# Differences in Clinical Efficacy of Erector Spinae Plane Block Performed at the Medial and Lateral Transverse Processes: A Randomised Controlled Trial

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## ABSTRACT

**Objective:** To compare the clinical efficacy of erector spinae plane block (ESPB) administered at the medial *versus* lateral aspect of the fifth thoracic transverse process (TP) apex and to investigate the potential influence of the intermuscular partitioning fascia (IMPF) on medicine diffusion.

**Study Design:** Randomised controlled trial.

**Place and Duration of the Study:** Department of Anaesthesiology, Affiliated Cancer Hospital of Xinjiang Medical University, Xinjiang, China, from August 2023 to April 2024.

**Methodology:** Twenty patients undergoing thoracic surgery were randomly allocated to the medial TP apex group (M Group, n = 10) or lateral TP apex group (L Group, n = 10). ESPB was performed at the T5 level, and sensory blockade regions were evaluated 30 minutes post-injection.

**Results:** All patients in the M Group (10/10) exhibited sensory blockade covering the posterior midline to 2 cm laterally (L group: 0/10, p <0.001). The M Group also demonstrated a significantly higher blockade rate at the T11-T12 region (7/10 *vs*. 1/10, p = 0.020). Anatomical analysis indicated that the IMPF at the TP apex segregated medial and lateral medicine diffusion pathways.

**Conclusion:** ESPB administered at the medial TP apex provides a broader blockade range, potentially mediated by the IMPF restricting multidirectional medicine diffusion. This fascial barrier may influence clinical efficacy by directing medicine spread.

**Key Words:** *Erector spinae plane block, Transverse process, Ultrasound-guided, Fascial barrier, Sensory blockade*.

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## INTRODUCTION

Since its initial description by Forero *et al*. in 2016,[1] the erector spinae plane block (ESPB) has rapidly emerged as a pivotal perioperative analgesic technique in thoracic, abdominal, and spinal surgeries due to its technical simplicity and broad analgesic efficacy.[2-6] The fundamental mechanism involves local anaesthetic deposition within the fascial plane between the erector spinae muscle and thoracic transverse process (TP), achieving neural blockade through the medicine diffusion to the dorsal rami of spinal nerves and intercostal nerves.[7-9]

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Despite widespread clinical adoption, substantial variability persists in block efficacy, particularly regarding the undetermined influence of injection site positioning relative to the TP apex (medial *vs*. lateral) on the aesthetic dispersion patterns.[1,10,11]

Multiple clinical and anatomical studies suggest that the TP apex may serve as a critical anatomical nexus for medicine distribution. Forero *et al*. initially reported dye confinement to the lateral TP apex,[1] whereas Harbell *et al*. and Breidenbach *et al*. documented medial medicine diffusion beyond the TP apex.[10,11] This paradoxical evidence implies potential anatomical constraints governing directional medicine spread near the TP apex. Zhang *et al*. further demonstrated that ESPB at T5 vertebral level produced craniocaudal blockade from T3 to T12, yet exhibited marked mediolateral variation (scapular line to posterior midline).[12] However, none of these investigations elucidated the underlying mechanisms for such discrepancies.

An intermuscular partitioning fascia (IMPF) at the TP apex was identified by the authors in a recent animal experiments, with its deep layer attaching to the TP apex and superficial layer

connecting to the thoracolumbar fascia. This structure creates two distinct compartments: A medial located between the spinous process (SP) and TP apex, and a lateral between TP apex and costal angle (CA). In rabbit models, medial TP apex injections demonstrated IMPF-mediated dye confinement to the SP-TP region with enhanced craniocaudal spread, while lateral injections restricted dispersion to the TP-CA interface. These anatomical findings suggest IMPF may physically regulate medicine distribution pathways through compartmentalisation, thereby influencing clinical blockade extent.

Based on this evidence, the authors hypothesised that IMPF in humans may differentially restrict ESPB medicine diffusion depending on the injection site (medial *vs*. lateral to TP apex), accounting for observed variations in clinical efficacy. To test this hypothesis, a randomised controlled trial was conducted comparing clinical outcomes and anatomical correlates of medial *versus* lateral TP apex ESPB at the T5 level, aiming to establish an anatomical basis for the precision application of ESPB techniques.

