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# Effectiveness of Erector Spinae Plane Block (ESPB) for Idiopathic Scoliosis Surgery in Pediatric Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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## Abstract

**Background:** This meta-analysis aims to evaluate the efficacy of the erector spinae plane block (ESPB) in enhancing postoperative analgesia following idiopathic scoliosis surgery in pediatric patients.

**Methods:** PubMed, Embase, and Cochrane Library were systematically searched in May 2025. Inclusion criteria were randomized controlled trials (RCTs) comparing ESPB versus no block or sham block for spinal surgery; patients under 21 years of age; and studies reporting immediate postoperative outcomes. Studies with overlapping populations or lacking a direct comparison between ESPB and no/sham block were excluded. Mean difference (MD) and standardized mean difference (SMD) with 95% confidence intervals (CI) was pooled. Random-effects model was used, and all statistical analyses were performed using R version 4.4.2. Quality assessment and risk of bias were conducted according to Cochrane recommendations.

**Results:** Five RCTs comprising 249 patients were included, of whom 123 (49%) received the ESPB. Following spinal surgery, ESPB significantly reduced static pain scores at post-anesthesia care unit (PACU) arrival (MD = -3.12 mm; 95% CI: -3.50 to -2.73; $p < 0.01$) and the incidence of postoperative nausea and vomiting (PONV) (RR = 0.33; 95% CI: 0.13 to 0.82; $p = 0.018$) compared to control. However, no significant differences were observed between groups in opioid consumption over 24 hours, static pain scores at 12 and 24 hours, or dynamic pain scores at 24 hours postoperatively.

**Conclusion:** The findings suggest that the ESPB reduces pain scores at PACU arrival and PONV. Further research is needed to better understand the full effects and potential benefits of the ESPB in the pediatric population.

**Keywords:** Erector spinae plane block; Pediatric surgery; Spinal surgery; Opioid consumption; Pain score and PONV.

**Abbreviations:** **ESPB** – Erector Spinae Plane Block; **RCT** – Randomized Controlled Trial; **$I^2$** – I-squared; **MD** – Mean Difference; **SMD** - Standardized Mean Difference; **ASA** – American Society of Anesthesiologists; **R** – R Programming Language (version 4.4.2); **CI** – Confidence Interval; PRISMA: Preferred Reporting Items For Systematic Reviews And Meta-Analyses; RoB-2: Risk of Bias-2.

**PROSPERO registration number:** CRD420251077437

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## Introduction

The erector spinae plane block (ESPB) was first described by Forero et al. [1] in 2016 as a new method to treat severe thoracic neuropathic pain in patients with rib fractures or metastatic disease [1]. Since then, this straightforward technique with a favorable safety profile, and wide applicability have led to its rapid adoption. Now ESPB use expanding to the management of both acute and chronic pain in a variety of surgical settings.

The exact mechanism of local anesthetic distribution remains unclear; some studies suggest the contribution through anterior diffusion of the local anesthetic solution into the paravertebral space, although the main effect is likely due to interfascial spread toward the posterior rami of the spinal nerves. A recent review of the literature, based on anatomical investigations using cadaveric dissections and various imaging techniques, demonstrated that the spread of medication can vary considerably. It also showed that larger volumes of local anesthetic may be required at lower vertebral levels to achieve longitudinal spread comparable to that obtained with thoracic injections [2].

Spinal surgeries are often followed by severe postoperative pain, where effective management enhances recovery, ambulation, discharge, and reduces chronic pain development [3]. Multimodal analgesia is considered the best strategy, and in this context, regional anesthesia may represent a valuable option. Damião et al. [4] showed in a recent study that ESPB may reduce opioid consumption during the first 24 hours after sternotomy [4]. In the same way, another study found that ESPB offers safe and effective postoperative pain relief compared with ultrasound-guided caudal block in children undergoing circumcision and lower abdominal surgery [5].

There are several studies on ESPB in adult spinal surgery; however, data in the pediatric population are very scarce. Therefore, this systematic review and meta-analysis, including only RCTs, aims to compare the efficacy of ESPB versus no block in reducing postoperative opioid consumption, pain scores, and PONV in pediatric patients undergoing spinal surgery.

## Methods

This meta-analysis was conducted in accordance with the Cochrane Collaboration and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

**Registration and protocol:** The prospective meta-analysis protocol was uploaded to the International Prospective Register of Systematic Reviews (PROSPERO; CRD420251077437) on June 19, 2025.

**Search Strategy:** A comprehensive search was conducted in PubMed, Embase, and the Cochrane Central Register of Controlled Trials up to on May 15, 2025. The initial search and study selection were performed by two independent investigators (PA, RC) using these three electronic databases. The Rayyan platform (http://rayyan.qcri.org) was used to facilitate independent and blinded screening.

Study selection was conducted in two phases. In Phase 1, two independent reviewers screened the titles and abstracts of all retrieved references, excluding studies that did not meet the predefined inclusion criteria. In Phase 2, the same reviewers independently assessed the full texts of the remaining studies, applying the eligibility criteria.

Discrepancies were resolved through discussion or, if necessary, by consulting a third reviewer.

