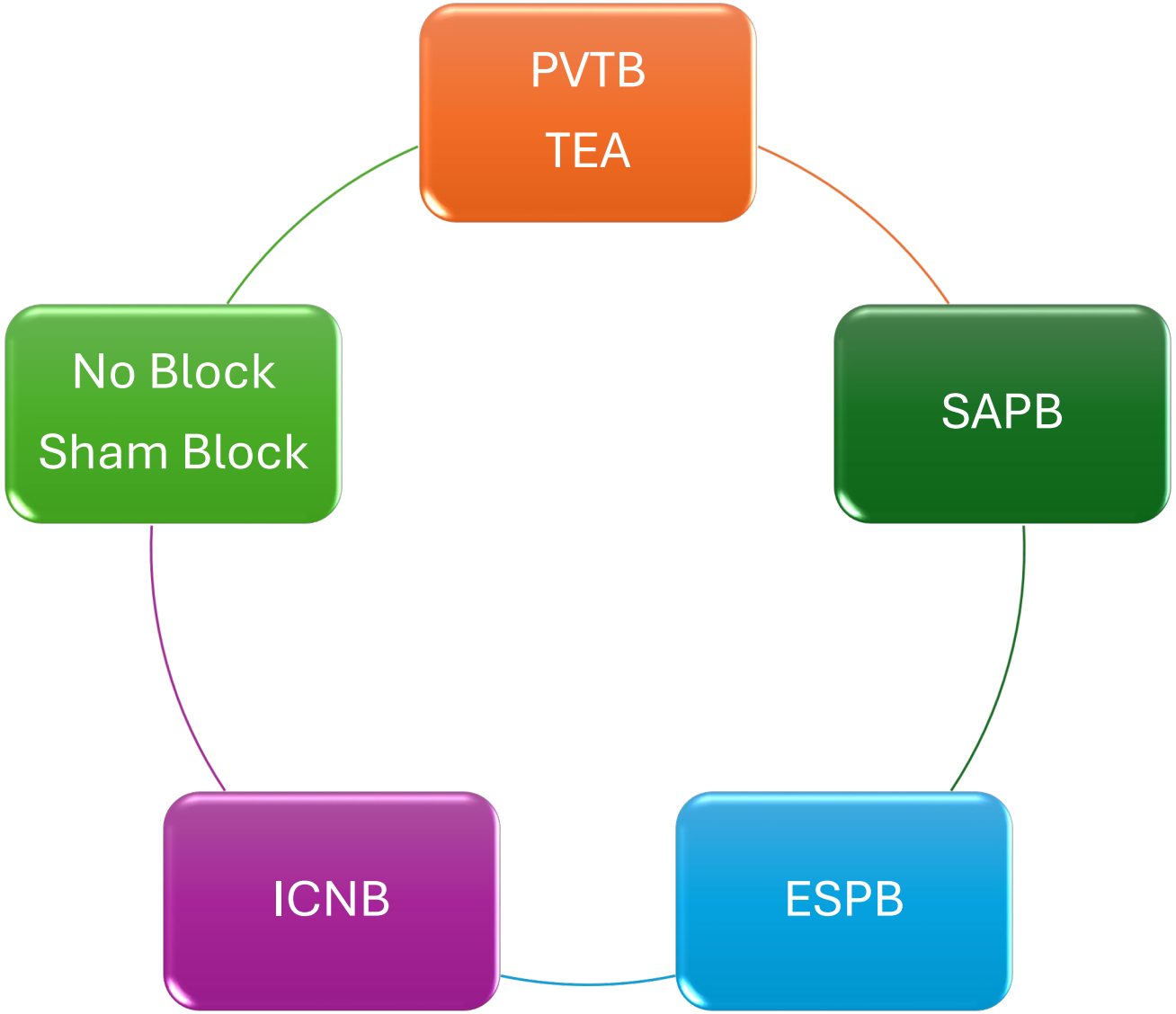
Regional analgesic techniques such as **PVTB** and **ESPB** are recommended, using either a single shot or preferably a catheter with a continuous infusion of local anaesthetics.

- A PVB is recommended because of its efficacy on pain control and limited side effects compared to TEA. The use of a catheter instead of single-shot analgesia prolongs the analgesic effect.
- An ESPB is also recommended as several studies have shown efficacy of ropivacaine ESPB versus sham block. Two studies have shown non-inferiority of ESPB compared with PVB. ESPB should therefore be considered as an alternative.

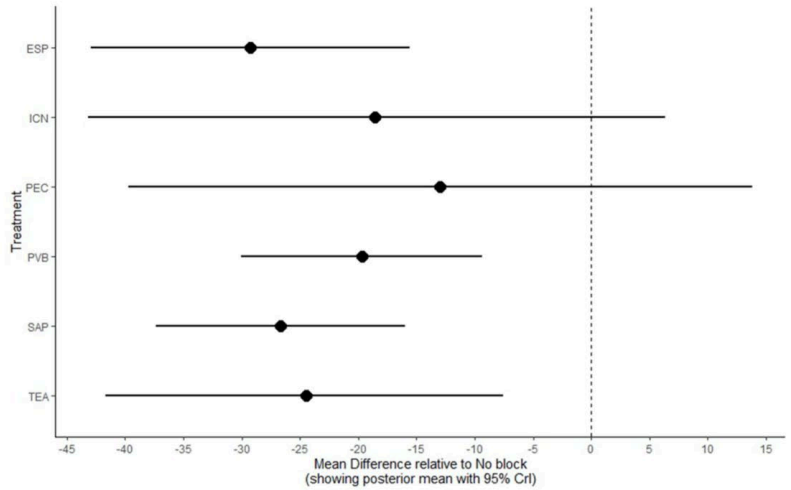
Serratus anterior plane block can be used as a second choice.

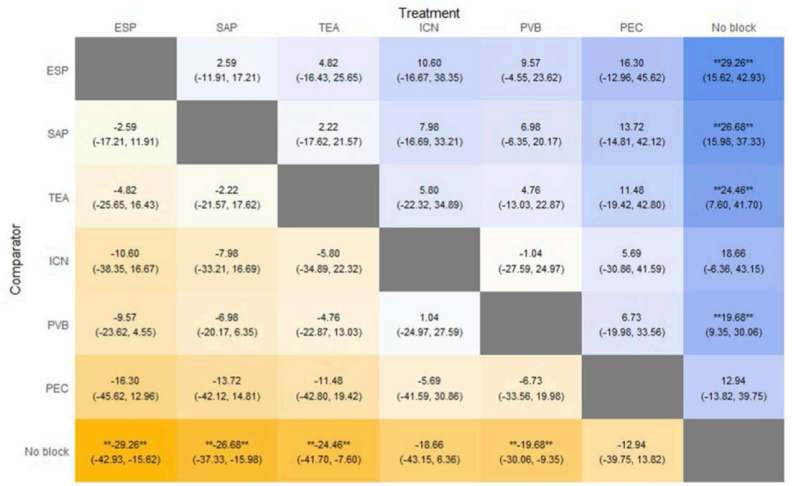
- The studies retrieved considered a single injection and documented a benefit in terms of pain and opioid consumption compared to systemic basic analgesia or compared to infiltration of the incision site.

Feray S. et al. Anaesthesia 2022,77,311-325


PVTB
TEA
SAPB
ESPB
ICNB
No Block
Sham Block

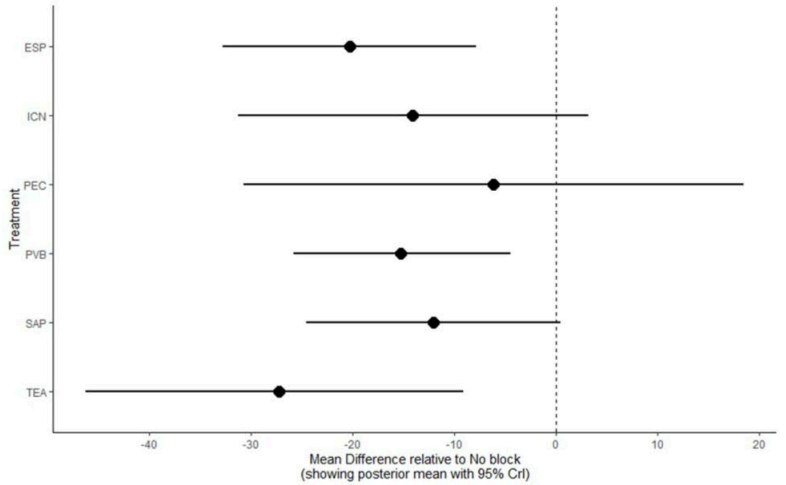
Effectiveness of Thoracic Wall Blocks in Video-Assisted Thoracoscopic Surgery, a Network Meta-Analysis

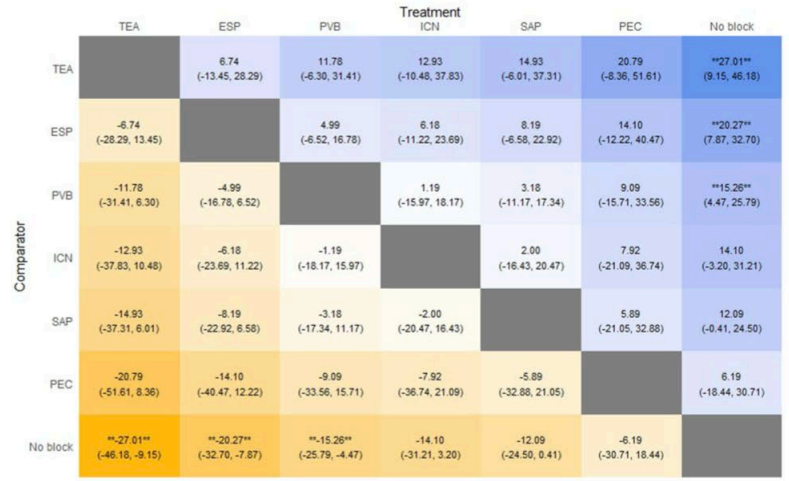




Pain Score

When compared to the “no block” arm, ESP, SAP, TEA and PVB demonstrated significant reduction in the pain score.