## METHODOLOGY

This study was a single-centre, prospective, randomised, single-blind, controlled clinical trial conducted in strict accordance with the CONSORT (Consolidated Standards of Reporting Trials) guidelines. The study protocol was approved by the Ethics Committee of the Affiliated Cancer Hospital of Xinjiang Medical University, Xinjiang, China (Approval No. K-2023032) and retrospectively registered with the Chinese Clinical Trial Registry (Registration No. CHiCTR2400081715). All participating patients provided written informed consent, which explicitly stated that they would be randomly assigned to receive one of two different ESPB techniques, with specific procedural details withheld to maintain blinding. The study adhered to the principles of the Declaration of Helsinki throughout.

Inclusion criteria comprised patients aged 18-75 years, classified as American Society of Anesthesiologists (ASA) physical status I-II, scheduled for unilateral thoracic surgery, conscious, and without a history of local anaesthetic allergy or contraindications. Exclusion criteria included infection at the puncture site, coagulopathy (INR >1.5 or platelet count <80×10^9/L), pre-existing spinal deformity or cutaneous sensory abnormalities, and inability to cooperate with assessments or refusal to participate.

Patients were randomly allocated in a 1:1 ratio to either the medial TP apex group (M Group) or the lateral TP apex group (L Group) using an online randomisation tool (https://www. randomizer.org). The allocation was concealed from patients and assessors but disclosed to the operator. A single-blind design was employed: patients were not informed of the specific injection site (medial or lateral), and sterile drapes were used to cover puncture marks to prevent visual identification of group allocation. The assessor (XY-J), blinded to group assignment, independently recorded sensory blockade areas using electrical stimulation. The operator (YH-R) performed the puncture according to group allocation but did not participate in data recording or analysis.

Under ultrasound guidance, the operator used a low-frequency convex probe frequency 2-5 MHz to locate the T5 TP apex, positioning the probe perpendicular to the spinal longitudinal axis to clearly visualise the TP apex and the deep fascial interface of the erector spinae muscle. An in-plane needle insertion technique was employed, using a 21G needle inserted 1 cm lateral to the probe edge. The needle tip was advanced to within 0.5 cm of the medial (M Group) or lateral (L Group) aspect of the TP apex. After confirming negative aspiration for blood or cerebrospinal fluid, 0.5% ropivacaine was injected at a dose of 0.3 ml/kg at a rate ≤5 ml/min. Patients were monitored for 30 minutes post-injection to exclude local anaesthetic systemic toxicity.

The primary outcome was the coverage rate of the sensory blockade area. The mediolateral extent was divided into eight regions (A0-A1 to A7-A8) between the posterior midline (A0 line) and the posterior axillary line (A8 line). The craniocaudal extent was divided into 11 regions (T1-T2 to T11-T12) based on the SP levels of T1-T12. The assessor used an electrical stimulator (50 Hz, 0.5 mA) to symmetrically test the blocked and non-blocked sides, with reduced or absent pain sensation defined as a positive response. Blockade boundaries were mapped onto a standardised back model, and the coverage rates of the above regions were recorded. The highest (cephalad) and lowest (caudad) vertebral levels corresponding to the intersection points of the sensory blockade area with the A0-A8 lines were also recorded for each patient. Within each group, the average highest and lowest intersection points of the A0-A8 lines with the blockade area were calculated, and the corresponding points were marked on the standardised back model. These points were connected to generate average distribution maps of the blockade areas for both groups (Figure 1).

Secondary outcomes included procedural time (from skin disinfection to completion of injection), number of puncture attempts (defined as needle adjustments ≥2 times), and complications (e.g., haematoma, pneumothorax, local anaesthetic systemic toxicity). Procedural time was recorded by an independent timer, and the number of puncture attempts was reported in real-time by the operator.

Based on preliminary results (20% A0-A1 blockade rate in the lateral TP apex group *vs*. 90% in the medial group), sample size estimation was performed using PASS 2021 software ($\alpha = 0.05$, power = 0.90, dropout rate = 10%), yielding 10 patients per group (total n = 20).

Statistical analysis was performed using SPSS version 26.0. Baseline data: Continuous variables (e.g., age, weight, and BMI) were expressed as mean ± standard deviation and compared using independent t-tests. Categorical variables (e.g., gender, ASA classification) were described as frequencies (percentages), with between-group differences analysed using Fisher's exact test. Primary outcome: Categorical variables (A0-A1, T11-T12 blockade rates) were compared between groups using Fisher's exact test, with a two-tailed significance threshold of $p < 0.05$.

