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SYSTEMATIC REVIEW

Comparison of analgesic effects between erector spinae plane block and serratus anterior plane block in breast and thoracic surgery: a systemic review and meta-analysis

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Abstract

Background: Although erector spinae plane block (ESPB) and serratus anterior plane block (SAPB) provide effective analgesia following breast and thoracic surgical procedures, the relative analgesic efficiency of these blocks remains unclear.This meta-analysis aimed to compare the analgesic outcomes of ESPB and SAPB in patients undergone breast and thoracic surgery. **Methods**: Systematic searches were conducted on Embase, Cochrane Library, Web of Science and PubMed from their inception until 31 December 2023, to quantify intraoperative and postoperative opioid consumption with mean differences (MDs) and 95% confidence intervals (CIs) using random-effects models. The degree of certainty for evidence was assessed using the Grade of Recommendations, Assessment, Development and Evaluation (GRADE) framework. **Results**: In total, nine articles were included in the current study. The meta-analysis revealed that ESPB significantly reduced intraoperative opioid use (MD = −2.32 mg, 95% CI (−3.92, −0.73); $p < 0.01$, $I^2 = 65\%$) and postoperative opioid consumption (MD = −4.86 mg, 95% CI (−7.85, −1.88); $p < 0.01$, $I^2 = 95\%$) compared to SAPB. Furthermore, the need for rescue analgesia was lower in the ESPB group, and the differences in the incidence of nausea and vomiting were not significant between the two groups. **Conclusions**: ESPB might offer superior analgesic effects compared to SAPB in patients after thoracic and breast surgery. However, further studies are necessary to confirm this conclusion due to the low quality of evidence. **Registration number**: This meta-analysis has been registered to PROSPERO: CRD42022322760.

Keywords

Serratus anterior plane block; Opioid consumption; Erector spinae plane block; Meta-analysis

1. Introduction

Postoperative pain remains a primary contributor to adverse postoperative experience in patients following breast or thoracic surgeries [1, 2]. Serious postoperative pain is associated with an increased risk of anxiety, hemodynamic instability, and elevated myocardial oxygen demand. Furthermore, inadequate management of acute postoperative pain has been implicated in 20–60% of cases evolving into chronic pain conditions [3, 4]. Traditional approaches to postoperative analgesia include epidural analgesia [5], patient-controlled intravenous analgesia (PICA) devices [6], intercostal nerve blocks [7], paravertebral blocks [8], and infiltration with local anesthetics [9]. Notably, paravertebral and intercostal blocks have been reported to carry an increased risk of pneumothorax [10], PICA is often criticized for its association with excessive opioid administration, and epidural analgesia has been shown to be limited due to risks associated with nerve damage and technical challenges in needle placement.

In 2016, Forero introduced the ultrasound-guided erector spinae plane block (ESPB), an interfascial plane block that has been found to offer wide applicability for pain management across various surgical interventions [11]. As a paraspinal block, ESPB specifically targets the ventral and dorsal rami, effectively alleviating pain across the posterior and anterolateral chest walls [12]. Additionally, ultrasound-guided serratus anterior plane blocking (SAPB) has emerged as another novel interfascial plane block technique for thoracic analgesia [13]. It involves the administration of local anesthetic (LA) between the latissimus dorsi and serratus anterior muscles to provide thoracic analgesia. Presently, numerous studies have validated the efficacy of both ESPB and SAPB in significantly reducing postoperative pain following thoracic or breast surgeries [14–17].

In this study, we conducted a systemic review and meta-analysis to compare the analgesic efficacy of SAPB and ESPB in patients undergoing breast and thoracic surgical procedures.

2. Methods

This systematic review and meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and checklist (**Supplementary Table 1**) and is registered with PROSPERO under the registration number CRD42022322760.

2.1 Systematic literature search

Several web-based databases, including Embase, PubMed, Cochrane Library and Web of Science, were systematically searched for studies conducted from the inception until 31 December 2023, without language restrictions. The search terms included: "erector spinae plane block", "ESP block", "ESPB", "serratus anterior plane block", "SAP block", "SAPB", "thoracic surgery", "thoracoscopic surgery", "thoracotomy", "modified radical mastectomy", "mastectomy" and "breast surgery".

2.2 Criteria for selection and extraction of data

The study eligibility requirements for inclusion were: (1) Participants (P): adult patients receiving thoracic or breast surgery under general anesthesia. (2) Intervention (I): trials reporting ESPB as an analgesic technique. (3) Comparison (C): trials reporting SAPB as a comparative analgesic measure. (4) Outcome (O): trials that reported the effects of these two types of nerve blocks. (5) Study designs (S): randomized controlled trials (RCTs).

Exclusion criteria encompassed non-randomized trials such as case reports, letters to the editor, or review articles, as well as ongoing clinical studies and conference abstracts.

The primary outcome of this study was the consumption of intraoperative and postoperative opioids, with opioid dosages reported in various studies being converted to morphine equivalents for uniformity. Secondary outcomes included the need for rescue analgesia, the incidence of postoperative nausea and vomiting (PONV), and complications related to the nerve blocks. A comprehensive analysis of postoperative pain scores was not conducted due to a lack of sufficient data.