The following medical search terms were used: “erector spinae plane block,” “nerve block,” “child,” “children,” “pediatric,” “paediatric,” “scoliosis surgery,” “spine surgery,” and “spinal surgery.” No filters or language limitations were applied to our search.

**Eligibility criteria:** Eligibility criteria considered the classification of the acronym PICOS to answer the following focused question: ‘Which approach (ESPB or NO block) is more effective in pediatric spinal surgery?’ P = Participants (patients up to 21 years old undergoing spine surgery); I = Intervention (ESPB); C = Comparison (No block/Sham block); O = Outcome (opioid consumption, postoperative pain scores and PONV); S = Study design (randomized controlled trials).

Inclusion in this meta-analysis was restricted to studies that met all the following eligibility criteria: 1) randomized controlled trials (RCTs); 2) comparing ESPB to No block/ Sham block; and 3) enrolling pediatric patients who underwent spinal surgery. In addition, studies were included only if they reported any of the clinical outcomes of interest. No studies based on population gender, language, or time of publication were excluded.

Studies were excluded if: 1) no control group; 2) enrolling in other surgeries; and 3) Conference abstracts and case reports 4) no pediatric surgery.

**Data extraction:** Extracted variables included study identification (first author, year of publication and study design), number of patients receiving ESPB and No block, patient's characteristics (number of females, age, ASA classification), duration of surgery and outcomes (24-hour opioid consumption, static and dynamic pain scores at postoperatively at variable intervals and PONV. The primary outcome was 24-hour opioid consumption.

We also performed a technique of backward snowballing, searching for additional eligible studies through a review of the references from prior publications, including meta-analyses and included studies.

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**Data items:** Our primary outcome was 24-hour opioid consumption, while secondary outcomes included static pain scores assessed using the numeric rating scale (NRS) at 12 and 24 hours, dynamic pain scores at 24 hours, and the incidence of postoperative nausea and vomiting (PONV).

**Statistical analysis:** Endpoints were analyzed using the mean difference (MD) for PONV and pain scores. The standardized mean difference (SMD) with 95% confidence intervals (CI) was used to compare 24-hour opioid consumption between groups. The inverse-variance method was used to pool estimates. Heterogeneity was assessed using Cochran's Q test and the $I^2$ statistic, categorized as follows: $I^2$ of 0%–40% may not be important, 30%–60% may indicate moderate heterogeneity, 50%–90% may suggest substantial heterogeneity, and 75%–100% may indicate considerable heterogeneity. For all outcomes, a random-effects model with the restricted maximum-likelihood estimator for $\tau^2$ was used, given the expected variability in study designs, interventions, and methodologies. Statistical analyses were performed using R (R Foundation for Statistical Computing, Vienna, Austria), version 4.4.1. Missing means and standard deviations were estimated from medians and interquartile ranges using the method proposed by Wan et al. [6] in accordance with Cochrane recommendations. Sensitivity analyses were also conducted using a leave-one-out approach.

**Study risk of bias assessment**: Quality assessment of RCTs was performed using the Cochrane Collaboration's tool for assessing risk of bias in randomized trials (RoB-2) [7,8], in which studies are scored as high, low, or unclear risk of bias in five domains: selection, performance, detection, attrition, and reporting biases. The risk of bias for each included study was independently evaluated by D.V.

**Certainty of evidence:** The certainty of evidence for the primary outcome was evaluated according to the GRADE methodology. This approach assesses six key domains: study design, risk of bias, inconsistency, indirectness, imprecision, and other considerations. Based on these domains, the overall quality of evidence is categorized as high, moderate, low, or very low. To present the findings, GRADEpro software (version 3.6.1) was used to generate a summary table outlining the certainty of the evidence.

## Results

**Study selection and Characteristics:** As detailed in Figure 1, our search strategy identified 156 articles, from which 28 duplicates were removed. The remaining 128 articles were screened according to the prespecified inclusion criteria, resulting in seven articles eligible for full-text review. In the end, five randomized controlled trials (RCTs) comparing the ESPB to a control group were included [9-13], comprising a total of 249 patients, of whom 123 (49.3%) were allocated to the ESPB group. Among the included trials, the mean patient age ranged from 9.9 to 15.3 years in the ESPB group and from 8.2 to 15.1 years in the control group. Mean body weight, reported in four studies, ranged from 43.2 to 52.4 kg in the ESPB group and from 44.6 to 52.4 kg in the control group. The ASA physical status distribution, available in four studies, indicated that most patients in both groups were classified as ASA I or II.