**Table I: Patient characteristics between the M and L groups.**

| Variables | M Group (n = 10) | L Group (n = 10) | p-value |
|---|---|---|---|
| Age, years | 47.7 ± 8.7 | 46.1 ± 9.2 | 0.695[a] |
| Height, cm | 167.0 ± 6.2 | 166.8 ± 6.3 | 0.944[a] |
| Weight, kg | 65.5 ± 7.0 | 63.1 ± 4.0 | 0.360[a] |
| BMI, kg/m$^2$ | 23.5 ± 2.5 | 22.7 ± 1.7 | 0.427[a] |
| ASA class, n (%) | | | >0.990[b] |
| Class I | 7 (70) | 6 (60) | |
| Class II | 3 (30) | 4 (40) | |
| Gender, n (%) | | | >0.990[b] |
| Male | 6 (60) | 5 (50) | |
| Female | 4 (40) | 5 (50) | |

*BMI, Body mass index; ASA, American Society of Anesthesiologists. Values are presented as mean ± SD or n (%). [a]p-value of two independent samples t-test. [b]p-value of Fisher's exact test.*

**Table II: Difference of blockade region between M and L groups.**

| Variables | M Group (n = 10) | L Group (n = 10) | p-value[a] |
|---|---|---|---|
| Lateral blockade region, n (%) | | | |
| A0-A1 | 10 (100) | 0 (0) | <0.001 |
| A1-A2 | 10 (100) | 10 (100) | >0.990 |
| A2-A3 | 10 (100) | 10 (100) | >0.990 |
| A3-A4 | 10 (100) | 10 (100) | >0.990 |
| A4-A5 | 10 (100) | 10 (100) | >0.990 |
| A5-A6 | 10 (100) | 10 (100) | >0.990 |
| A6-A7 | 10 (100) | 10 (100) | >0.990 |
| A7-A8 | 8 (80) | 9 (90) | >0.990 |
| Cephalocaudal blockade region, n (%) | | | |
| t1-t2 | 1 (10) | 0 (0) | >0.990 |
| t2-t3 | 3 (30) | 2 (20) | >0.990 |
| t3-t4 | 5 (50) | 2 (20) | 0.350 |
| t4-t5 | 6 (60) | 2 (20) | 0.170 |
| t5-t6 | 10 (100) | 7 (70) | 0.211 |
| t6-t7 | 9 (90) | 10 (100) | >0.990 |
| t7-t8 | 9 (90) | 9 (90) | >0.990 |
| t8-t9 | 9 (90) | 9 (90) | >0.990 |
| t9-t10 | 8 (80) | 9 (90) | >0.990 |
| t10-t11 | 7 (70) | 6 (60) | >0.990 |
| t11-t12 | 7 (70) | 1 (10) | 0.020 |

*Values are presented as n (%). [a]p-value of Fisher's exact test. A0-A1 represents the region between the A0 and A1 lines; t0-t1 represents the region between the t0 and t1 lines. The same applies to the rest.*

## RESULTS

Out of the 21 subjects, 11 were allocated to the M Group and 10 to the L Group. Baseline characteristics, including age, gender, BMI, and other parameters, showed no significant differences between the two groups (p >0.05), as detailed in Table I.

As depicted in Figure 1, the medial-lateral coverage in the M Group extended to the A0-A8 lines, with craniocaudal spread reaching the T5-T11 segments. In contrast, the sensory blockade area in the L Group was concentrated between the A1-A8 lines mediolaterally and spanned the T5-T10 segments craniocaudally. Intergroup comparisons revealed that the blockade rate in the A0-A1 region (posterior midline to 2cm lateral) was 100% (10/10) in the M Group, significantly higher than 0% (0/10) in the L Group (p <0.001). No statistically significant differences were observed in other mediolateral regions (A1-A8) between the two groups (p >0.990). Craniocaudal analysis demonstrated that the blockade rate in the T11-T12 segments was 70% (7/10) in the M Group, significantly higher than 10% (1/10) in the L Group (p = 0.020). However, no significant differences were found in other craniocaudal regions (T1-T11) between the groups (p >0.05, Table II).