The study selection process involved two authors independently using EndNote to remove duplicates from the initially retrieved studies. Subsequently, they reviewed titles and abstracts to determine study relevance, followed by a detailed examination of the full texts to confirm eligibility based on inclusion criteria. Data extraction was also performed independently by the two authors, collecting information such as the first author's name, type of surgery, sample size, year of publication, techniques used for ESPB and SAPB, general anesthesia methods, amounts of opioids administered intraoperatively and postoperatively, incidences of block-related complications, and PONV.

2.3 Evaluation of the quality and the risk

The Cochrane Review Manager (version 5.3) software (Oracle Corporation, Redwood City, CA, USA) was used to evaluate the potential bias for each study. Two independent authors evaluated each study based on criteria including selective reporting, missing data on outcomes, blinding of outcome evaluators, concealing allocations, generation of random sequences, participants blinding, and other biases. The studies were then categorized based on their risk of bias as low, unclear or high.

To determine the strength of evidence, the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system was applied to categorize the level of evidence into four grades: very low, low, moderate or high.

2.4 Statistical analysis

The meta-analysis was conducted using Review Manager (version 5.3). Pooled risk ratio (RR) with 95% confidence intervals (CIs) were calculated for dichotomous outcomes, while mean differences (MDs) and 95% CIs were computed for continuous data. In cases where continuous data were presented as median (interquartile ranges) or median (min–max), values were transformed to the relevant mean and standard deviation [18]. Statistical significance was determined at a threshold of $p < 0.05$. Assessment of trial heterogeneity was performed using the I^2 statistic, with $I^2 > 50\%$ indicating high heterogeneity. Clinical heterogeneity, primarily stemming from methodological and clinical factors, was identified as a contributing factor to high heterogeneity. Consequently, studies with low I^2 values were also analyzed using a random-effects model.

3. Results

3.1 Search results

A total of 528 studies were initially identified from the databases using the established search strategy. Of these, 98 duplicated were removed. Upon reviewing the titles and abstracts, 418 studies were excluded, leaving 12 studies for in-depth full-text review to assess their eligibility for inclusion. Of these, three studies were excluded for specific reasons: one did not use general anesthesia (n = 1) [19], and two were case reports (n = 2) [20, 21]. Consequently, nine studies that met the inclusion criteria were selected for the meta-analysis [22–30]. The literature screening process is shown in Fig. 1.

3.2 Study characteristics

Nine RCTs involving a total of 555 patients (273 in the ESPB group and 282 in the SAPB group) were analyzed. These studies were published between 2019 and 2022, with sample sizes ranging from 34 to 100 participants. Bupivacaine was the local anesthetic used in five trials [22–24, 26, 29], ropivacaine was used in three trials [27, 28, 30], and levobupivacaine was utilized in one trial [25]. The detailed characteristics of the included RCTs are presented in (Table 1, Ref. [22–30]).