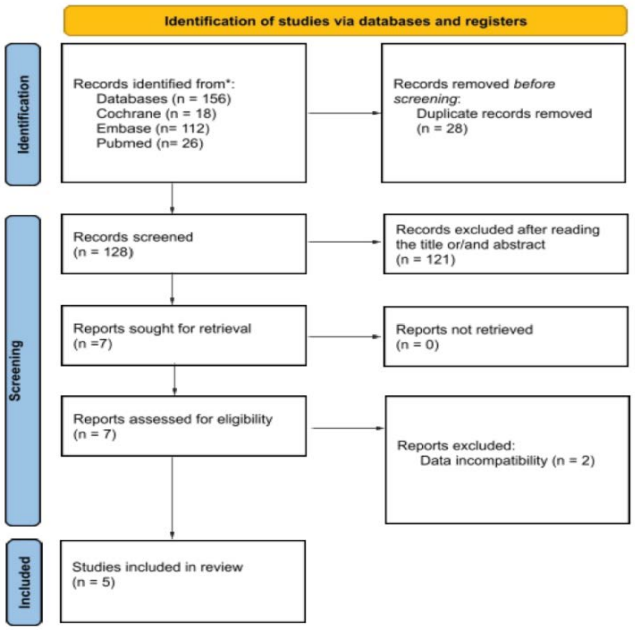


**Figure 1:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of study screening and selection.

As shown in Table 1, one study performed a sham block in the control group, while the remaining studies used no block. The type, concentration, and volume of local anesthetic varied among studies, and some included adjuvant medications such as dexamethasone or dexmedetomidine.

## Pooled analysis of all studies:

### 24h opioid consumption

We found no statistically significant difference in 24-hour opioid consumption between the ESPB and control groups based on pooled data (SMD -2.22; 95% CI [-5.58 to 1.13]; $p = 0.19$, $I^2 = 97.3\%$; 4 RCTs; 205 patients (Figure 2A).

### Pain score

Our analysis of postoperative pain scores at rest demonstrated a significant reduction in the ESPB group compared with the control group in the PACU (MD = –3.12; 95% CI [–3.50 to –2.73]; $p < 0.01$; $I^2 = 51\%$; 3 RCTs; 155 patients (Figure 3C). Additionally, pooled analyses revealed no significant differences between groups at 12 hours (MD = –0.92; 95% CI [–2.07 to 0.24]; $p = 0.12$; $I^2 = 80.3\%$; 3 RCTs; 155 patients (Figure 3A) or at 24 hours (MD =-0.80; 95% CI [-2.13 to 0.54]; $p = 0.24$; $I^2 = 94.3\%$; 3 RCTs; 205 patients

Pechim de Andrade P, et al., Anesth Crit Care 2026
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| Study | Anesthetic Bilateral | Sample size | | Block | | Age, years* | | Weight (kg)* | | Duration of surgery (min)* | | ASA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ESPB | Control | ESPB | Control | ESPB | Control | ESPB | Control | ESPB | Control | ESPB | Control |
| Damagalska, 2024 | Ropivacaine 0,20% Th4/Th10 10ml each *Bilevel | 30 | 30 | ESPB | Sham block | 13.5±1.81 | 13.3±1.57 | 47.0±9.9 | 52.4±15.9 | 249.0±36.8 | 252.7±64.7 | NA | NA |
| Jingchun, 2024 | Ropivacaine 0,25% Th5 0,5ml/Kg *One level | 25 | 25 | ESPB | No block | 13.7±1.6 | 13.5±1.7 | 44.6±5.2 | 43.2±6.0 | 230.0±61.3 | 242.9±58.6 | I: 17 II: 8 | I: 16 II: 9 |
| Kamel, 2024 | Bupivacaine 0,25% Th8-Th10/L3 10ml each *Bilevel | 22 | 22 | ESPB | No block | 15.3±2.5 | 14.4±2.1 | 49.7±7.0 | 48.6±4.3 | 360.0±120.0 | 360.0±120.0 | I:2 II:9 III:11 | I:3 II:8 III:11 |
| Ren, 2024 | Ropivacaine 0.3% 0.5 ml/kg dexmedetomidine 0.5 µg/kg *Bilevel only if more than 6 levels fusion | 35 | 37 | ESPB | No block | 9.9±1.5 | 8.2±1.8 | NA | NA | 219.4±26.3 | 201.0±21.1 | I:6 II:29 | I:3 II:34 |
| Ruby, 2024 | Bupivacaine 0,25% 1ml/kg dexamethasone 2mg each side *One level | 11 | 12 | ESPB | No block | 14.6±2.1 | 15.1±2.3 | NA | NA | NA | NA | NA | NA |

ESPB, erector spinae plane block; NA, not available; BMI, body mass index; RCT, randomized control trial; *mean or median.