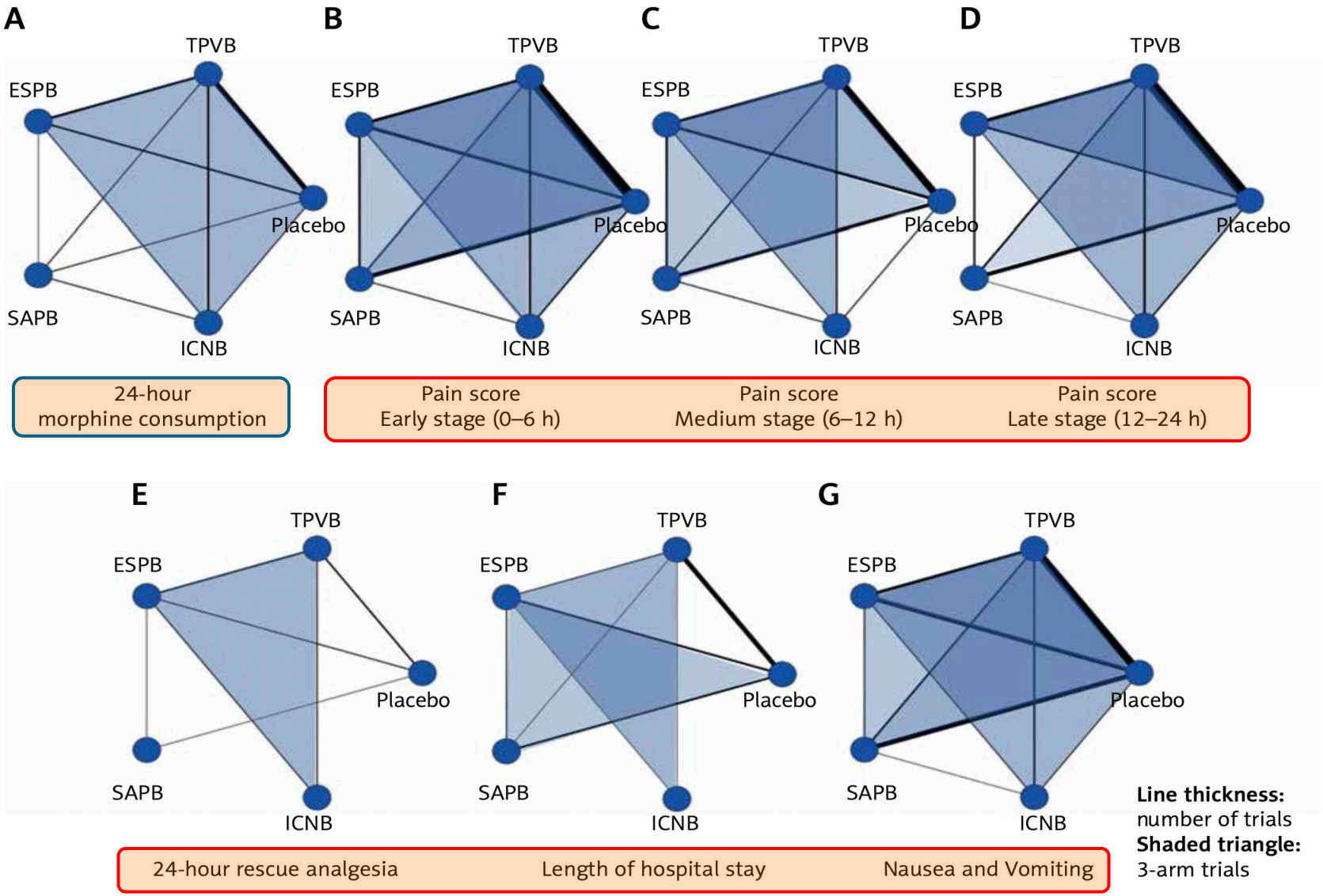
24h opioid requirement

When compared to the “no block” arm, TEA, ESP, PVB demonstrated significant opioid sparing efficacy, while SAP had no significant benefit

PECS and ICNB were not associated with significant analgesic benefits as measured by opioid requirement and pain score.

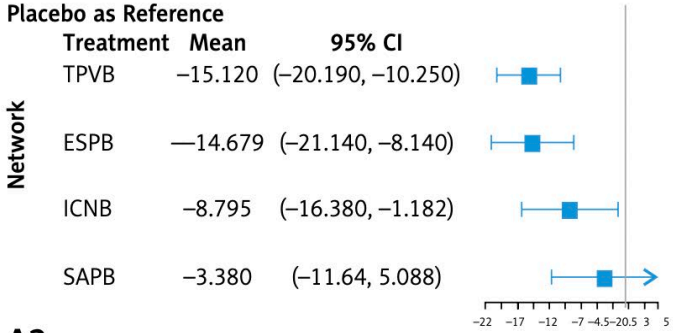
Scorsese G, Jin Z, Greenspan S, Seiter C, Jiang Y, Huang MB, Lin J. J Pain Res. 2023 Mar 7;16:707-724

Regional block techniques for pain management after video-assisted thoracoscopic surgery: a covariate-adjusted Bayesian network meta-analysis



Tao Jiang et al. Videosurgery Miniinv 2023; 18 (1): 52–68

A1 24-hour morphine consumption [mg]



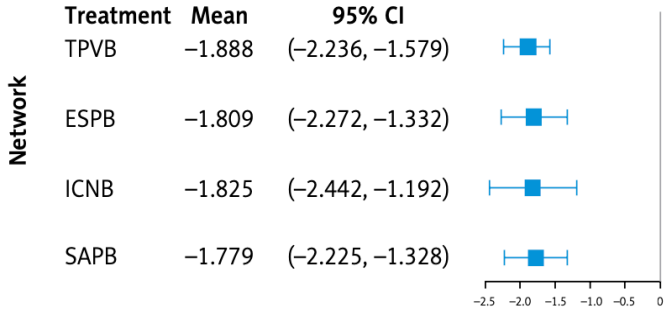
TPVB, ESPB and ICNB are significantly different from the placebo group in terms of **24 h morphine consumption**, except for SAPB.

A2

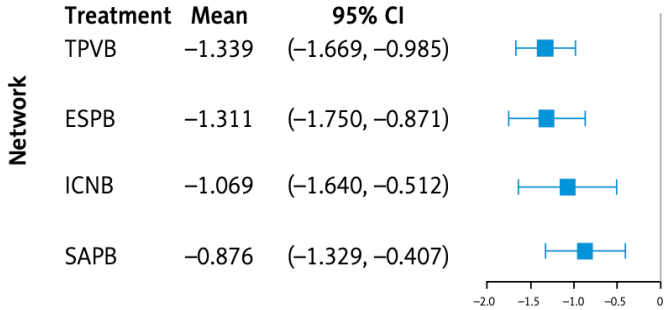
Direct \ Indirect	Placebo	TPVB	ESPB	ICNB	SAPB
Placebo		**−14.0 (−24.0, −3.8)**	**−16.0 (−25.0, −6.5)**	−7.8 (−18.0, 2.0)	−3.6 (−15.0, 7.8)
TPVB	**−16.0 (−22.0, −9.6)**		2.5 −8.2, 13.0)	**14.0 (1.5, 28.0)**	7.1 (−2.9, 17.0)
ESPB	**−13.0 (−23.0, −3.5)**	−1.5 (−10.0, 7.1)		**12.0 (0.8, 23.0)**	**10.0 (0.3, 21.0)**
ICNB	−11.0 (−25.0, 3.4)	5.0 (−4.4, 14.0)	−2.9 (−16.0, 9.0)		**−12.0 (−24.0, −0.7)**
SAPB	−3.5 (−17.0, 9.8)	**21.0 (6.7, 35.0)**	17.0 (−15.0, 48.0)	3.6 (−9.5, 17.0)	

There are significant differences in direct comparisons: Placebo vs TPVB, Placebo vs ESPB, and TPVB vs SAPB.

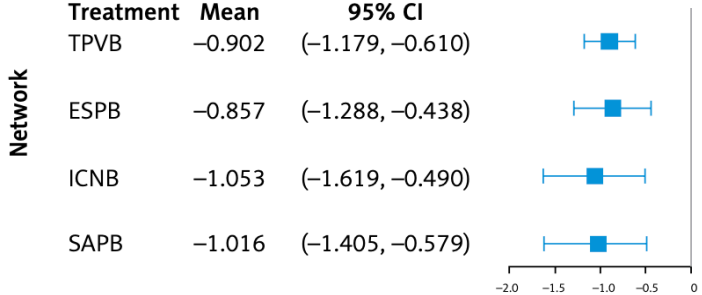
B1 Pain score Early stage (0–6 h)



B2 Pain score Medium stage (6–12 h)

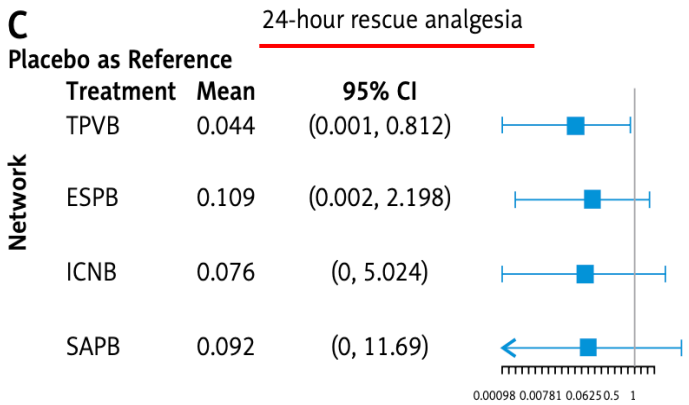


B3 Pain score Late stage (12–24 h)