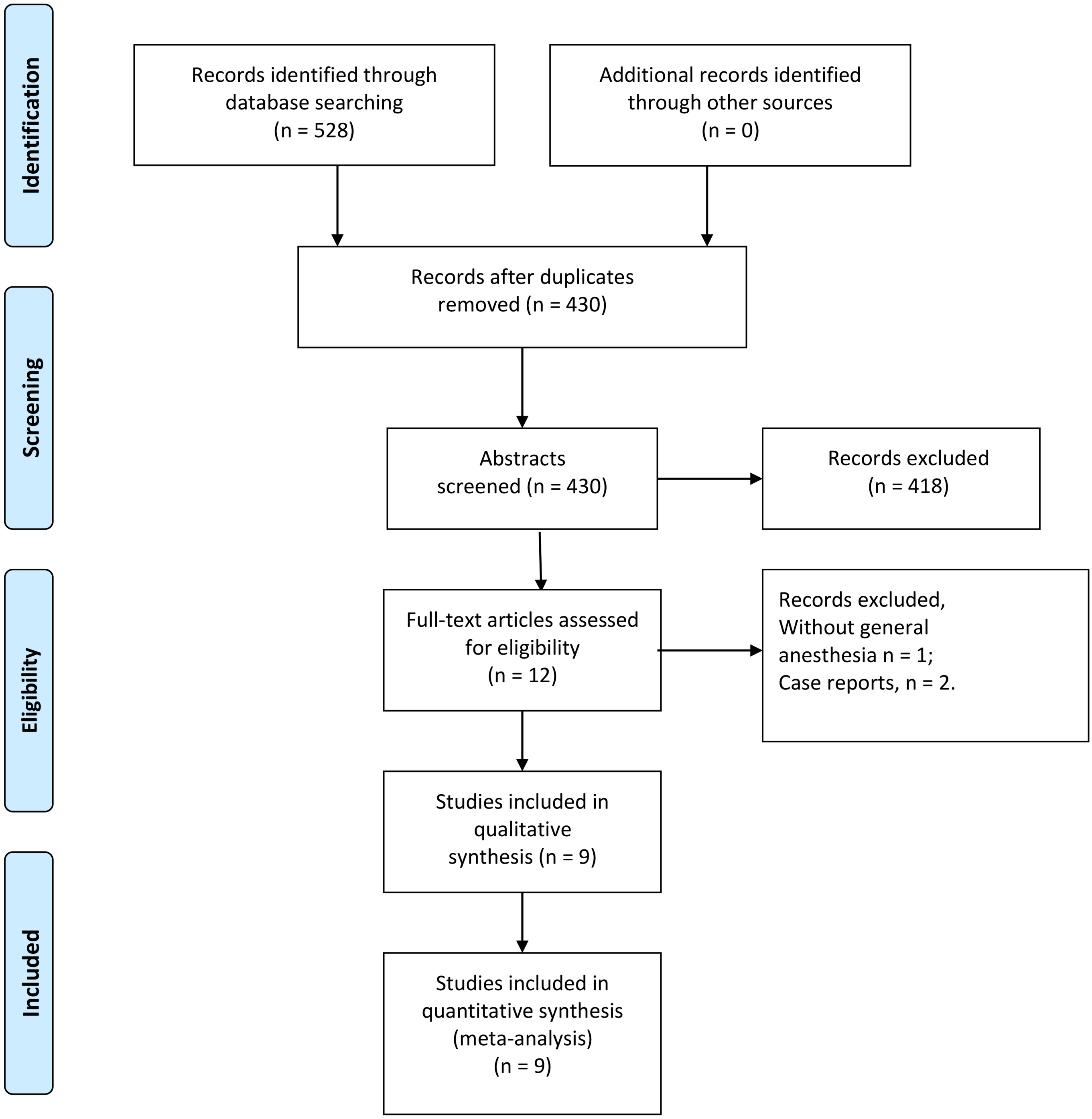

FIGURE 1. Schematic diagram of the retrieval process for studies.

TABLE 1. The details of included studies.

Study	Age (yr)	Sample size	ASA scale	Type of surgery	SAPB group	ESPB group	General anesthesia	PCA
Ekinci 2020 [22]	18–65	SAPB: 30 ESPB: 30	I–II	Video-assisted thoracic surgery	Position: lateral Local anesthetics: 0.25% bupivacaine 20 mL.	Position: sitting Local anesthetics: 0.25% bupivacaine 20 mL below ESM.	Induction: 2–2.5 mg/kg propofol, 1–1.5 µg/kg fentanyl, 0.6 mg/kg rocuronium bromide; Maintenance: sevoflurane, remifentanil.	10-mg/mL dose of fentanyl and the following settings: a 2-mL dose of bolus without an infusion dose, a lockout time of 20 minutes, and a four-hour time limit.
Elsabeeny 2021 [23]	18–65	SAPB: 17 ESPB: 17	I–II	Thoracotomy	Position: lateral Local anesthetics: 0.25% bupivacaine 30 mL.	Position: sitting Local anesthetics: 0.25% bupivacaine 30 mL below ESM.	Induction: 2 mg/kg propofol, 2 mg/kg fentanyl, 0.6 mg/kg of rocuronium; Maintenance: sevoflurane, 0.15 mg/kg rocuronium.	None.
Elsabeeny 2020 [24]	18–65	SAPB: 25 ESPB: 25	I–II	Breast cancer surgeries	Position: lateral Local anesthetics: 0.25% bupivacaine 25 mL.	Position: lateral Local anesthetics: 0.25% bupivacaine 25 mL below ESM.	Induction: 2 mg/kg propofol, 2 µg/kg fentanyl, rocuronium 0.6 mg/kg; Maintenance: sevoflurane and rocuronium.	None.
Finnerty 2020 [25]	18–80	SAPB: 30 ESPB: 30	I–III	Minimally invasive thoracic surgery	Position: lateral Local anesthetics: 0.25% levobupivacaine 30 mL.	Position: lateral Local anesthetics: 0.25% levobupivacaine 30 mL below ESM.	Induction: propofol, 1–2 µg/kg fentanyl, neuromuscular antagonist; Maintenance: sevoflurane.	None.
Hassan 2022 [26]	18–70	SAPB: 28 ESPB: 27	II	Thoracotomy	Position: lateral Local anesthetics: 0.5% bupivacaine 20 mL.	Position: sitting Local anesthetics: 0.5% bupivacaine 20 mL below ESM.	Induction: 2 mg/kg propofol, 2 µg/kg fentanyl, 0.6 mg/kg rocuronium; Maintenance: 2–2.5% sevoflurane, 0.1 mg/kg rocuronium.	Morphine solution (1 mg/mL) set to deliver a demand dose of 1 mg morphine, with a lockout interval of 10 minutes without a continuous background infusion.
Toscano 2022 [27]	≥18	SAPB: 43 ESPB: 36	NR	Mini-Thoracotomy	Position: lateral Local anesthetics: 0.375% ropivacaine 150 mg.	Position: lateral Local anesthetics: 0.375% ropivacaine 150 mg below ESM.	Induction: midazolam, propofol or etomidate, fentanyl or sufentanil, cisatracurium; Maintenance: propofol, sufentanil.	None.

TABLE 1. Continued.