Secondary outcomes indicated no significant differences in procedural time (5.2 ± 1.1 minutes in the L Group *vs*. 5.5 ± 1.3 minutes in the M Group, p = 0.561) or the number of puncture attempts (all ≤2 attempts). No complications, such as haematoma, pneumothorax, or local anaesthetic systemic toxicity, were observed. Combined with the previously identified IMPF mechanism in animal experiments, the extensive blockade in the M Group may be attributed to the IMPF restricting lateral medicine diffusion. Anatomical analysis revealed that the IMPF separates the medial TP apex region (between the SP and TP) from the lateral TP apex region (between the TP and CA). Medial injections allowed simultaneous blockade of both medial and lateral branches of the dorsal rami of spinal nerves, whereas lateral injections were confined by the physical barrier of the IMPF, blocking only the lateral branches of the dorsal rami, resulting in incomplete coverage of the A0-A1 region.

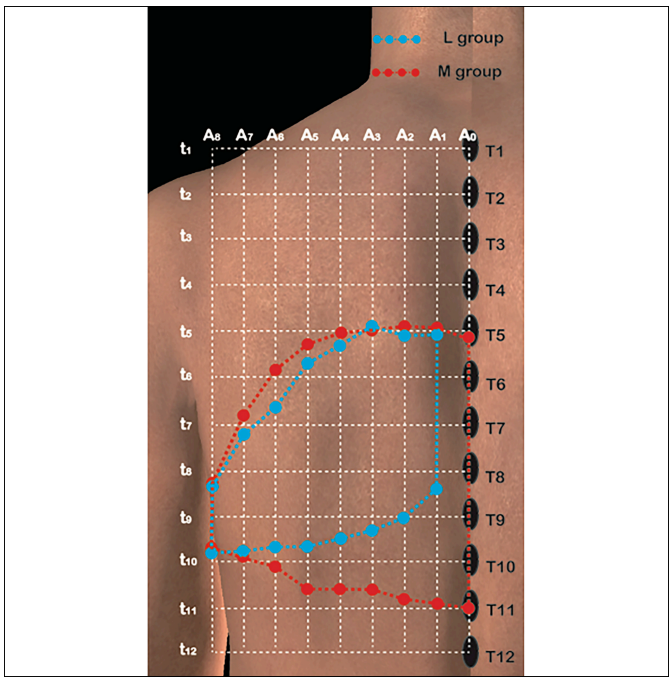


**Figure 1: Diagram of the average distribution of sensory blockade regions and landmark lines in the M and L groups.**

## DISCUSSION

This randomised controlled trial demonstrates that performing ESPB medial to the T5 TP apex significantly expands the sensory blockade coverage, particularly in the posterior midline region (A0-A1 zone) and lower thoracic segments (T11-T12 levels). These findings align closely with the IMPF mechanism identified in prior animal experiments, providing critical anatomical insights for optimising the ESPB technique.

The study revealed a 100% blockade rate in the A0-A1 region for the M Group, whereas the L Group exhibited no coverage in this area ($p < 0.001$), indicating superior blockade efficacy of medial injections on the medial branches of spinal nerve dorsal rami. This observation corroborates clinical reports by Zhang *et al*., who described midline sensory blockade following ESPB without specifying injection sites relative to the TP.[12] This study's findings further establish that medial TP apex positioning is pivotal for midline coverage. Additionally, the M Group demonstrated significantly higher blockade rates at T11-T12 segments (70% *vs*. 10%, $p = 0.020$), likely attributable to enhanced caudal medicine diffusion through IMPF-restricted medial fascial compartments. In contrast, lateral injections permitted medicine dispersion towards the CA, reducing craniocaudal spread.

Previous animal experiments confirmed that the IMPF, anchored at the TP apex, partitions the deep part of the erector spinae muscle into two discrete compartments: Medial (between SP and TP) and lateral (between TP and CA). Combined with clinical data, the authors postulate that the IMPF similarly regulates medicine dispersion in humans through physical compartmentalisation. Medial injections likely breach the IMPF, enabling simultaneous blockade of both medial and lateral branches of the dorsal rami, whereas lateral injections remain confined by the IMPF to the lateral compartment, selectively affecting lateral branches. This mechanism partially aligns with human anatomical studies by Ivanusic *et al*., who identified fascial dependencies in ESPB medicine spread but did not characterise the IMPF's role.[13]

While Forero *et al*.'s seminal work advocated lateral TP apex injections as standard practice,[1] the present findings demonstrate superior blockade extension with medial placement, highlighting limitations of conventional approaches. This conclusion is supported by Adhikary *et al*.'s MRI evidence of enhanced midline medicine spread following medial TP apex injections.[14] However, conflicting reports of bidirectional diffusion by Harbell *et al*. may reflect anatomical variations in IMPF integrity or injection site discrepancies.[10] This study attempts to directly correlate the IMPF mechanism with the clinical effects. To some extent, it fills the gap of lack of anatomical explanations for differences in injection sites and is expected to provide theoretical support for the precise practice of ESPB.