**Table 1:** Baseline patient and study characteristics.

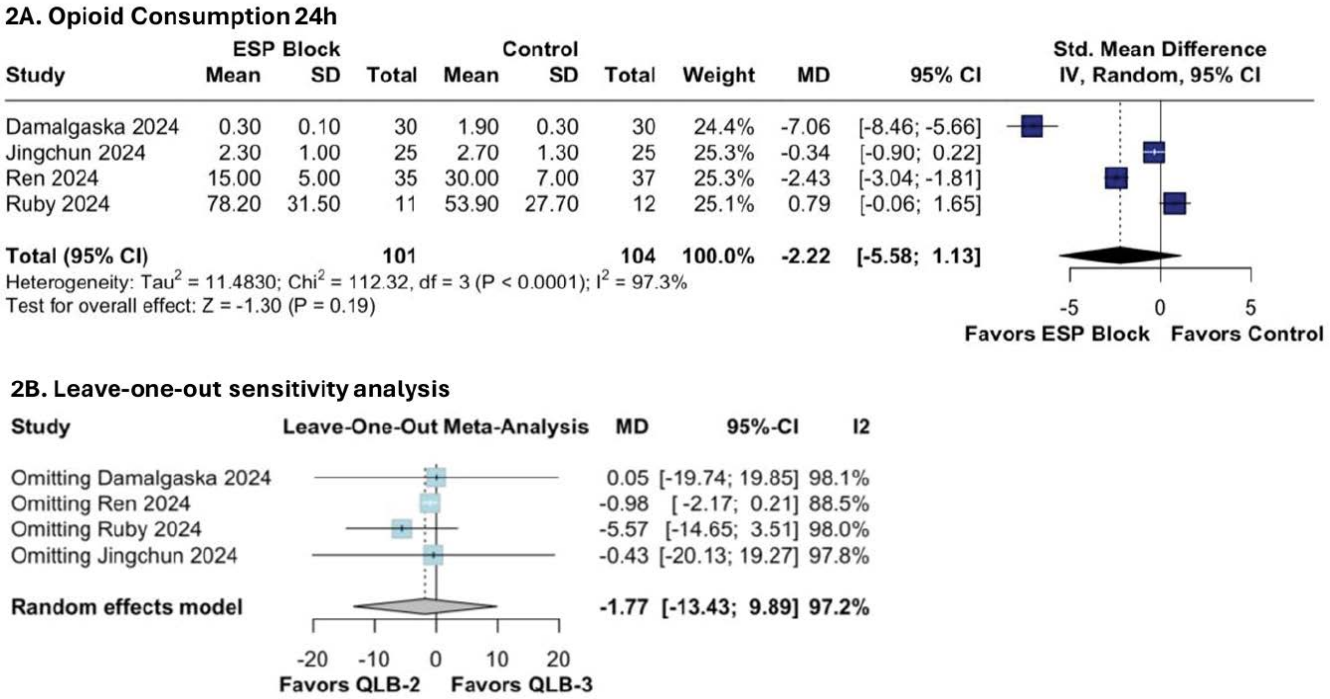


**Figure 2:** 2A - Opioid consumption 24h SMD: Opioid consumption in the first 24 hours after surgery was not significantly different between ESPB and control groups; 2B: L1o Opioid consumption 24h - Leave-one-out sensitivity analysis, indicating that no single study disproportionately influenced the overall effect size.

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Pechim de Andrade P, et al., Anesth Crit Care 2026
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(Figure 3B). Regarding postoperative pain at mobilization, we found no statistically significant difference between groups at 24 hours (MD = –1.18; 95% CI [–2.52 to 0.17]; $p = 0.09$; $I^2 = 82.8\%$; 3 RCTs; 145 patients (Figure 3D).

**Post operative nausea and vomiting**

However, post operative nausea and vomiting was significantly reduced in the ESPB group compared to the control group (RR 0.33; 95% CI [0.13 to 0.82]; $p = 0.018$, $I^2 = 32.5\%$; 3RCTs; 182 patients (Figure 4).