Study		Age (yr)	Sample size	ASA scale	Type of surgery	SAPB group	ESPB group	General anesthesia	PCA
Wang [28]	2019	NR	SAPB: 50 ESPB: 50	I–II	Breast cancer surgeries	Position: lateral Local anesthetics: 0.375% ropivacaine 20 mL.	Position: lateral Local anesthetics: 0.375% ropivacaine 20 mL below ESM.	Induction: 2 mg/kg propofol 0.02 mg/kg midazolam, 0.4 μg/kg sufentanil, 0.2 mg/kg cisatracurium; Maintenance: 3∼4 μg/mL propofol, 3.5∼4.5 ng/mL remifentanil.	1 μg/mL dose of sufentanil and the following settings: a 2 mL dose of bolus with an infusion dose 1 mL/h, a lockout time of 10 minutes.
Zengin [29]	2022	18–65	SAPB: 30 ESPB: 30	I–III	Video-assisted thoracoscopic surgery	Position: lateral Local anesthetics: 0.25% bupivacaine 20 mL.	Position: lateral Local anesthetics: 0.25% bupivacaine 20 mL below ESM.	Induction: 2 mg/kg propofol, 1.5 mg/kg of fentanyl, 0.1 mg/kg of vecuronium. Maintenance: sevoflurane, remifentanil.	Administering a bolus dose of 1 mg of morphine and delivering a maximum dose of 12 mg of morphine in total within 4 hours, with lockout intervals of 15 minutes.
Zhang [30]	2022	18–80	SAPB: 29 ESPB: 28	I–III	Video-assisted thoracoscopic surgery	Position: lateral Local anesthetics: 0.4% ropivacaine 20 mL.	Position: lateral Local anesthetics: 0.4% ropivacaine 20 mL above ESM.	Induction: 2 mg/kg propofol, 0.05 mg/kg midazolam, 0.5 μg/kg sufentanil, 0.6 mg/kg rocuronium bromide. Maintenance: 2% sevoflurane, remifentanil, propofol.	1 μg/mL dose of sufentanil and the following settings: loading dose of 2 mL, background dose of 2 mL, and locking duration of 15 minutes.

Abbreviations: ASA, American Society of Anesthesiologists; SAPB, serratus anterior plane block; ESPB, erector spinae plane block; PCA, patient-controlled analgesia; NR, not report; ESM, erector spinae muscle.

3.3 Assessment of bias

Eight studies clearly provided detailed descriptions of their random sequences methods [22–26, 28–30], and seven trials reported allocation concealment procedures [22–26, 29, 30]. Double-blinding was described in 3 trials [25, 26, 30], while blinding of outcome assessors was reported in 6 studies [22, 23, 25, 26, 29, 30]. There were no instances of selective reporting across the trials. However, one study did not perform sample size calculation, which might lead to other biases [28]. An overview of the risk of bias assessment is illustrated in Fig. 2.

3.4 Meta-analysis

3.4.1 Intraoperative opioids consumption

A total of 6 trials reported intraoperative opioid consumption. The result showed that the ESPB group experienced a significant reduction in opioid use during surgery compared to the SAPB group (MD = −2.32 mg, 95% CI (−3.92, −0.73); $p < 0.01$, $I^2 = 65\%$, Fig. 3).

3.4.2 Postoperative opioids consumption

Data from nine trials were analyzed to assess postoperative opioid consumption within the first 24 hours after surgery. The findings showed that ESPB was associated with a significant decrease in opioid consumption compared to SAPB within the first 24 hours following surgery, as shown by the forest plot (MD = −4.86 mg, 95% CI (−7.85, −1.88); $p < 0.01$, $I^2 = 95\%$, Fig. 4).

3.4.3 Rescue analgesia

The requirement for rescue analgesia was reported in four trials. The results showed that patients in the ESPB group were less likely to require rescue analgesia compared to those in the SAPB group (RR = 0.62, 95% CI (0.45–0.85); $p < 0.01$, $I^2 = 0\%$, Fig. 5).

3.4.4 Complication

The incidence of PONV was assessed in six trials, and the results revealed no significant difference between the ESPB and SAPB groups (RR = 0.80, 95% CI (0.47–1.38); $p = 0.43$, $I^2 = 26\%$, Fig. 6).

In addition, no complications related to the blocks were reported in the reviewed trials.

3.5 Publication bias

The analysis of funnel plots for postoperative opioid consumption demonstrated a symmetrical distribution, suggesting an absence of significant publication bias (Fig. 7).

3.6 Grade evaluation

Every study incorporated into this systematic review and meta-analysis employed a randomized trial design. High I^2 values were observed in the assessment of postoperative opioid consumption, indicating significant inconsistency. In several studies, opioid consumption data were presented as median (interquartile range), leading to a categorization of "serious" for indirectness. The GRADE levels for the outcomes ranged from low to high. An overview of the GRADE outcomes is presented in Table 2.

4. Discussion

This systematic review and meta-analysis suggest that compared to SAPB, ESPB may significantly reduce opioid consumption and the incidence of rescue analgesia in patients undergoing breast and thoracic surgeries.