Considering the IMPF's compartmentalising effects, medial TP apex ESPB is recommended for procedures requiring midline coverage (e.g., spinal fusion,[15,16] laminectomy),[17] while lateral injections suffice for intercostal nerve-focused interventions (e.g., thoracoscopy,[18] and rib fixation).[19,20] Individualised site selection balances efficacy and safety: Medial injections warrant vigilance for unintended paravertebral space diffusion, whereas lateral injections minimise non-target blockade. Notably, comparable, procedural duration and incidence of complications between the two groups L suggest that medial placement does not increase technical demands or procedural risks.

This study has the following limitations. A single-blinded design was adopted in this study. Although blinding of patients and assessors reduced subjective bias, operator awareness of group allocation may have affected the standardisation of procedures (such as injection speed and needle tip adjustment). The existence of IMPF was not directly verified by imaging or human anatomy, and the interpretation of the mechanism relied on extrapolation from animal experiments. The relatively small sample size may affect statistical power. There may be differences between the dye distribution and the actual diffusion of local anaesthetics. Future research should combine enhanced MRI or cadaveric dissection to clarify the anatomical characteristics of IMPF and verify the optimal injection strategies for different types of surgeries through multi-centre, large-sample trials.

## CONCLUSION

Compared with performing ESPB on the lateral aspect of the TP apex, conducting ESPB on the medial aspect of the TP apex can significantly expand the scope of sensory block, especially for surgeries that require coverage of the area around the spinal midline. Moreover, the IMPF may be a key anatomical barrier restricting the diffusion of medicines, providing a mechanistic basis for explaining the differences in injection sites.

**ETHICAL APPROVAL:**
The study was conducted after approval from the Ethics Committee of the Affiliated Cancer Hospital of Xinjiang Medical University, Xinjiang, China (Approval No: K-2023032).

**PATIENTS' CONSENT:**
Informed consent was taken from all participants after explaining the study protocol and addressing the queries in detail.

**COMPETING INTEREST:**
The authors declared no conflict of interest.

**AUTHORS' CONTRIBUTION:**
CC: Sample collection, analysis, writing, editing, and statistical analysis.
HD: Supervision, statistical analysis, and corrections.
XJ: Data collection, analysis, and corrections.
MN: Data collection and analysis.
YR: Data analysis and corrections.
TW: Supervision, writing, editing, and corrections.
All authors approved the final version of the manuscript to be published.