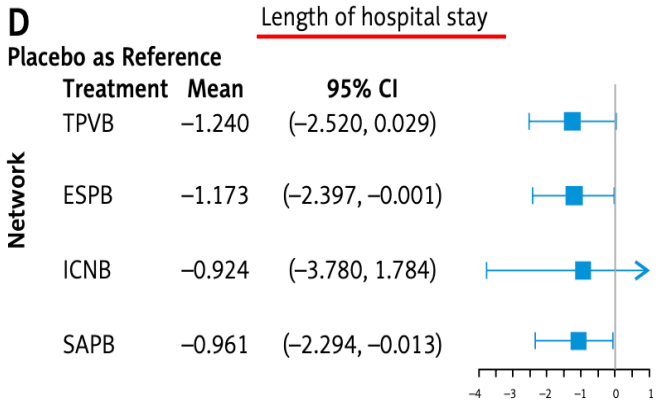


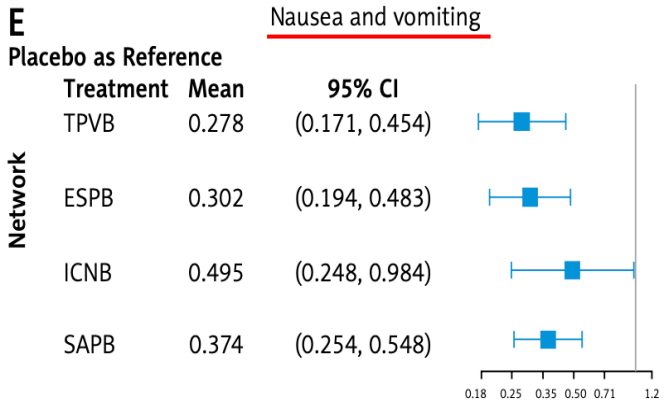
In the early and mid-term pain scores, TPVB and SAPB are two extremes; however, the late VAS scores are reversed, and ICNB and SAPB showed lower pain scores.
Notably, there are significant differences between TPVB and ESPB in direct, indirect, and network comparisons in late VAS scores

Tao Jiang et al. Videosurgery Miniinv 2023; 18 (1): 52–68



TPVB and ICNB are less likely to require rescue analgesia. There are significant differences between Placebo vs. SAPB and ESPB vs. SAPB.

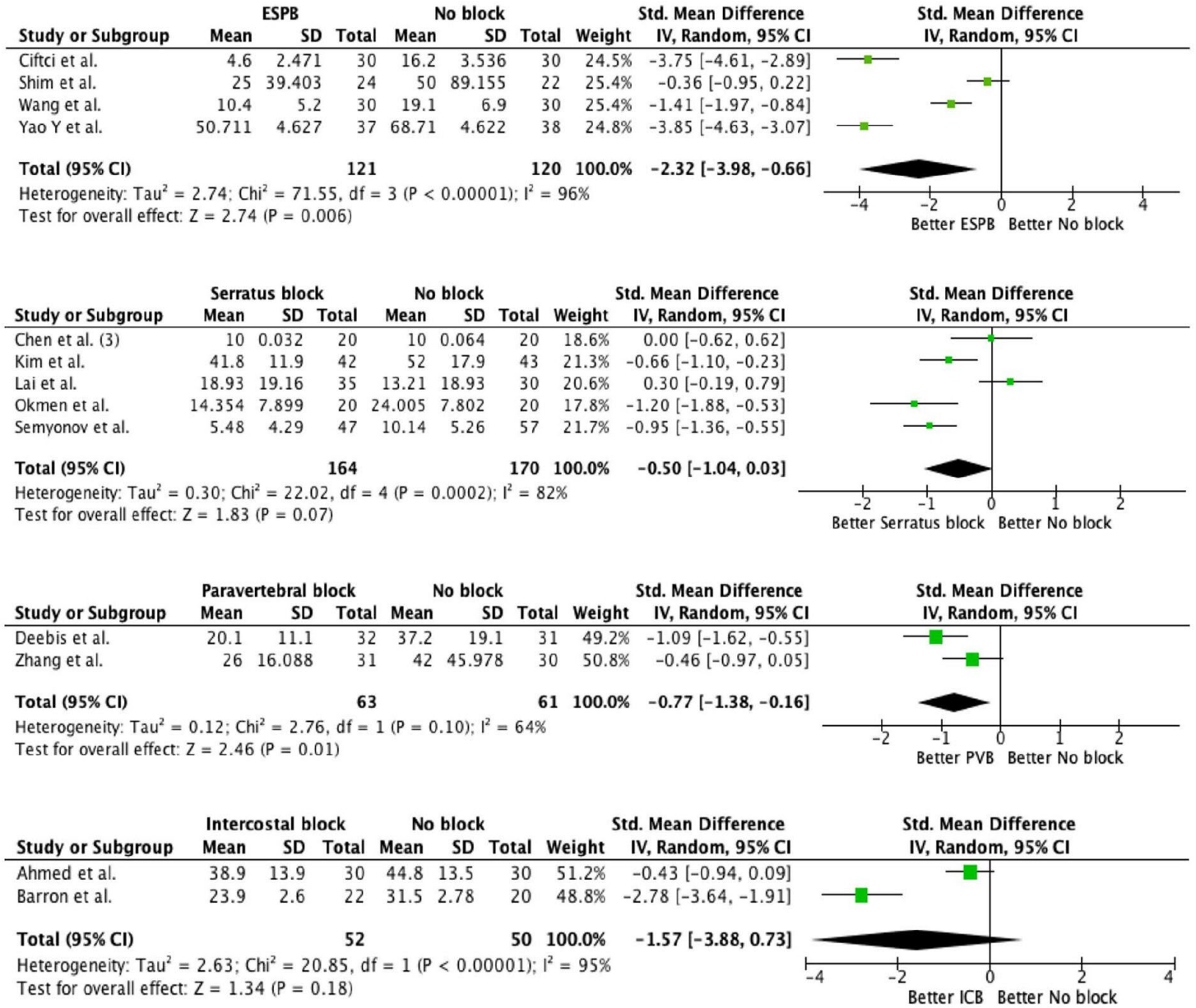




The performance of intervention measures in the two events of the length of hospital stay and PONV are similar: **TPVB < ESPB < SAPB < ICNB.**

TPVB performed overwhelmingly better than the other three measures. ESPB is an alternative, secondary to TPVB. ICNB and SAPB play a considerable role in pain management and postoperative recovery after VATS, but they should not be taken as the primary measures.

Tao Jiang et al. Videosurgery Miniinv 2023; 18 (1): 52–68



Regional Analgesia is a useful choice in thoracic surgery.

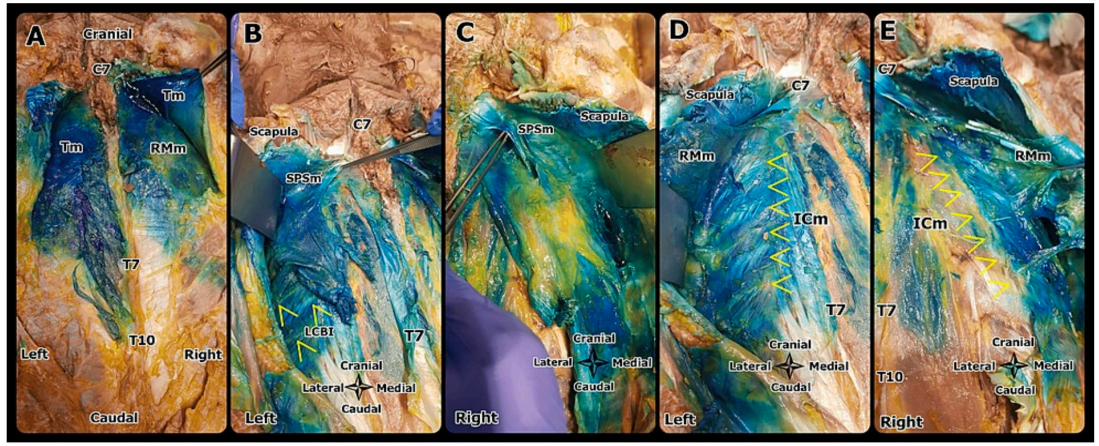
However, it is still not possible to determine the most appropriate block in the individual surgical settings to be performed due to RCTs paucity.

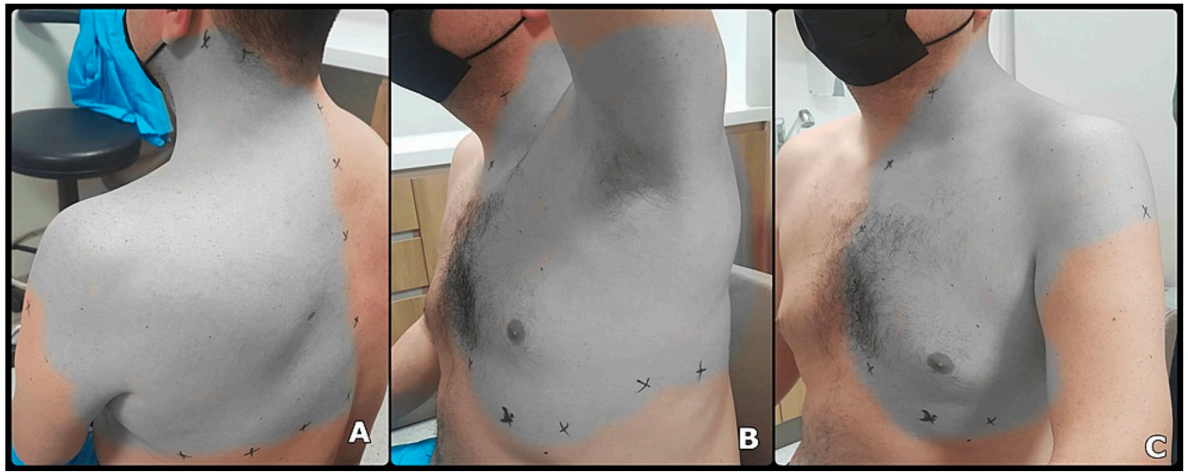
Balzani E. et al. The effect of peripheral regional analgesia in thoracic surgery: a systematic review and a meta-analysis of randomized-controlled trials. Tumori Journal. 2023;109(1):6-18.