Inadequate pain control post-surgery is a notable risk factor for readmission [31]. Opioids have conventionally been utilized to manage acute postsurgical pain following thoracic and breast surgeries. However, recent evidence from a large-scale clinical retrospective study indicates that opioid-related adverse events occur in approximately 10% of adult patients receiving opioids post-surgery or endoscopic procedures, correlating with increased mortality rates and prolonged hospital stays [32]. Consequently, while effectively addressing postoperative pain, minimizing opioid usage is crucial. Presently, multi-modal analgesia has emerged as a viable approach to postoperative pain management, associated with a reduced incidence of opioid-related adverse effects [33–35].

Our meta-analysis revealed that the ESPB group patients experienced significantly reduced intraoperative and postoperative opioid consumption, suggesting that ESPB offers superior analgesia compared to SAPB for individuals undergone breast and thoracic surgeries. This observation is further supported by a decreased need for rescue analgesia among patients treated with ESPB, aligning with findings from previous research [22, 23]. The anatomical basis for this difference lies in the broader nerve blockade achieved by ESPB, which targets both dorsal and ventral rami as well as the rami supplying the sympathetic chain. In contrast, SAPB primarily blocks only the lateral branches of the intercostal nerves, which are part of the ventral rami [36]. Since the pain associated with thoracic and breast surgeries predominantly arises from damage to the intercostal nerves and muscles [1, 37], the extensive coverage of the erector spinae fascia from the cervical region to the sacrum allows ESPB to provide a multi-level dermatomal block. This block effectively manages pain across the anterior, lateral, and posterior aspects of the chest wall [38].

The levels of certainty for evidence in our meta-analysis ranged from low to high, attributed to several factors. Primarily, the use of continuous data for most outcomes introduced significant heterogeneity across trials. Additionally, the consumption of opioids, which did not adhere to normal distributions, required conversion to mean and standard deviation values, rendering the evidence indirect. Consequently, these issues necessitated a reduction in the certainty levels according to the GRADE scale. Within the studies analyzed, eight trials documented the administration of local anesthetic beneath the erector spinae muscle, while one trial [30] indicated injection above this muscle. Furthermore, only four trials [22, 23, 26, 30] explicitly stated that a single anesthesiologist performed all block procedures. However, due to a lack of data, we were limited in conducting further subgroup analysis. Variability in drug selection, anesthesia techniques, and surgical practices contributed to clinical heterogeneity, justifying the adoption of a random-effects model for our analysis.