## REFERENCES


1. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain. *Reg Anesth Pain Med* 2016; **41(5)**:621-7. doi: 10.1097/AAP.0000000000000451.
2. Nair A, Saxena P, Borkar N, Rangaiah M, Arora N, Mohanty PK. Erector spinae plane block for postoperative analgesia in cardiac surgeries- A systematic review and meta-analysis. *Ann Card Anesth* 2023; **26(3)**:247-59. doi: 10.4103/aca.aca_148_22.
3. Guan HY, Yuan Y, Gao K, Luo HX. Efficacy and safety of erector spinae plane block for postoperative analgesia in breast cancer surgery-A systematic review and meta-analysis. *J Surg Oncol* 2023; **127(6)**:905-20. doi: 10.1002/jso.27221.
4. Muneeb Akhtar SM, Fareed A, Afzal U, Asghar MS, Mumtaz M, Faraz F, *et al*. Effectiveness of erector spinae plane block in reducing opioid consumption after colorectal surgery: A comprehensive meta-analysis. *Am J Surg* 2024; **232**:31-44. doi: 10.1016/j.amjsurg.2024.01.032.
5. Pandey SP, Yadav U, Khan MMA, Singh AK, Verma S, Nigam S. Efficacy of ultrasound-guided erector spinae plane block in percutaneous nephrolithotomy. *Cureus* 2023; **15(6)**: e40186. doi: 10.7759/cureus.40186.
6. Deng K, Huang K, Wu GF. Ultrasound-guided erector spinae plane block in posterior lumbar surgery (review). *Biomed Rep* 2024; **20(6)**:95. doi: 10.3892/br.2024.1783.
7. Marija T, Aleksandar D. Erector spinae plane block in various abdominal surgeries: A case series. *Saudi J Anaesth* 2020; **14(4)**:528-30. doi: 10.4103/sja.SJA_31_20.
8. Diwan S, Shivamallappa S, Timane R, Pai P, Gupta A. Pathways of dye spread after injections in the paraspinal spaces-A cadaveric study. *Saudi J Anaesth* 2024; **18(2)**: 181-6. doi: 10.4103/sja.sja_582_23.
9. Theja RS, Gupta N, Panwar V, Kumar N. Erector spinae plane block for peri-operative analgesia in a patient undergoing surgery for Ewing's sarcoma of the clavicle. *Anaesth Rep* 2023; **11(1)**:e12228. doi: 10.1002/anr3.12228.
10. Harbell MW, Langley NR, Seamans DP, Koyyalamudi V, Kraus MB, Carey FJ, *et al*. Evaluating two approaches to the erector spinae plane block: An anatomical study. *Reg Anesth Pain Med* 2023; **48(10)**:495-500. doi: 10.1136/rapm-2022-104132.
11. Breidenbach KA, Wahezi SE, Kim SY, Koushik SS, Gritsenko K, Shaparin N, *et al*. Contrast spread after erector spinae plane block at the fourth lumbar vertebrae: A cadaveric study. *Pain Ther* 2023; **12(1)**:241-9. doi: 10.1007/s40122-022-00453-2.
12. Zhang J, He Y, Wang S, Chen Z, Zhang Y, Gao Y, *et al*. The erector spinae plane block causes only cutaneous sensory loss on ipsilateral posterior thorax: A prospective observational volunteer study. *BMC Anesthesiol* 2020; **20(1)**:88. doi: 10.1186/s12871-020-01002-0.
13. Ivanusic J, Konishi Y, Barrington MJ. A cadaveric study investigating the mechanism of action of erector spinae blockade. *Reg Anesth Pain Med* 2018; **43(6)**:567-71. doi: 10.1097/AAP.0000000000000789.
14. Adhikary SD, Bernard S, Lopez H, Chin KJ. Erector spinae plane block *Versus* retrolaminar block: A magnetic resonance imaging and anatomical study. *Reg Anesth Pain Med* 2018; **43(7)**:756-62. doi: 10.1097/AAP.0000000000000798.
15. Lin H, Guan J, Luo S, Chen S, Jiang J. Bilateral erector spinae plane block for quality of recovery following posterior lumbar interbody fusion: A randomized controlled trial. *Pain Ther* 2022; **11(3)**:861-71. doi: 10.1007/s40122-022-00395-9.
16. Birnbaums JV, Ozolina A, Solovjovs L, Glazniece-Kagane Z, Nemme J, Logina I. Efficacy of erector spine plane block in two different approaches to lumbar spinal fusion surgery: A retrospective pilot study. *Front Med (Lausanne)* 2024; **11**:1330446. doi: 10.3389/fmed.2024.1330446.
17. Xiao X, Zhu T, Wang L, Zhou H, Zhang Y. Efficacy of postoperative analgesia by erector spinal plane block after lumbar surgery: A systematic review and meta-analysis of randomized controlled trials. *Comput Math Methods Med* 2022; **2022**:3264142. doi: 10.1155/2022/3264142.
18. Sun L, Mu J, Gao B, Pan Y, Yu L, Liu Y, *et al*. Comparison of the efficacy of ultrasound-guided erector spinae plane block

and thoracic paravertebral block combined with intercostal nerve block for pain management in video-assisted thoracoscopic surgery: A prospective, randomized, controlled clinical trial. *BMC Anesthesiol* 2022; **22(1)**:283. doi: 10.1186/s12871-022-01823-1.

19. Ramesh S, Ayyan SM, Rath DP, Sadanandan DM. Efficacy and safety of ultrasound-guided erector spinae plane block compared to sham procedure in adult patients with rib fractures presenting to the emergency department: A randomized controlled trial. *Acad Emerg Med* 2024; **31(4)**:316-25. doi: 10.1111/acem.14820.
20. Liao CA, Chen YJ, Shen SJ, Wang QA, Chen SA, Liao CH, *et al*. Erector spinae plane block (ESPB) enhances hemodynamic stability decreasing analgesic requirements in surgical stabilization of rib fractures (SSRFs). *World J Emerg Surg* 2024; **19(1)**:36. doi: 10.1186/s13017-024-00567-2.