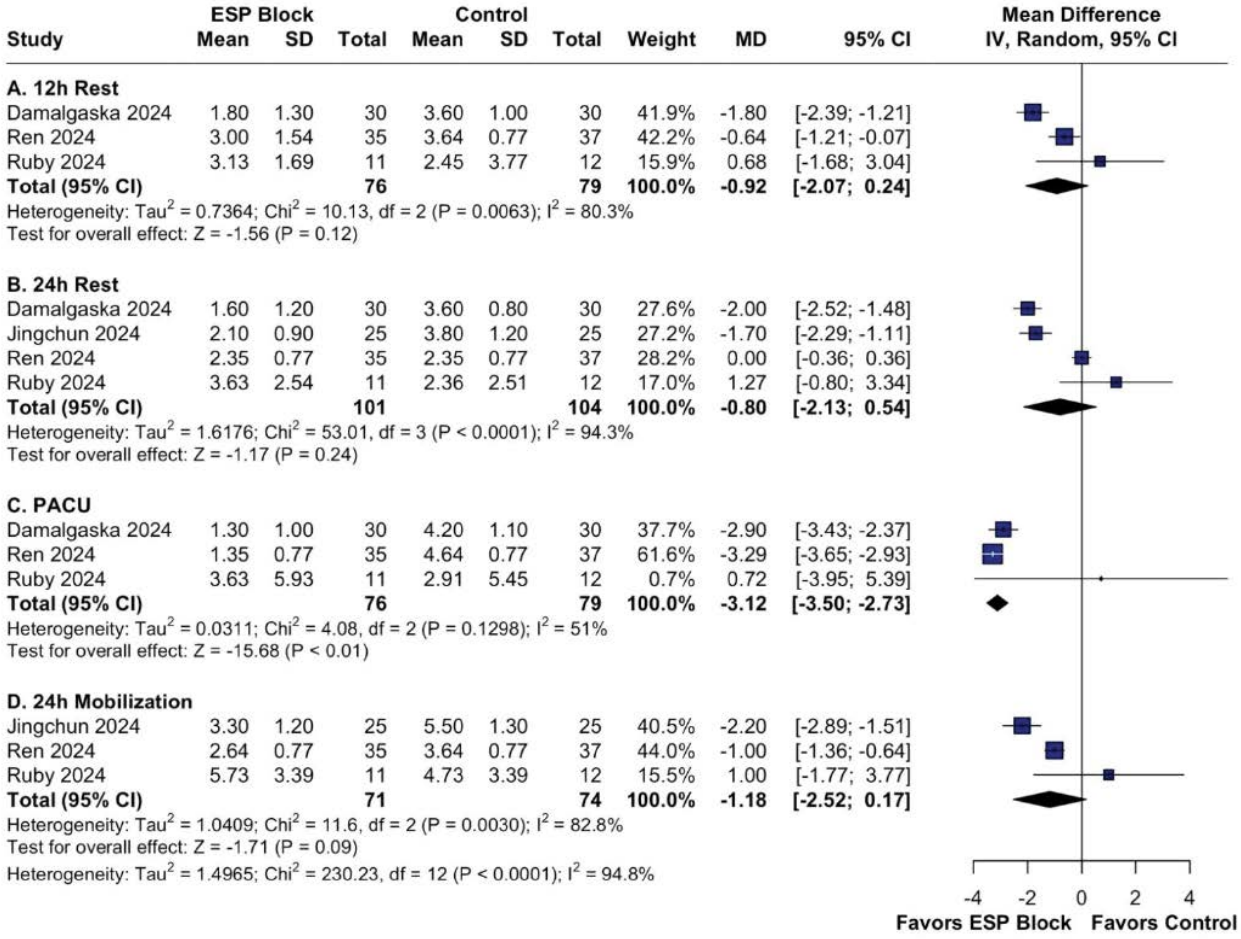


**Figure 3:** TOTAL pain score: (C) Static pain score at PACU arrival demonstrated a significant reduction in the ESPB group compared with the control group. (A) Static pain score at 12 h was not significantly different between ESPB and control group. (B) Static pain score at 24 h was not significantly different between ESPB and control group. (D) Dynamic pain score at 24 h was not significantly different between ESPB and control group .

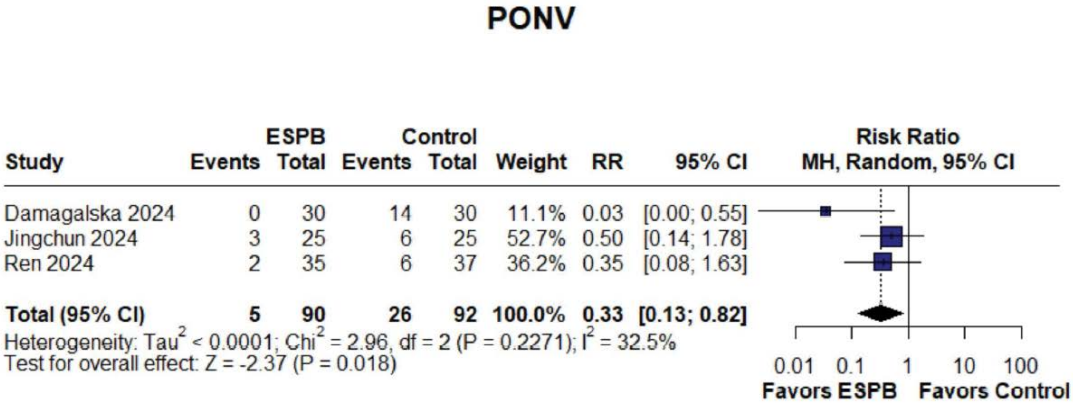


**Figure 4:** PONV: Post-operative nausea and vomiting was significantly reduced in the ESPB group compared to the control group.

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**Sensitivity analyses:** The significance of 24-hour opioid consumption remained unchanged after we performed a leave-one-out sensitivity analysis, indicating that no single study disproportionately influenced the overall effect size (Figure 2B).

Leave-one-out sensitivity analyses were performed only when at least four studies were available for an outcome, as analyses with fewer studies may yield unstable estimates and limited interpretability. Therefore, this assessment was conducted exclusively for 24-hour opioid consumption.

**Reporting biases**: Between the randomized trials, three studies (Damagalska 2024, Ren 2024, Ruby 2024 and Kamel 2024) showed a low overall risk of bias. In contrast, Jingchun 2024 presented some concerns, primarily related to the randomization process, as allocation concealment was likely compromised (Figure 5).