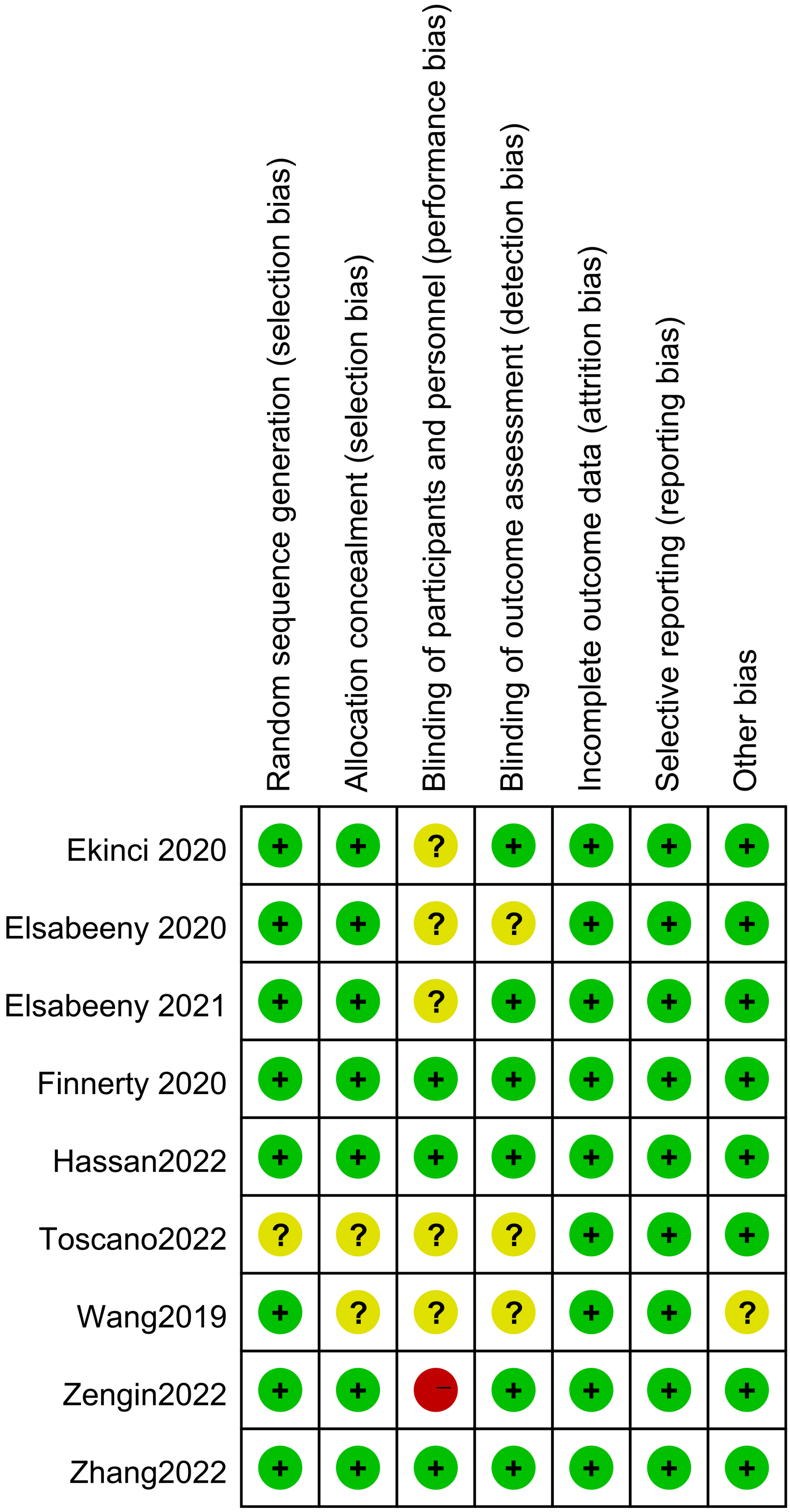

FIGURE 2. Risk bias of included RCTs. +, high risk; −, low risk; ?, uncertain.

Study or Subgroup	ESPB Mean	ESPB SD	ESPB Total	SAPB Mean	SAPB SD	SAPB Total	Weight	Mean Difference IV, Random, 95% CI
Ekinci 2020	23.9	5.46	30	27.5	3.92	30	17.0%	-3.60 [-6.01, -1.19]
Elsabeeny 2020	0.96	2.2	25	1.34	2.21	25	23.8%	-0.38 [-1.60, 0.84]
Hassan2022	22.6	5.9	27	29	7.28	28	11.9%	-6.40 [-9.90, -2.90]
Toscano2022	17.5	3.95	36	18.6	6.87	43	16.9%	-1.10 [-3.53, 1.33]
Wang2019	27	5	50	28.8	4.7	50	19.9%	-1.80 [-3.70, 0.10]
Zhang2022	36	8.04	28	39	6.9	29	10.5%	-3.00 [-6.90, 0.90]
Total (95% CI)			**196**			**205**	**100.0%**	**-2.32 [-3.92, -0.73]**

Heterogeneity: Tau² = 2.40; Chi² = 14.42, df = 5 (P = 0.01); I² = 65%
Test for overall effect: Z = 2.85 (P = 0.004)

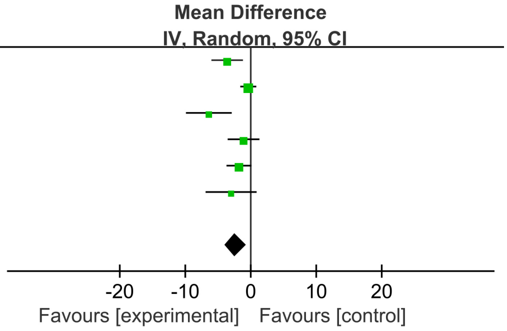

FIGURE 3. An intraoperative opioid consumption forest plot based on a pooled analysis. SAPB, serratus anterior plane block; ESPB, erector spinae plane block; CI, confidence intervals; SD, standard deviation; IV, inverse variance.

Study or Subgroup	ESPB Mean	ESPB SD	ESPB Total	SAPB Mean	SAPB SD	SAPB Total	Weight	Mean Difference IV, Random, 95% CI
Ekinci 2020	3.6	2.69	30	9.5	4.77	30	12.3%	-5.90 [-7.86, -3.94]
Elsabeeny 2020	4.2	1.64	25	4	1.55	25	12.9%	0.20 [-0.68, 1.08]
Elsabeeny 2021	1.8	4	17	10	0.1	17	12.4%	-8.20 [-10.10, -6.30]
Finnerty 2020	14.5	15.5	30	20	17	30	6.5%	-5.50 [-13.73, 2.73]
Hassan2022	8.52	4.29	27	19.57	7.63	28	11.3%	-11.05 [-14.31, -7.79]
Toscano2022	1.06	2.32	36	1.42	3.07	43	12.8%	-0.36 [-1.55, 0.83]
Wang2019	39	8	50	42	10	50	11.0%	-3.00 [-6.55, 0.55]
Zengin2022	18.07	12.32	30	20.1	12.64	30	8.2%	-2.03 [-8.35, 4.29]
Zhang2022	35.4	2.8	28	43.3	2.7	29	12.6%	-7.90 [-9.33, -6.47]
Total (95% CI)			**273**			**282**	**100.0%**	**-4.86 [-7.85, -1.88]**

Heterogeneity: Tau² = 17.82; Chi² = 174.99, df = 8 (P < 0.00001); I² = 95%
Test for overall effect: Z = 3.19 (P = 0.001)