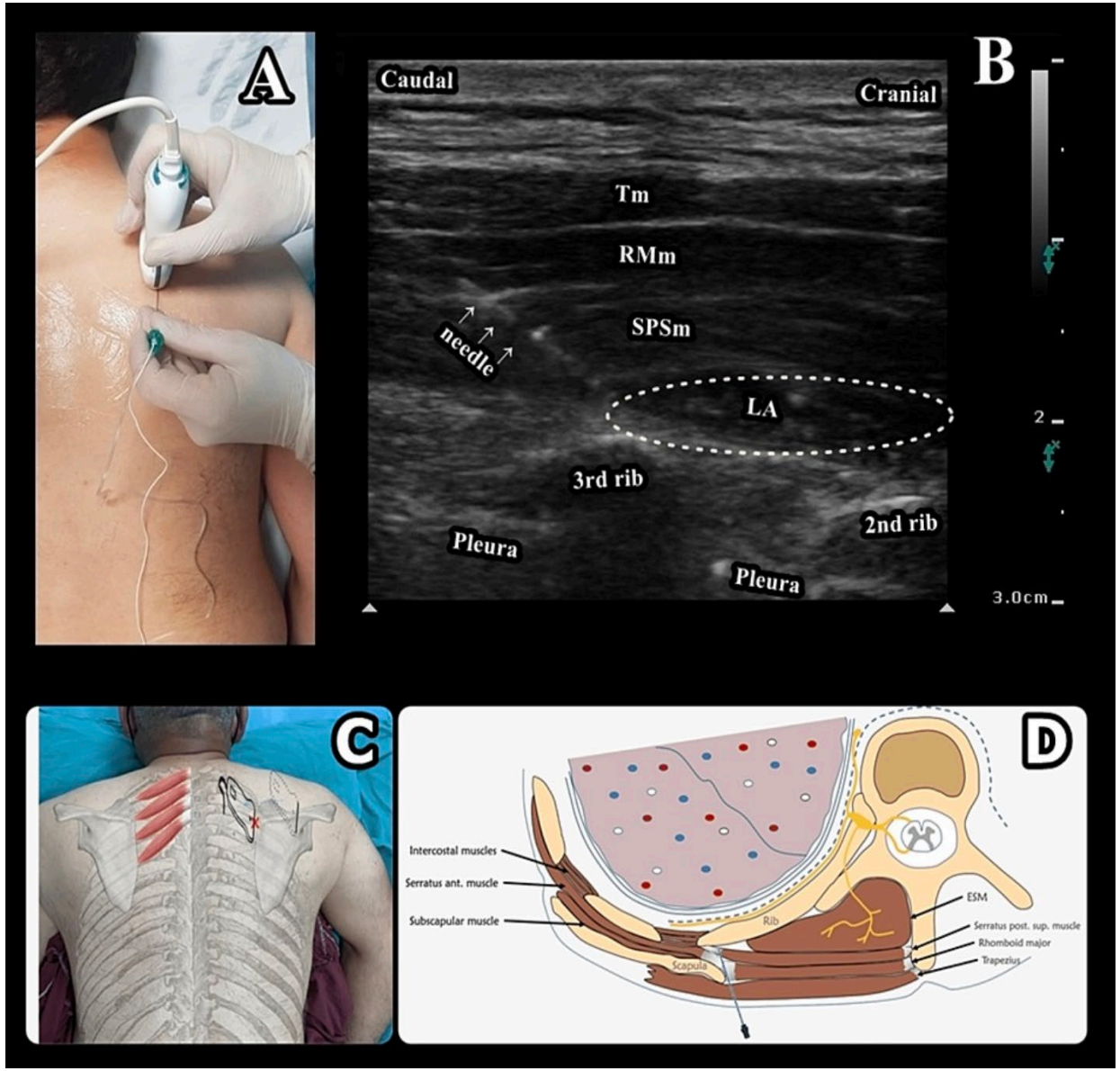
Heterogeneity of the trials

Heterogeneity of the context

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







Tulgar et al. Cureus 2023, 15(2): e34582.

Efficacy of serratus posterior superior intercostal plane block (SPSIPB) on post-operative pain and total analgesic consumption in patients undergoing video-assisted thoracoscopic surgery (VATS): A double-blinded randomised controlled trial

Table 2: Static and dynamic NRS assessments of the patients

	Group SPSIPB (*n*=12)	Group Control (*n*=12)	*P*
Static NRS values			
0th h	3 (1.04)(2.34–3.66)	6.58 (0.51)(6.26–6.91)	<0.001
1st h	3 (1.04)(2.34–3.66)	6.5 (0.67)(6.07–6.93)	<0.001
6th h	2.67 (0.65)(2.25–3.08)	4.92 (0.51)(4.59–5.24)	<0.001
12th h	2.08 (0.9)(1.51–2.66)	4.17 (0.39)(3.92–4.41)	<0.001
18th h	1.5 (0.67)(1.07–1.93)	3.92 (0.79)(3.41–4.42)	<0.001
24th h	1 (0.74)(0.53–1.47)	3 (0.85)(2.46–3.54)	<0.001
Dynamic NRS values			
1st h	4 (1.04)(3.34–4.66)	7.58 (0.67)(7.16–8.01)	<0.001
6th h	3.83 (0.83)(3.3–4.36)	6.08 (0.51)(5.76–6.41)	<0.001
12th h	3.33 (0.98)(2.71–3.96)	5.33 (0.49)(5.02–5.65)	<0.001
18th h	2.67 (0.78)(2.17–3.16)	5.25 (0.97)(4.64–5.86)	<0.001
24th h	2.08 (0.9)(1.51–2.66)	4.08 (1.08)(3.39–4.77)	<0.001

Pain scores are presented as mean (standard deviation) (95% confidence interval). NRS: Numerical rating scale

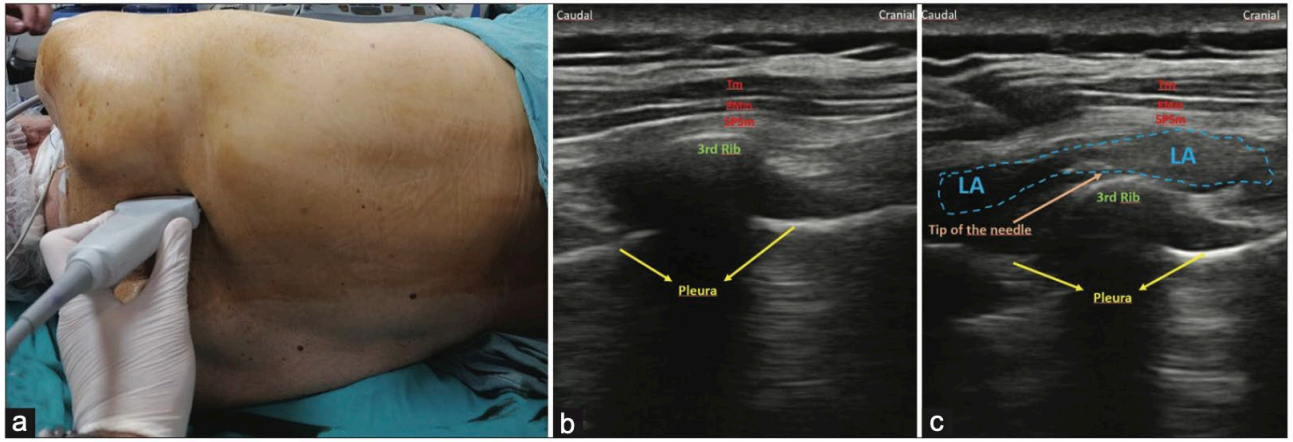


Table 3: Tramadol consumption in post-operative time intervals and total tramadol consumption

Tramadol consumption (mg)	Group SPSIPB (*n*=12)	Group Control (*n*=12)	*P*
In 0th–1st h	16.67 (7.78)(11.72–21.61)	18.33 (7.18)(13.77–22.89)	0.532
In 1st–6th h	21.67 (7.18)(17.11–26.23)	39.17 (7.93)(34.13–44.2)	<0.001
In 6th–12th h	13.33 (11.55)(6–20.67)	33.33 (4.92)(30.2–36.46)	<0.001
In 12th–18th h	5.83 (6.69)(1.59–10.08)	32.5 (6.22)(28.55–36.45)	<0.001
In 18th–24th h	0.83 (2.89)(1–2.67)	20.83 (7.93)(15.8–25.87)	<0.001
Total tramadol consumption	58.33 (26.23)(41.67–75)	144.17 (13.11)(135.83–152.5)	<0.001

Data are expressed as mean (standard deviation) (95% confidence interval). CI: Confidence interval