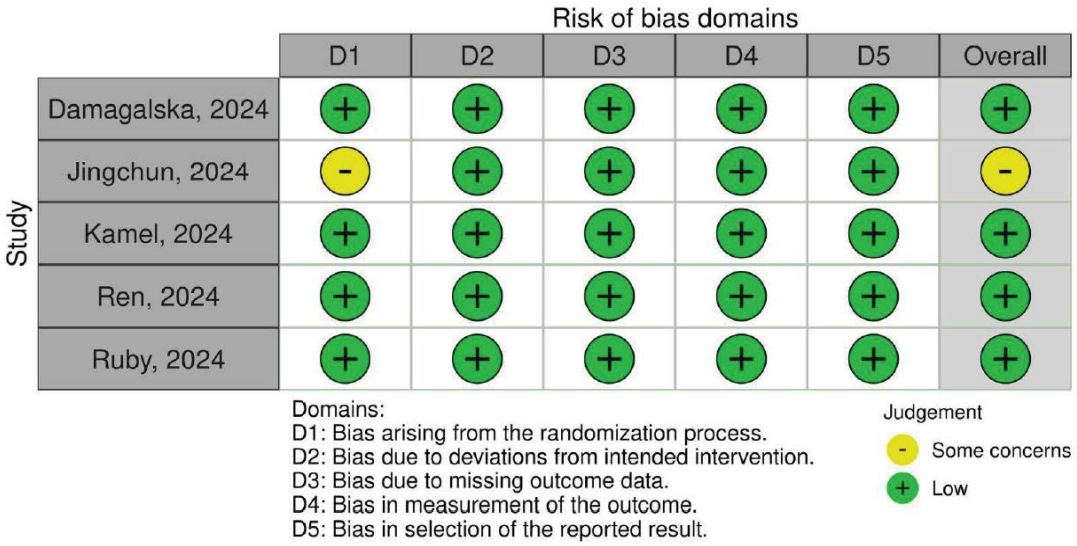


**Figure 5:** Critical appraisal according to the RoB-2 tool for assessing the risk of bias in randomized trials.

**Quality assessment:** The quality assessment of the randomized controlled trials (RCTs) was performed using the Cochrane Collaboration's tool for assessing risk of bias in randomized trials (RoB-2). Three of the five included RCTs [9,10,12], demonstrated a low overall risk of bias. However, one trial (Jingchun 2024) raised concerns, primarily regarding the randomization process, as allocation concealment was likely compromised. The overall certainty of the evidence for all critical outcomes was subsequently evaluated using the GRADE methodology. This assessment classified the certainty as **Moderate** for postoperative nausea and vomiting (PONV), **Low** for static pain scores at PACU arrival, and **Very Low** for 24-hour opioid consumption and all later pain scores. Downgrading was consistently driven by the serious risk of bias, and by Very Serious Inconsistency (ranging from I2=80.3% to I2=97.3%) across most continuous outcomes (Figure S1).

## Discussion

In this meta-analysis, comprising 5 randomized controlled trials with a total of 249 pediatric patients, we compared the efficacy of the erector spinae plane block (ESPB) versus no block or sham block for spine surgery in children with idiopathic scoliosis. The main findings showed that ESPB was associated with lower pain scores upon arrival in the PACU and a reduced incidence of postoperative nausea and vomiting (PONV). However, no significant clinical benefit of ESPB was observed regarding 24-hour opioid consumption, static pain scores at 12 and 24 hours, or dynamic pain scores at 24 hours postoperatively.

Our meta-analysis showed that the ESPB significantly reduced pain scores on the PACU arrival compared with the control group in pediatric patients undergoing spinal surgery (MD = -3.12 mm; 95% CI: -3.50 to -2.73; $p < 0.01$). This finding aligns with most recent studies, which also reported lower immediate postoperative pain in patients who received ESPB. The likely explanation is the spread of local anesthetic to the dorsal rami and paraspinal fascial planes, providing effective early analgesia. Similar results have been reported in adult open spine surgeries, where ESPB reduced early postoperative pain and opioid use [14]. Clinically, this early pain reduction is important because it can decrease the need for rescue opioids, lower the risk of postoperative nausea and vomiting, and improve patient comfort during recovery from anesthesia. However, as this benefit seems to be short-lived and not sustained at later time points, its main clinical value may lie in improving comfort during the immediate recovery phase rather than providing long-lasting analgesia.

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Pechim de Andrade P, et al., Anesth Crit Care 2026
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In our meta-analysis, the ESPB was associated with a significantly lower incidence of PONV compared with the control group (RR = 0.33; 95% CI: 0.13 to 0.82; p = 0.018). This finding is consistent with several recent studies using this block. For example, a meta-analysis in adult patients undergoing spinal surgery showed that those who received ESPB experienced lower rates of postoperative nausea and vomiting [15]. Similarly, a meta-analysis in pediatric patients undergoing elective surgeries demonstrated that ESPB reduces PONV [16]. Likewise, all studies included in our analysis showed a similar trend toward reduced PONV. Previous literature suggests that ESPB may decrease PONV primarily by reducing intraoperative opioid consumption and improving early pain control, thereby minimizing emetogenic stimuli. Systematic reviews in both spine surgery and broader surgical populations support this mechanism, showing that ESPB contributes to enhanced recovery by lowering PONV incidence [17]. Clinically, this effect is important because nausea and vomiting are among the most distressing postoperative complications, especially in children, as they can impair comfort, prolong PACU stay, increase the risk of dehydration, delay oral intake, and reduce patient and caregiver satisfaction. However, this finding should be interpreted with caution, since most included studies had small sample sizes, and PONV was often assessed as a secondary outcome with variable definitions and limited blinding. Larger, well-designed pediatric RCTs focusing on PONV as a primary endpoint are needed to confirm the consistency and magnitude of this effect.