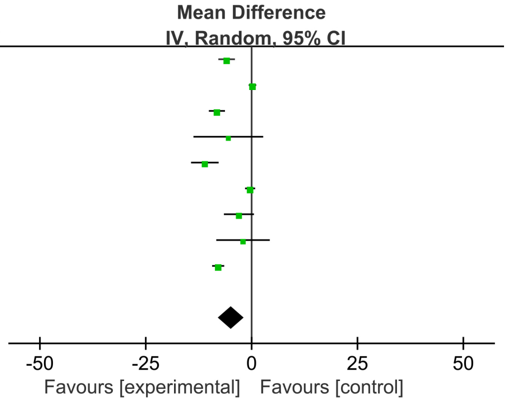

FIGURE 4. A postoperative opioid consumption forest plot based on a pooled analysis. SAPB, serratus anterior plane block; ESPB, erector spinae plane block; CI, confidence intervals; SD, standard deviation; IV, inverse variance.

Study or Subgroup	ESPB Events	ESPB Total	SAPB Events	SAPB Total	Weight	Risk Ratio M-H, Random, 95% CI
Ekinci 2020	16	60	9	30	21.7%	0.89 [0.45, 1.77]
Elsabeeny 2020	7	25	8	25	14.3%	0.88 [0.37, 2.05]
Elsabeeny 2021	8	17	15	17	36.3%	0.53 [0.31, 0.91]
Zengin2022	9	30	19	30	27.7%	0.47 [0.26, 0.87]
Total (95% CI)		**132**		**102**	**100.0%**	**0.62 [0.45, 0.85]**
Total events	40		51			

Heterogeneity: Tau² = 0.00; Chi² = 2.78, df = 3 (P = 0.43); I² = 0%
Test for overall effect: Z = 2.93 (P = 0.003)

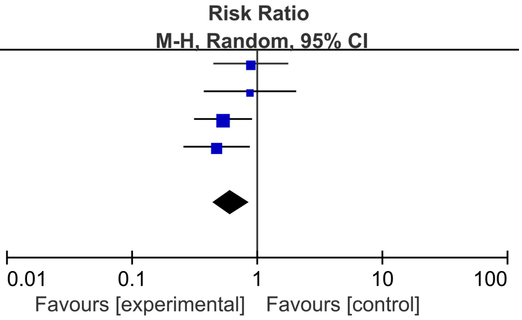

FIGURE 5. The incidence of rescue analgesia is shown in a forest plot of pooled analysis. SAPB, serratus anterior plane block; ESPB, erector spinae plane block; CI, confidence intervals.

Study or Subgroup	ESPB Events	ESPB Total	SAPB Events	SAPB Total	Weight	Risk Ratio M-H, Random, 95% CI
Ekinci 2020	7	30	11	30	26.9%	0.64 [0.29, 1.42]
Elsabeeny 2021	1	17	4	17	6.1%	0.25 [0.03, 2.01]
Hassan2022	3	27	3	28	10.7%	1.04 [0.23, 4.70]
Toscano2022	0	36	5	43	3.4%	0.11 [0.01, 1.89]
Wang2019	18	50	13	50	36.5%	1.38 [0.76, 2.51]
Zhang2022	4	28	6	29	16.4%	0.69 [0.22, 2.19]
Total (95% CI)		**188**		**197**	**100.0%**	**0.80 [0.47, 1.38]**
Total events	33		42			

Heterogeneity: Tau² = 0.12; Chi² = 6.79, df = 5 (P = 0.24); I² = 26%
Test for overall effect: Z = 0.80 (P = 0.43)

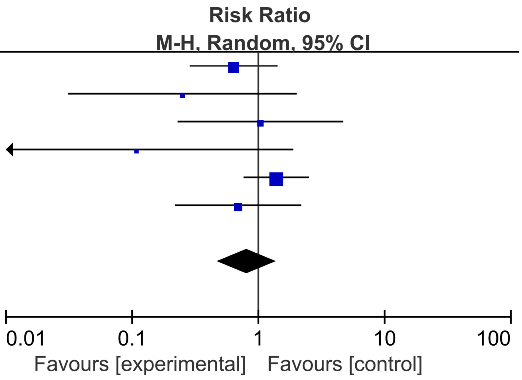

FIGURE 6. PONV incidence forest plot based on pooled analysis. SAPB, serratus anterior plane block; ESPB, erector spinae plane block; CI, confidence intervals.