Avci O. et al. Indian J Anaesth 2023;67:1116-22

Author, year of publication	Characteristics of study participants(age, ASA)	Sample size (ESPB/PVB)	Location of block,	Local anesthetics(type, dose)	Surgery type	Duration of surgery (PVB & ESPB)	Outcome
Chen et al. (9), 2020	Patients aged 18–75 years, ASA I–II	24/24	PVB at T5-T7 ESPB at T5 level	20 mL of 0.375% ropivacaine for both blocks	VATS (Lobectomy, Segmentectomy, Wedge resection)	PVB = 128.4 (58.2), and 134.5 (43.1)	Cumulative morphine consumption, rescue analgesia, VAS pain scores at rest and while coughing at 0, 2, 4, 8, 24 and 48 h postoperatively.
Çiftçi et al. (25), 2020	Patients aged 18–65 years & ASA I-II	30/30	At the level of the T5 vertebra.	20 mL of 0.25% bupivacaine for both blocks	VATS (lobectomies/wedge resections)	PVB = 125.86 ± 17.67 min. & ESPB = 135.50 ± 29.13 min.	Total fentanyl consumption, rescue analgesia, VAS scores at 1, 2, 4, 8, 16, 24, 48 h at movement and at rest, Block procedure time, and side effects of the block (Nausea, Vomiting)
Duran et al. (26), 2022	Patients aged 18–75 years and ASA I-III	45/45	----------	----------	Thoracotomy	---------	Morphine consumption
Fang et al. (27), 2019	Patients aged 18–81 years and ASA I-II	46/45	----------	20 mL of 0.25% bupivacaine for either blocks	Thoracotomy (Wedge resection, Segmentectomy, Lobectomy)	72.61 ± 24.47 min and 78.33 ± 29.62 min.	VAS scores under the status of rest and cough at 1, 6, 12, and 24 h, puncture time and success rate of one puncture, and adverse effects (nausea and vomiting)
Jain et al. (28), 2022	Age ≥ 18 years, and ASA I-III	30/30	At T5/T6 level for PVB and T5 level for ESPB	20 mL 0.25% bupivacaine for either block	Thoracotomy, decortication, VATS, multiple open drainage system, and thoracomyoplasty	----------	Analgesic consumption, VAS scores at 0, 1, 3, 6, 12, and 24 h.
Taketa et al. (29), 2020	Patients aged 20–80 years, and ASA I-III	40/41	T4 or T5 intercostal level for both blocks	20 mL of 0.2% levobupivacaine for either block	VATS (radical lobectomy)	178.6 ± 28.2 and 179.3 ± 48.0	Rescue analgesia, NRS scores at rest and on movement at 0, 1, 3, 6, 12, and 24 h, and PONV.
Turhan et al. (30), 2021	Age ≥ 18 years, and ASA I-III	35/35	At the level of the T5 vertebra.	20 mL of 0.5% bupivacaine for either block	VATS	101.71 ± 24.55 min and 97.71 ± 43.05 min	Morphine consumption, VAS scores at rest and on movement, 0, 1, 4, 12, 24, 36 and 48.
Zengin et al. (31), 2022	Patients aged 18–80 years, and ASA I-III	30/30	At the level of the T5 vertebra.	20 mL 0.25% bupivacaine for either block	VATS (Wedge Resection, Segmenthectomy, Lobectomy)	175 (120–240) min and 150 (135–210) min.	Morphine consumption, rescue analgesia, Static and dynamic VAS resting and coughing scores at 1, 2, 4, 8, and 16 h, and PONV.
Zhang et al. (32), 2022	Patients aged 40–70 years, and ASA I-II	22/22	At T4 and T5 levels	30 mL of 0.5% ropiv-acaine	VATS lobectomy	126.05 ± 6.81 min and 126.82 ± 7.56 min.	VAS resting and coughing scores at 1, 6, 12, 24, and 48 h, PONV.
Zhao et al. (33), 2020	Patients aged 18–75 years, and ASA I-II	33/33	At T4 and T6 levels	30 mL 0.4% ropivacaine	VATS	107 ± 30 min and 121 ± 58 min.	Oxycodone consumption, VAS resting and coughing scores at 24 h, PONV.

- For patients undergoing thoracic surgeries PVB provides a superior postoperative analgesia compared to ESPB as a part of multimodal analgesic regimen.
- Additionally, by using significantly less opioids, PVB showed superior opioid sparing.

Fenta E. et al. The analgesic efficacy of erector spinae plane block versus paravertebral block in thoracic surgeries: a meta-analysis. Front. Med., 17 August 2023 Sec. Intensive Care Medicine and Anesthesiology

Erector spinae plane block for postoperative pain (Review)

Schnabel A, Weibel S, Pogatzki-Zahn E, Meyer-Frießem CH, Oostvogels L

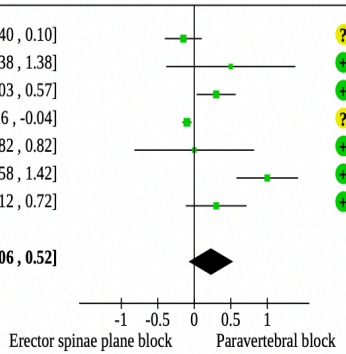
64 RCTs (3973 participants) in the meta-analysis.

Primary outcomes: postoperative pain at rest at 24 h and block-related adverse events.
Secondary outcomes: postoperative pain at rest (2-48 h) and during activity (2-24-48 h), chronic pain after three and six months, cumulative oral morphine requirements at 2, 24, 48h, rates of opioid-related side effects.

Analysis 3.1. Comparison 3: Erector spinae plane block vs paravertebral block, Outcome 1: Mean difference in postoperative pain intensity at rest (24 hours postoperatively) (VAS)

Study or Subgroup	Erector spinae plane block Mean	SD	Total	Paravertebral block Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI	Risk of Bias A B C D E F
Ciftci 2020c	0.1	0.5	30	0.25	0.5	30	18.0%	-0.15 [-0.40 , 0.10]	? + + + + ?
El Ghamry 2019a	3.5	2.222	35	3	1.481	35	7.0%	0.50 [-0.38 , 1.38]	+ + + + + +
Fang 2019	2.2	0.6	45	1.9	0.7	46	17.7%	0.30 [0.03 , 0.57]	+ ? + - + -
Guo 2019	2.8	0.1	20	2.9	0.1	20	20.7%	-0.10 [-0.16 , -0.04]	? + + + + ?
Taketa 2019	1	2.222	41	1	1.481	40	7.7%	0.00 [-0.82 , 0.82]	+ + + + + +
Turhan 2020	2	1.25	35	1	0.25	35	14.4%	1.00 [0.58 , 1.42]	+ ? + + + ?
Zhao 2020	2.5	0.7	33	2.2	1	33	14.5%	0.30 [-0.12 , 0.72]	+ + + + + +
Total (95% CI)			**239**			**239**	**100.0%**	**0.23 [-0.06 , 0.52]**	

Heterogeneity: Tau² = 0.10; Chi² = 37.61, df = 6 (P < 0.00001); I² = 84%
Test for overall effect: Z = 1.55 (P = 0.12)
Test for subgroup differences: Not applicable

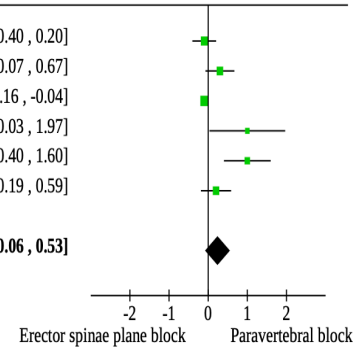


Risk of bias legend
(A) Bias arising from the randomization process
(B) Bias due to deviations from intended interventions
(C) Bias due to missing outcome data
(D) Bias in measurement of the outcome
(E) Bias in selection of the reported result
(F) Overall bias

Analysis 3.3. Comparison 3: Erector spinae plane block vs paravertebral block, Outcome 3: Mean difference in postoperative pain intensity during activity (24 hours postoperatively) (VAS)

Study or Subgroup	Erector spinae plane block Mean	SD	Total	Paravertebral block Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Ciftci 2020c	0.4	0.6	30	0.5	0.6	30	20.0%	-0.10 [-0.40 , 0.20]
Fang 2019	4.2	0.9	45	3.9	0.9	46	18.1%	0.30 [-0.07 , 0.67]
Guo 2019	2.9	0.1	20	3	0.1	20	25.0%	-0.10 [-0.16 , -0.04]
Taketa 2019	4	2.222	41	3	2.222	40	6.8%	1.00 [0.03 , 1.97]
Turhan 2020	3	1.5	35	2	1	35	12.5%	1.00 [0.40 , 1.60]
Zhao 2020	2.8	0.8	33	2.6	0.8	33	17.7%	0.20 [-0.19 , 0.59]
Total (95% CI)			**204**			**204**	**100.0%**	**0.24 [-0.06 , 0.53]**

Heterogeneity: Tau² = 0.09; Chi² = 23.68, df = 5 (P = 0.0002); I² = 79%
Test for overall effect: Z = 1.57 (P = 0.12)
Test for subgroup differences: Not applicable

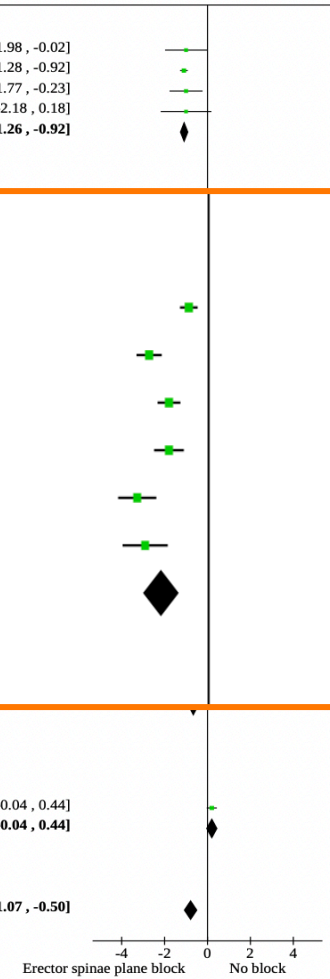


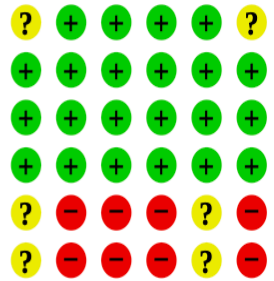
Erector spinae plane block for postoperative pain (Review)

Schnabel A, Weibel S, Pogatzki-Zahn E, Meyer-Frießem CH, Oostvogels L

Analysis 10.1. Comparison 10: Subgroup analysis: erector spinae plane block vs no block, Outcome 1: Mean difference in postoperative pain intensity at rest (24 hours postoperatively) (VAS) - Type of surgery