In our meta-analysis, no significant differences were observed between the erector spinae plane block and control groups in opioid consumption over 24 hours. This contrasts with several studies reporting reduced opioid use with ESPB. For example, a recent systematic review and meta-analysis in adults undergoing spinal surgery found that ESPB significantly reduced postoperative opioid requirements [15]. Similarly, pediatric studies have reported decreased opioid consumption in patients receiving ESPB during elective surgeries [18,19]. The discrepancy between our findings and prior studies may be explained by differences in study design, sample size, surgical procedures, block technique, local anesthetic dosage, and use of adjunct analgesics, which likely contributed to the observed heterogeneity in opioid outcomes across trials. Clinically, our results suggest that while ESPB may provide effective early analgesia, its effect on total 24-hour opioid consumption may be limited, highlighting the need to incorporate ESPB within a multimodal analgesia strategy to optimize postoperative pain management in pediatric spine surgery.

The analysis demonstrated considerable variability in postoperative pain outcomes across studies. Two of three trials reported lower static pain scores in the ESPB group within the first 12 hours [9,10], while two of four studies observed analgesic benefits extending up to 24 hours [9,11]. In contrast, one of three studies found no improvement in dynamic pain at 24 hours [12]. This latter trial also reported increased postoperative opioid consumption and higher pain scores, further contributing to the inconsistency among findings. These discrepancies may be related to differences in the elasticity and anatomical characteristics of fascial planes in pediatric patients, which can lead to unpredictable local anesthetic spread and variable sensory block distribution, even when performed by the same practitioner [20]. This variability may partly explain no finding of significance on this time pain scores and the greater postoperative opioid use and higher pain scores observed in Ruby et al. [12].

Our study represents the first meta-analysis including only randomized controlled trials (RCTs) evaluating the efficacy of the ESPB for pediatric scoliosis surgery. In recent years, several studies have investigated the use of ESPB in spinal procedures; however, evidence specifically addressing pediatric populations remains limited. The recent meta-analysis by Al-Naseem et al. [21] evaluated the safety and efficacy of ESPB in patients with idiopathic scoliosis undergoing posterior spinal fusion reported significant reductions in postoperative pain scores within the first 24 hours as well as intra and postoperative opioid consumption [21], findings that differ from ours.

While Al-Naseem et al. [21] observed a sustained analgesic effect up to 24 hours, our results suggest that the primary benefit of ESPB occurs during the immediate postoperative period, particularly upon arrival in the PACU, without a clear impact on total 24-hour opioid use. These differences may reflect variations in study populations (adolescents versus younger children), block techniques, anesthetic protocols, or adjunct analgesic strategies.

The decision to conduct a meta-analysis restricted to RCTs was made not only to ensure greater methodological rigor and strengthen causal inference regarding ESPB effectiveness but also because only a few studies are currently available, and data inconsistency was identified in one large non-RCT study, which was deemed unreliable for quantitative synthesis [22]. Despite these limitations in the available evidence, our findings provide important clinical insights. From a clinical perspective, ESPB can be a valuable tool to enhance early postoperative comfort, reducing pain and postoperative nausea and vomiting, factors especially relevant in pediatric patients. However, given the absence of a sustained effect on later pain or opioid use, ESPB should not be viewed as an exclusive intervention for prolonged analgesia but rather as an effective component of a multimodal pain management strategy in pediatric spinal surgery.

Our study has several limitations. There were variations in the type, dosage and concentration of the local anesthetics across studies, with doses ranging from 0.5 $mL \cdot kg^{-1}$ per

side to 1.0 mL·kg$^{-1}$ per side, while some studies used a fixed volume of 10 mL per side without adjusting for patient weight. Furthermore, some studies did bilevel blocks instead of one level block and some used adjuvant medications, such as dexamethasone and dexmedetomidine. These differences likely introduced significant heterogeneity and reduced consistency among the results. Additionally, variations in the anesthetic agents used during general anesthesia may have influenced postoperative pain scores. The limited number of included studies also prevented sensitivity analyses for most outcomes; such analysis was only possible for opioid consumption, which showed no difference and confirmed the absence of statistical significance. Inconsistencies in data reporting, particularly in pain scores and postoperative opioid use, highlight the need for more standardized methodologies in future research. Implementing uniform pain assessment tools, consistently reporting standard deviations for pain scores, and applying standardized time intervals for postoperative opioid consumption would enhance the reliability and comparability of future studies.

## Conclusion

The present meta-analysis suggests that ESPB significantly reduces pain scores upon PACU arrival and the incidence of postoperative nausea and vomiting (PONV). However, no statistically significant differences were observed in later pain scores or 24-hour opioid consumption. Further studies with larger sample sizes and standardized methodologies are warranted to confirm these findings and establish more definitive conclusions.

## Data Availability Statement

All data analyzed in this study are derived from previously published articles and are available in the public domain.

## Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Ethics Approval

Ethical approval was not required for this study as it is a systematic review and meta-analysis of previously published data.