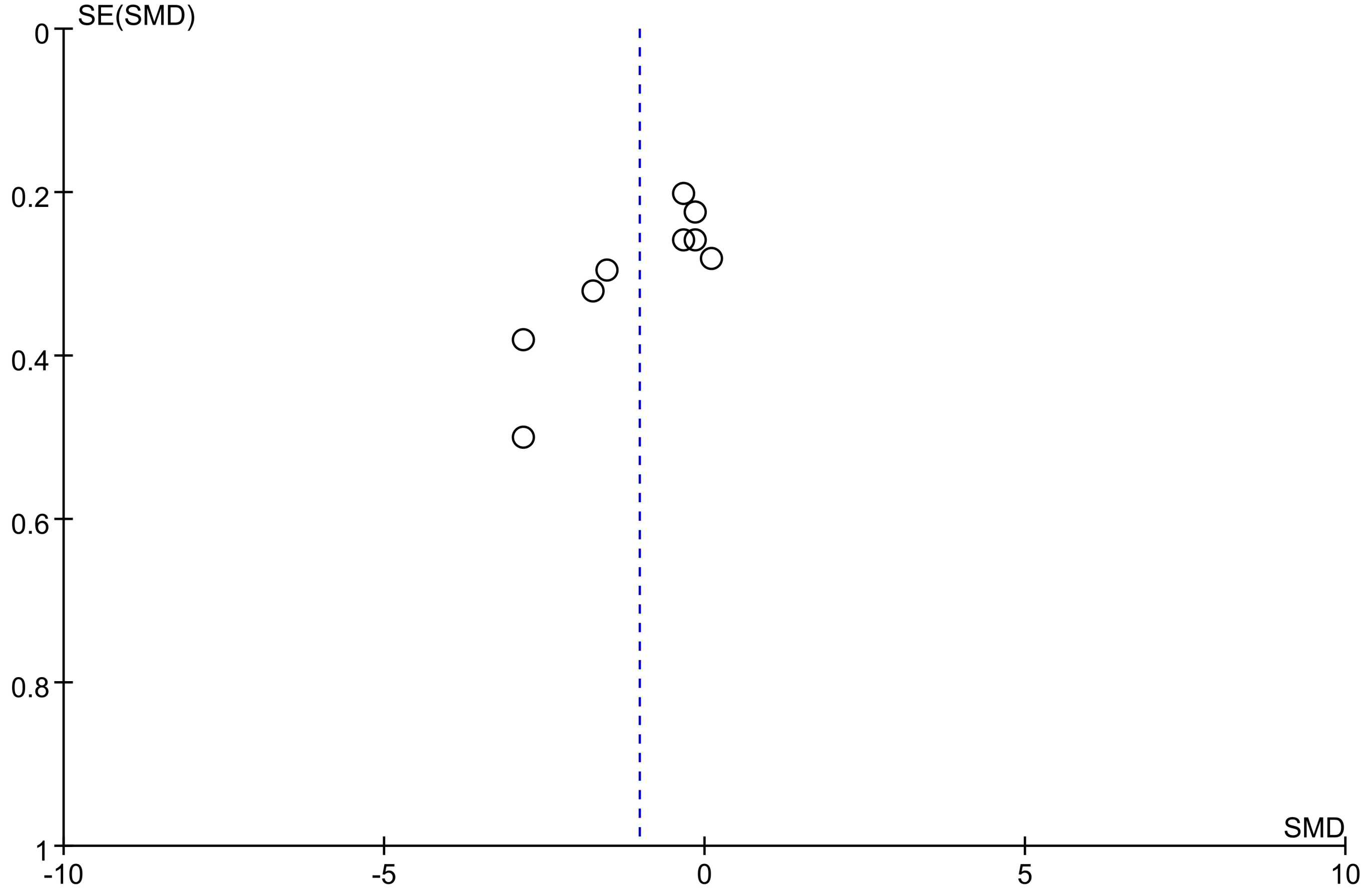

FIGURE 7. Consumption of opioids postoperatively shown by funnel plots. SE, standard error, SMD, standardized mean difference.

TABLE 2. The summarize of GRADE evaluation.

Outcome	MD/RR (95% CI)	Level of certainty	Reasons
Intraoperative opioid consumption	−2.32 (−3.92, −0.73)	⊕⊕◯◯ LOW	Indirectness was "serious"; Inconsistency was "serious".
Postoperative opioid consumption	−4.86 (−7.85, −1.88)	⊕⊕◯◯ LOW	Indirectness was "serious"; Inconsistency was "serious".
Rescue analgesia	0.62 (0.45, 0.85)	⊕⊕⊕⊕ MODERATE	None.
Incidence of PONV	0.80 (0.47, 1.38)	⊕⊕⊕⊕ HIGH	None.

MD, mean difference; RR, risk ratio; PONV, postoperative nausea and vomiting; CI, confidence intervals.

The implications of the current meta-analysis findings must be interpreted in light of several inherent limitations. Firstly, in some trials, double-blinding was not implemented, and certain assessors were not blinded, potentially influencing the quality of the included studies. Secondly, although our database queries were methodically conducted, the sample sizes of eligible trials reporting the incidence of chronic postoperative pain were relatively small. Thirdly, clinical heterogeneity is inevitable in this study.

5. Conclusion

ESPB provides better intraoperative and postoperative analgesic effects than SAPB in breast and thoracic surgeries, and can be used as a new regional block option. Future large-scale high-quality studies will confirm its universality.

AVAILABILITY OF DATA AND MATERIALS

Data of the systematic review and meta-analysis are available from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

PZ and JZ—conceptualization and methodology. GZZ and QHS—data curation and formal analysis. QWH—project administration and supervision. PZ—software, writing-original draft, and writing-review and editing. All authors contributed to the article and approved the submitted version.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This article is conducted based on existing research; none of the writers have undertaken new experiments with humans or animals.

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Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.signavitae.com/mre-signavitae/article/1876860889931366400/attachment/Supplementary%20material.docx.

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