Study or Subgroup	Erector spinae plane block Mean	SD	Total	No block Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
10.1.1 Abdominal surgery								
Abdelhamid 2020	2	0.741	22	3	2.222	22	4.0%	-1.00 [-1.98 , -0.02]
Fu 2020	1.4	0.3	30	2.5	0.4	30	7.3%	-1.10 [-1.28 , -0.92]
Gultekin 2020	1.87	1.69	30	2.87	1.333	30	4.9%	-1.00 [-1.77 , -0.23]
Prasad 2020	2	1.481	31	3	2.963	30	3.3%	-1.00 [-2.18 , 0.18]
Subtotal (95% CI)			**113**			**112**	**19.4%**	**-1.09 [-1.26 , -0.92]**
Heterogeneity: Tau² = 0.00; Chi² = 0.12, df = 3 (P = 0.99); I² = 0%								
Test for overall effect: Z = 12.58 (P < 0.00001)								
10.1.3 Thoracic surgery								
Ciftci 2020c	0.1	0.5	30	0.6	0.5	55	7.2%	-0.50 [-0.72 , -0.28]
Ciftci 2020d	0.27	0.52	30	1.77	0.72	30	6.8%	-1.50 [-1.82 , -1.18]
Liu 2021	2	0.741	40	3	0.556	40	7.0%	-1.00 [-1.29 , -0.71]
Sobhy 2020	2.5	0.741	30	3.5	0.741	30	6.6%	-1.00 [-1.37 , -0.63]
Yaoping 2019	2.4	0.9	30	4.2	1	30	6.2%	-1.80 [-2.28 , -1.32]
Zheng 2019	3.2	0.5	20	4.8	1.2	20	5.8%	-1.60 [-2.17 , -1.03]
Subtotal (95% CI)			**180**			**205**	**39.5%**	**-1.20 [-1.62 , -0.79]**
Heterogeneity: Tau² = 0.23; Chi² = 43.79, df = 5 (P < 0.00001); I² = 89%								
Test for overall effect: Z = 5.69 (P < 0.00001)								
Heterogeneity: Tau² = 0.00; Chi² = 2.33, df = 3 (P = 0.51); I² = 0%								
Test for overall effect: Z = 6.00 (P < 0.00001)								
10.1.5 Hip surgery								
Tulgar 2018	2.15	0.37	20	1.95	0.39	20	7.1%	0.20 [-0.04 , 0.44]
Subtotal (95% CI)			**20**			**20**	**7.1%**	**0.20 [-0.04 , 0.44]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.66 (P = 0.10)								
Total (95% CI)			**507**			**531**	**100.0%**	**-0.79 [-1.07 , -0.50]**
Heterogeneity: Tau² = 0.29; Chi² = 145.77, df = 17 (P < 0.00001); I² = 88%								
Test for overall effect: Z = 5.39 (P < 0.00001)								
Test for subgroup differences: Chi² = 88.40, df = 4 (P < 0.00001), I² = 95.5%								

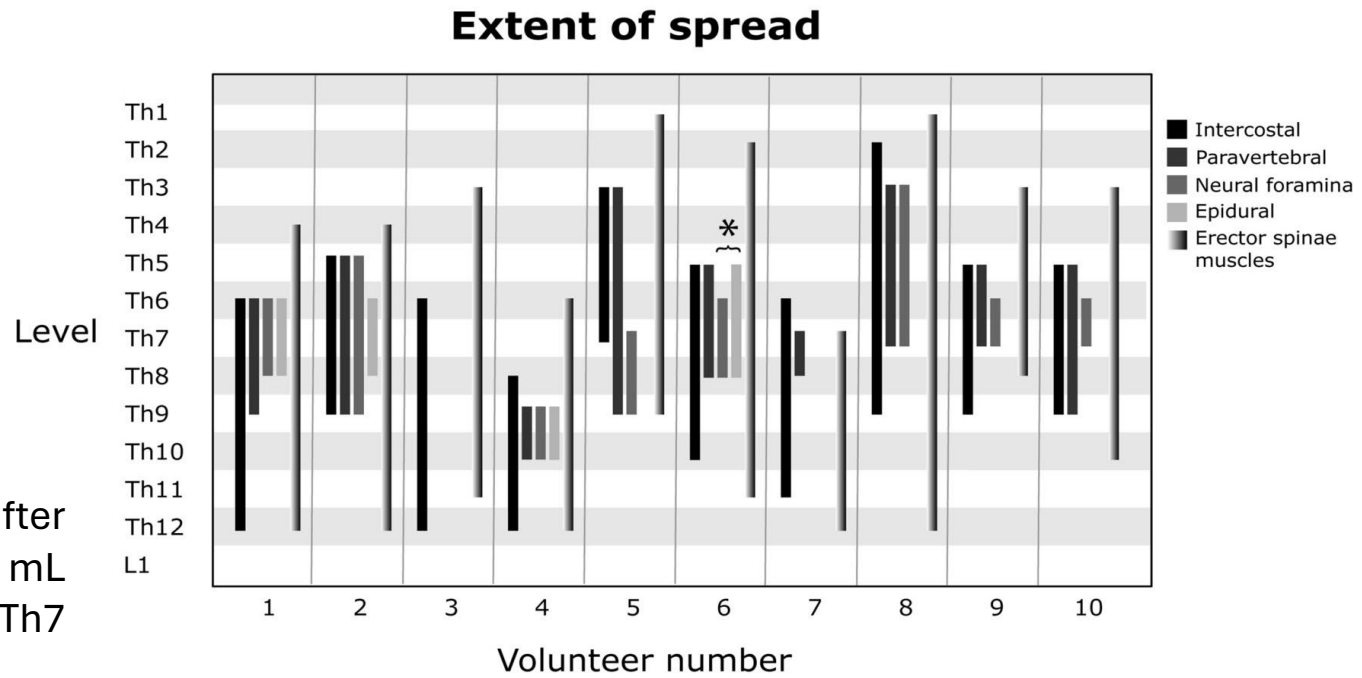




Risk of bias legend
(A) Bias arising from the randomization process
(B) Bias due to deviations from intended interventions
(C) Bias due to missing outcome data
(D) Bias in measurement of the outcome
(E) Bias in selection of the reported result
(F) Overall bias

Sensory testing 30-50 min after an ESPB shows highly variable results, and generally under-represents what could be expected from the visualized spread on MRI 60 min after block performance.

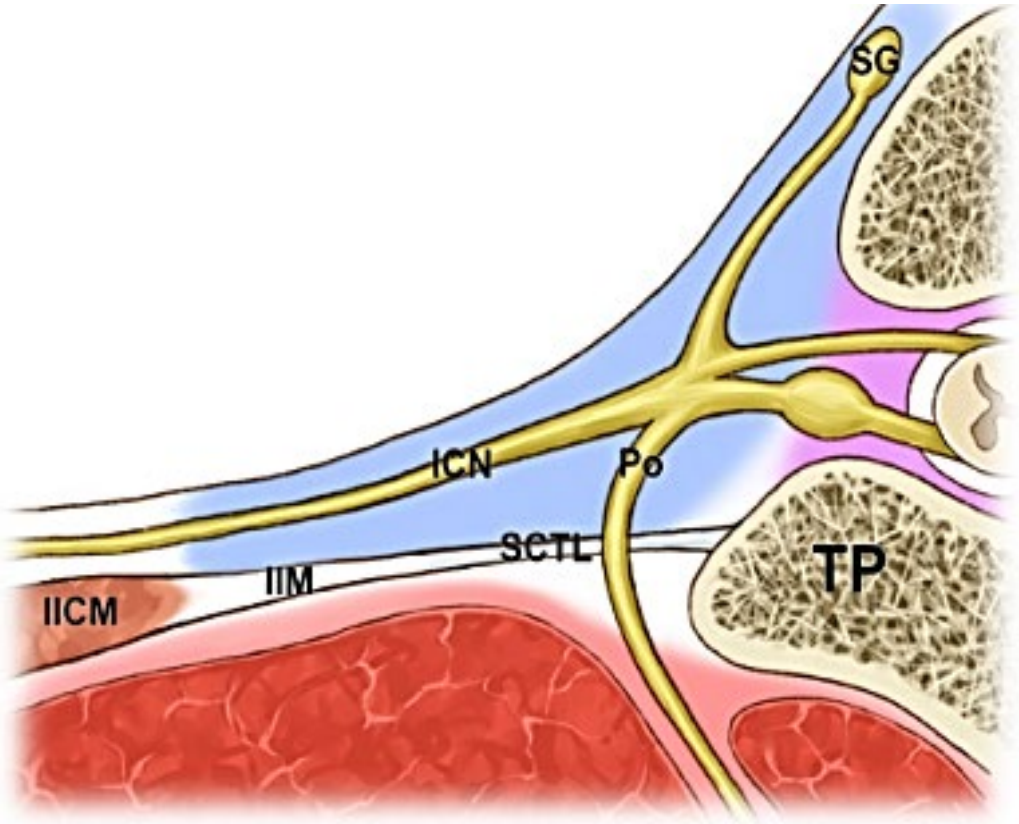
The extent of spread was evaluated using MRI after injection of 30 mL 2.5 mg/mL ropivacaine with 0.3 mL gadolinium at the level of Th7