## Patient Consent

Patient consent was not required as this study used data from previously published studies.

## Permission to Reproduce Material

Not applicable.

## Clinical Trial Registration

This systematic review and meta-analysis was registered in PROSPERO (Registration number: CRD420251077437).

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## Supplementary File:

Online Supplementary File S1: Summary of findings: ESBP versus No block/ Sham block for pediatric patients undergoing idiopathic scoliosis surgery.

**Erector Spinae Plane Block (ESPB) compared to No block / Sham block for Pediatric patients undergoing spinal surgery**
**Bibliography:**

| Certainty assessment | | | | | | | Summary of findings | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Study event rates (%) | | | Anticipated absolute effects | |
| Participants (studies) Follow-up | Risk of bias | Inconsistency | Indirectness | Imprecision | Publication bias | Overall certainty of evidence | With No block / Sham block | With Erector Spinae Plane Block (ESPB) | Relative effect (95% CI) | Risk with No block / Sham block | Risk difference with Erector Spinae Plane Block (ESPB) |
| **24-hour opioid consumption (assessed with: Morphine Equivalents)** | | | | | | | | | | | |
| 205 (4 RCTs) | serious[a] | very serious[b] | not serious | serious[c] | none | ⨁◯◯◯ Very low[a,b,c] | 104 | 101 | - | - | SMD **2.22 SD lower** (5.58 lower to 1.13 higher) |
| **Postoperative Nausea and Vomiting (PONV) (assessed with: yes/no)** | | | | | | | | | | | |
| 364 (3 RCTs) | serious[d] | not serious[e] | not serious[f] | not serious[g] | none | ⨁⨁⨁◯ Moderate[d,e,f,g] | 92/182 (50.5%) | 90/182 (49.5%) | **RR 0.33** (0.13 to 0.82) | 92/182 (50.5%) | **339 fewer per 1,000** (from 440 fewer to 91 fewer) |
| **Static pain scores at PACU arrival (assessed with: Visual Analog Scale)** | | | | | | | | | | | |
| 155 (3 RCTs) | serious[h] | serious[i] | not serious | not serious | none | ⨁⨁◯◯ Low[h,i] | 79 | 76 | - | 79 | MD **3.12 lower** (3.5 lower to 2.73 lower) |
| **Static pain scores at 12 hours** | | | | | | | | | | | |
| 155 (3 RCTs) | serious[h] | very serious[i] | not serious | not serious | none | ⨁◯◯◯ Very low[h,i] | 79 | 76 | - | 79 | MD **0.92 lower** (2.07 lower to 0.24 higher) |
| **Static pain scores at 24 hours** | | | | | | | | | | | |
| 205 (3 RCTs) | very serious[h] | very serious[k] | not serious | not serious | none | ⨁◯◯◯ Very low[h,k] | 104 | 101 | - | 104 | MD **0.8 lower** (2.13 lower to 0.54 higher) |
| **Dynamic pain scores at 24 hours** | | | | | | | | | | | |
| 145 (3 RCTs) | serious[h] | very serious[l] | not serious | not serious | none | ⨁◯◯◯ Very low[h,l] | 74 | 71 | - | 74 | MD **1.18 lower** (2.52 lower to 0.17 higher) |

**CI:** confidence interval; **MD:** mean difference; **RR:** risk ratio; **SMD:** standardised mean difference

**Explanations**

a. Two of the five included RCTs (Jingchun 2024 and Kamel 2024) were classified as having "some concerns," primarily due to likely compromised allocation concealment in the randomization process.
b. There is substantial and considerable heterogeneity ($I^2$=97.3%), sugesstting effect size varying drastically among the studies and severely compromises the reliability of the pooled estimate.
c. The result was not statistically significant (p=0.19). The 95% Confidence Interval is very wide [-5.58 to 1.13] and crosses the null effect (zero), indicating a lack of precision for the estimate.
d. Two of the five studies had "some concerns" related to randomization. Furthermore, the Discussion notes that PONV was often assessed as a secondary outcome with variable definitions and limited blinding, which increases the risk of detection bias for this subjective outcome.
e. The heterogeneity ($I^2$=32.5%) is considered low and may not be important.
f. Direct evidence available.
g. The result is statistically significant (p=0.018) , and the 95% CI [0.13 to 0.82] is reasonably narrow and excludes the null effect (RR=1.0)
h. Two of the five studies had "some concerns" related to randomization (Jingchun 2024 and Kamel 2024), suggesting a serious risk of bias across the body of evidence
i. The heterogeneity was moderate ($I^2$=51%), suggesting important variability in the magnitude of the pain reduction effect, which warrants a downgrade.
j. The heterogeneity ($I^2$==80.3%) is substantial, indicating large differences in effect size among studies. This constitutes a major concern, warranting a severe downgrade.
k. The heterogeneity ($I^2$=94.3%) is substantial/considerable, indicating large differences in effect size among studies. This warrants a severe downgrade.
l. The heterogeneity ($I^2$=82.8%) is substantial, indicating large differences in effect size among studies. This warrants a severe downgrade.

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