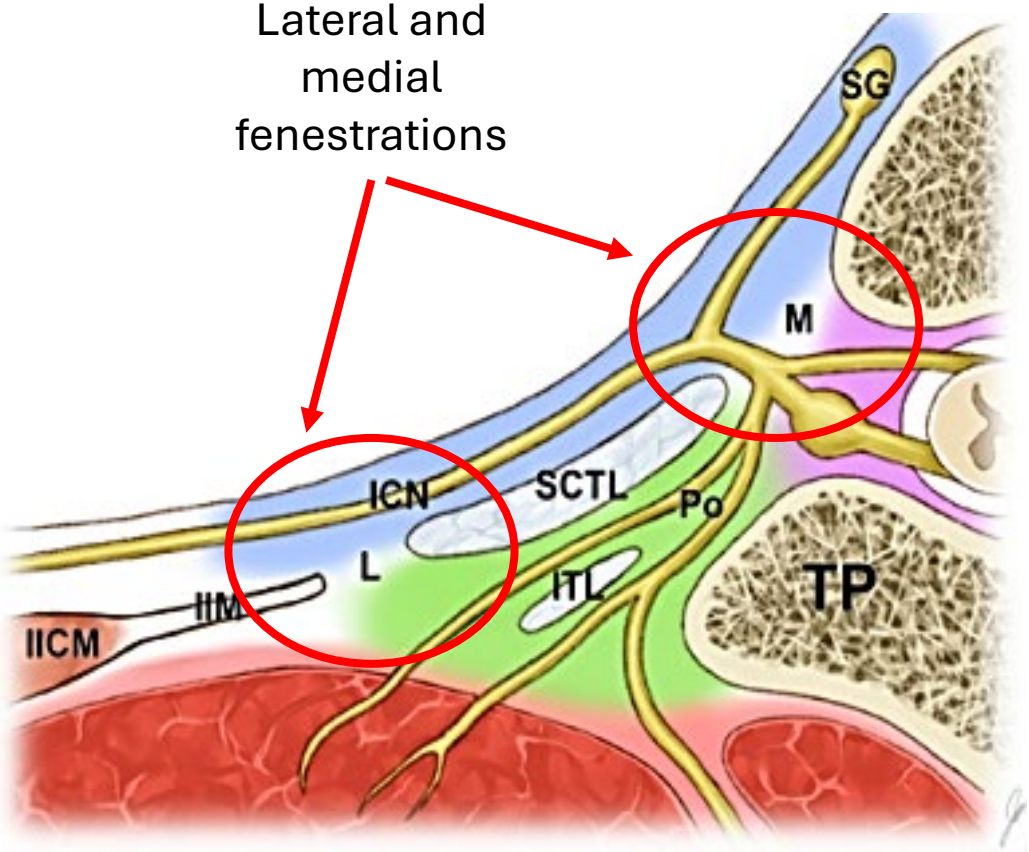
Sorenstua M. et al. Spread of local anesthetics after erector spinae plane block: an MRI study in healthy volunteers. Regional Anesthesia & Pain Medicine 2023;48:74-79

Present findings of the paravertebral space

Facial anathomy and physiology



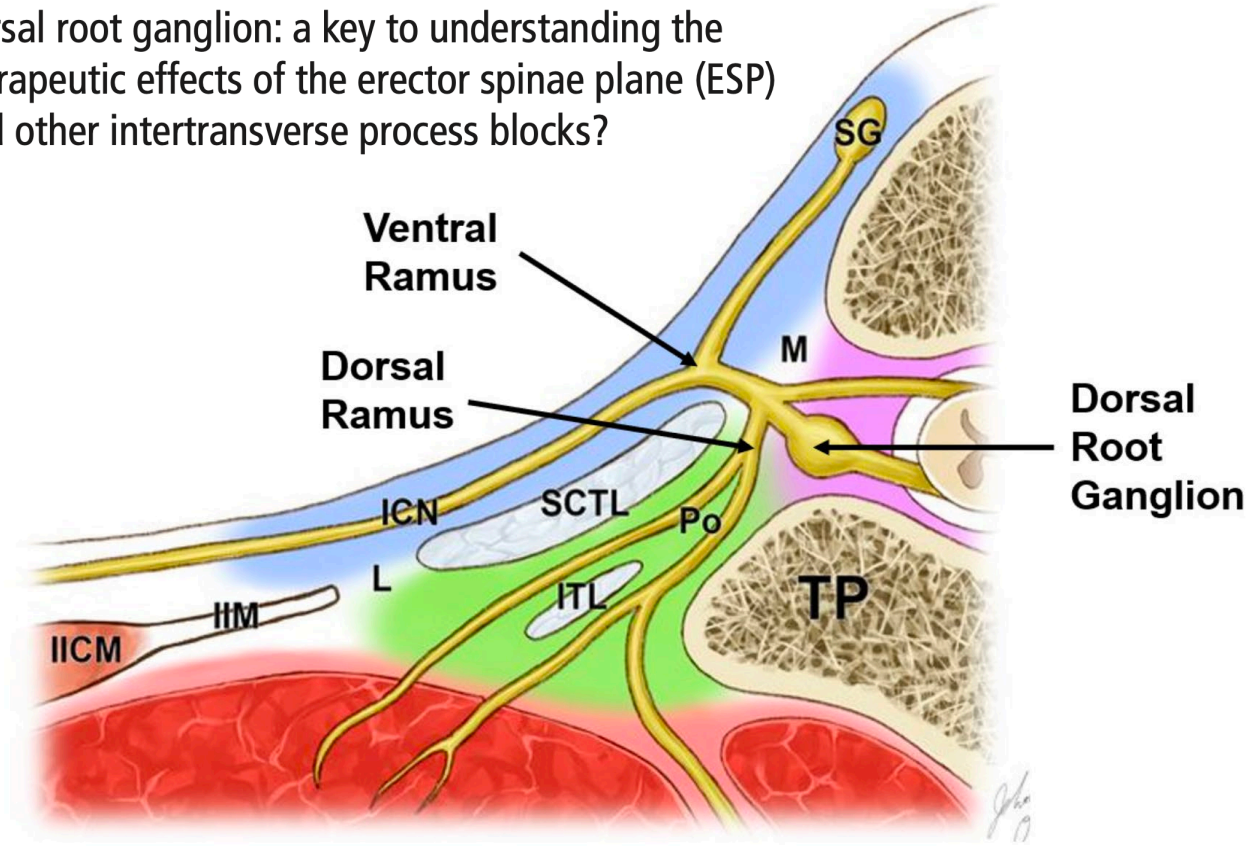
Lateral and medial fenestrations

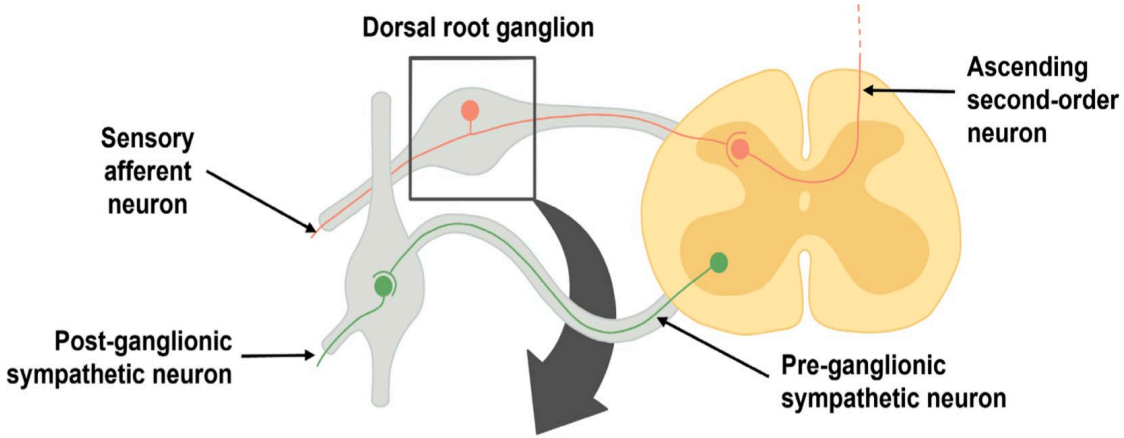


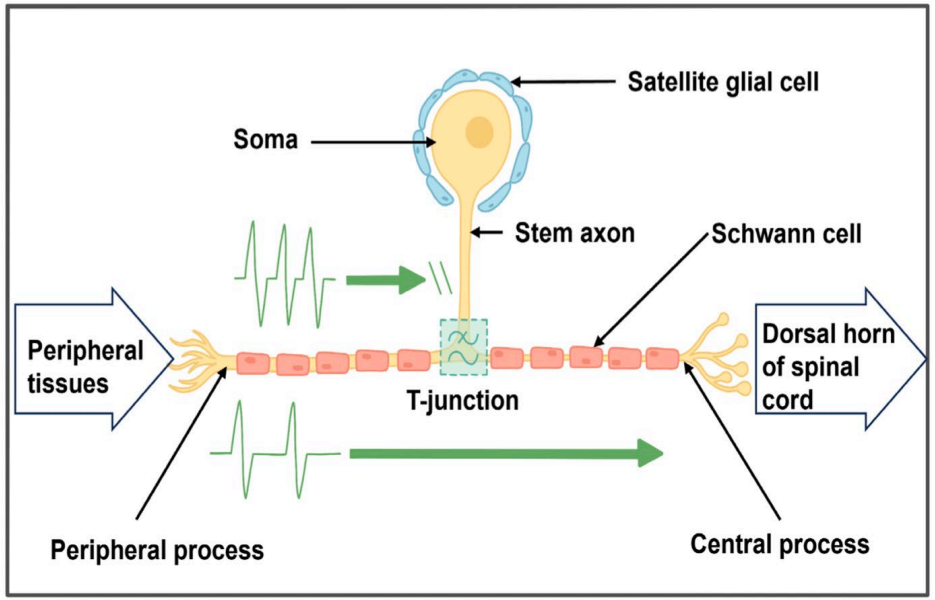
Paravertebral space | Intervertebral space | RetroSCTL space | Erector spinae compartment

Tae-Hyeon Cho et al. Reg Anesth Pain Med. 2021 Aug;46(8):699-703

Dorsal root ganglion: a key to understanding the therapeutic effects of the erector spinae plane (ESP) and other intertransverse process blocks?







The lack of tight junctions in the DRG capsule means that it is more permeable to LA molecules.

The **DRG will be more sensitive to conduction block by an equivalent concentration of LA in the interstitial space, compared with a peripheral nerve**.

This may be another explanation for the clinically apparent analgesia produced by the relatively small mass of LA that reaches the interforaminal region following an ESPB.

Sørenstua M. *et al*. *Reg Anesth Pain Med* 2024;49:223–226

As a control group, no block and sham block were considered identical, although opening of the fascial plane by saline diffusion (sham block) was not the same as without injection (no block).

FPBs involve injecting a local anestetic (LA) mixture into a plane between two fascial layer.

This technique aims to spread the anaesthetic along the plane to block nerves within or crossing through it.

Ease and safety.

Various clinical settings for surgical and nonsurgical indications.

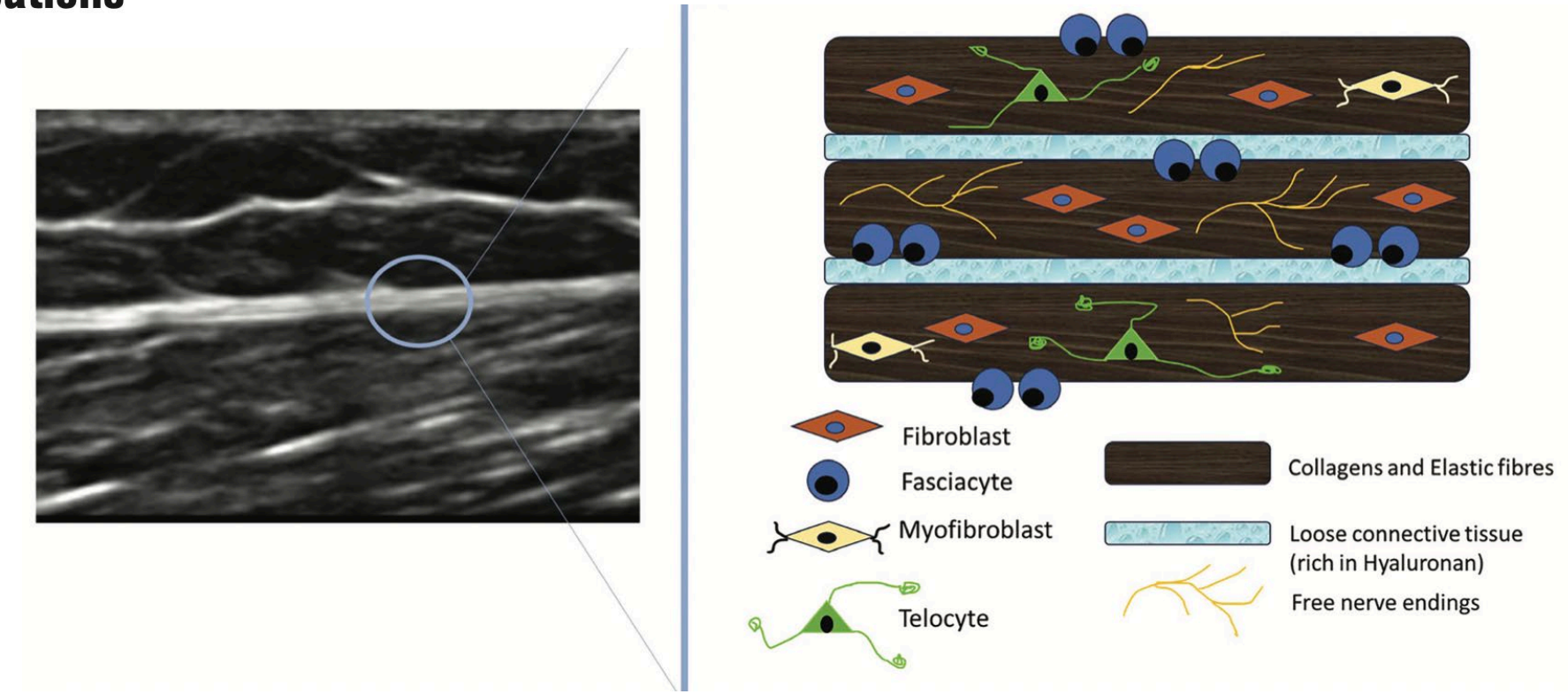
Variability in clinical outcomes.

Variability in anatomical spread.

The sensory blockade's dermatomal distribution often does not align with the expected innervation.

Pirri c. et al. Current Opin Anesthesiology 2024, 37(5): 526-532

Fascial plane blocks: from microanatomy to clinical applications



Fascial plane blocks (FPBS) represent a significant advancement in regional anaesthesia, providing effective analgesia through a novel mechanism that capitalises on fasciae's micro and macro anatomical features.

Understanding the cellular and molecular composition of fascia helps to optimise the clinical application of FPBs, enhancing their efficacy and reliability in pain management.

Pirri c. et al. Current Opin Anesthesiology 2024, 37(5): 526-532

LA injected into a fascial plane can follow three potential pathways

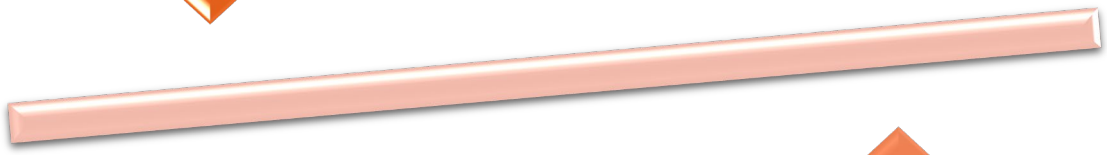
1. firstly, they may spread and remain confined within the space of the fascial plane;
2. secondly, they might disperse into adjacent muscle or tissue compartment through diffusion or bulk flow via larger openings;
3. thirdly, they could diffuse into blood vessels and be transported throughout the vascular system to distant tissue sites

Chin KJ et al. Mechanism of action of fascial plane blocks: a narrative review. Reg Anesth Pain Med 2021; 46:618–628.

When **LAs** are injected into the fascial plane, they **spread** through two primary processes

Bulk flow

Movement of the injected fluid en masse through the fascial plane, driven by the **pressure** of the injection.
Hydro-dissection involves the separation and expansion of the fascial layers.
Factors influencing this include the injected speed, the direction of injection and the inherent elasticity of the fascia.



Diffusion

Movement of anaesthetic molecules from areas of high **concentration** to low concentration
Diffusion is facilitated by the ECM and this is influenced by the local anaesthetic's properties and the features of the fascial plane.

Chin KJ. Et al . Anatomical basis of fascial plane blocks. Reg Anesth Pain Med 2021; 46:581–599

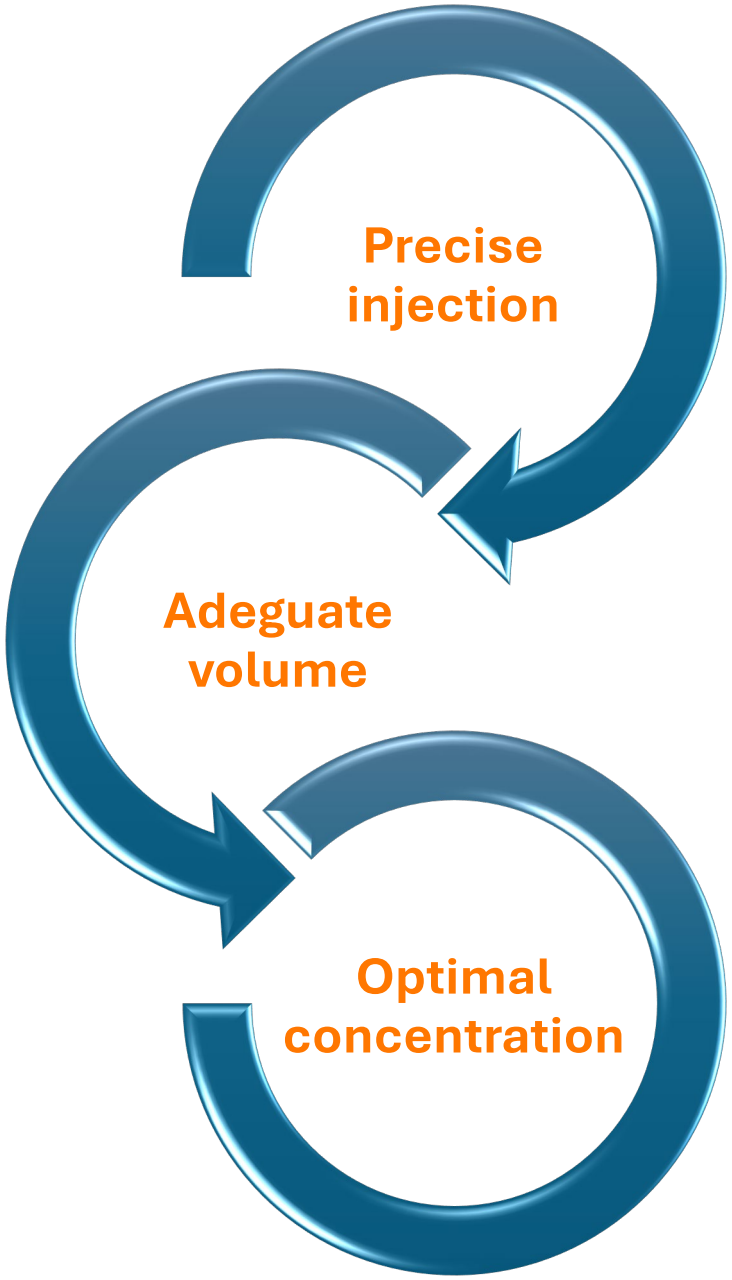
Epimysial

↑ Diffusion
↓ Bulk flow

Aponeurotic

↑ Bulk flow
↓ Diffusion

Black ND. Et al. Fascial Plane Blocks: More Questions Than Answers? Anesthesia & Analgesia 2021, 132(3):899-905



Ensuring the LA is deposited accurately near the target area.

Using sufficient volume to facilitate physical spread by bulk flow.

Adjusting the LA concentration to promote effective diffusion.

Understanding these patient-related variables and employing appropriate strategies are essential for optimal outcomes, with FPBs improving the overall analgesic effect.

Pirri c. et al. Current Opin Anesthesiology 2024, 37(5): 526-532

Take home message

The PACTS and PROSPECT recommendations are the basis for our clinical practice.

FPBs have a clear positive effect.

Their effectivness is not constat due to unavoidable variations in facial anathomy, physiology and operator approach.

It is necessary to performe the FPBs rigorously and precisely.

Let's open ourselves to knowledge.

Ognuno va dove vuole stare e perde

ciò che vuole perdere.

Frida Kahlo