

Ultrasound-guided Erector Spinae Plane Block for postoperative analgesia: A Meta-Analysis of Randomized Controlled Trials

Jiao Huang

Guangxi Medical University First Affiliated Hospital

Jing Chen Liu (✉ jingchenl@sina.com)

Guangxi Medical University First Affiliated Hospital

Research article

Keywords: Erector Spinae Plane Block (ESPB), postoperative analgesia, regional blockade, opioid, pain score

Posted Date: February 7th, 2020

DOI: <https://doi.org/10.21203/rs.2.22941/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: Ultrasound-guided Erector Spinae Plane Block (ESPB) has been increasingly applied in patients for postoperative analgesia. Its safety and effectiveness remain uncertain. This meta-analysis aimed to determine the clinical safety and efficacy of ultrasound-guided ESPB in adults undergoing general anesthesia (GA) surgeries.

Methods: A systematic databases search was conducted in PubMed, Embase, and the Cochrane Library for randomized controlled trials (RCTs) comparing ESPB with control or placebo. Primary outcome was iv. opioid consumption 24 h after surgery. Standardized mean differences (SMDs) or risk ratios (RRs) with 95% confidence intervals (CIs) were calculated with a random-effects model.

Results: A total of 11 RCTs consisting of 540 patients were included. Ultrasound -guided ESPB showed a reduction of iv. opioid consumption 24 h after surgery (SMD=-2.15; 95% confidence interval (CI) -2.76 to -1.5,p<0.00001), pain scores at 1st hour (SMD=-0.97;95% CI -1.84 to -0.1,p=0.03) and pain scores at 6th hour (SMD=-0.64,95% CI -1.05 to -0.23,p=0.002), Also, it lessened the number of patients who required postoperative analgesia (RR=0.41,95% CI 0.25 to 0.66,p=0,0002) and time to first rescue analgesia (SMD=4.56,95% CI 1.89 to 7.22, p=0.0008). Differences were not significant with the pain score at 12th hour,24th hour and postoperative nausea and vomiting (PONV).

Conclusions: Ultrasound-guided ESPB provides postoperative analgesic efficacy in adults undergoing GA surgeries with no increase in PONV.

Background

Ultrasound-guided Erector Spinae Plane Block (ESPB) is a novel regional anesthesia technique that local anesthetic(LA) injection is performed into the fascial plane situated between the transverse process of the vertebra and the erector spinae muscles, and it works by infiltration of LA into the thoracic paravertebral space[1].With the ease of complications and relatively security, its clinical application is increasing. Followed by first description in providing thoracic analgesia by Tulgar[2],it has been reported subsequently to relief both acute and chronic pain in various case reports and cadaveric studies[3–7].Nowadays, there are published a number of randomized controlled trials (RCTs) of ultrasound-guided ESPB for postoperative analgesia, owing to the modest sample size and inconsistent conclusion, We therefore conducted a meta-analysis to examine the clinical safety and efficacy of ultrasound-guided ESPB among adults undergoing general anesthesia (GA) surgery.

Methods

Literature search and selection Criteria

This systematic review and meta-analysis of RCTs was reported abiding by the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) statement[8].It was conducted base on the statement of the Cochrane Handbook for Systematic Reviews of Interventions[9]. No formal protocol was registered for this meta-analysis.

PubMed, EMBASE, and the Cochrane Library were searched from inception to August 2019 with no language restriction. The search terms used were:('erector spinal plan block' OR 'erector spinal block' OR 'erector spinal plan blocks' OR 'erector spinal blocks'). The bibliographies of included trials were manually searched for any eligible trials missed by the electronic search. This process was conducted iteratively until no extra reference could be verified.

Two of us independently performed the preliminary data search, after removing duplicate references, the titles and abstracts were screening for the eligible trials. We included all RCTs in adults who were undergoing GA surgery with the intervention of ultrasound-guided ESPB regardless the anaesthetic drug, volume and concentration administered. The control group should be conducted with a sham technique with saline or placebo. Trials were excluded for the following criteria: animal or cadaveric studies; reviews; did not report opioid consumption or pain scores as an outcome; Any discrepancies were resolved by double-check of the source data and discussion with coauthors.

Data extraction and quality assessment

Data were collected for each eligible trial on first author, publication year, patient number, patient characteristics, American Society of Anesthesiologists (ASA) physical status, surgical procedure, ESPB group (position, dosage and concentration), control group (placebo or no invention) and outcome data. Any uncertainty arose were figured out though a consensus achieved. For continuous data, we calculated mean and SD, if not provided, we contacted authors. Median and interquartile range were seen as means and standard deviation(SD) approximately as follows if we did not get reply: the median was considered equal to the mean, and the SD was calculated as the interquartile range divided by 1.35[10]. The primary outcome of this meta-analysis was i.v. opioid consumption during the 24 h postoperatively, the secondary outcomes included pain scores at the 1st hour,6st hour,12st hour,24st hour following surgery, no. need rescue analgesia requirement, time to first rescue analgesic and postoperative nausea or vomiting (PONV).

Two authors (JH and J-C I) evaluated the methodological quality of the trials according to the Cochrane risk-of-bias tool[11]. Each item was categorized as having a 'low', 'unclear', or 'high' risk of bias. Any uncertainty arose were resolve by discussion between two researches until a consensus was achieved.

Statistical Analysis

The relative risks (RRs) with 95% confidence intervals (CIs) was calculated for dichotomous outcome data. For continuous outcome data, standardized mean differences (SMDs) with 95% CIs were reported. A random effects model was selected to acquire the most conservative effects estimate. An I^2 statistic of 25%-50% were defined as low heterogeneity, an I^2 statistic of 50%-75% were described as moderate heterogeneity, and those with an I^2 statistic of > 75% were considered as high heterogeneity[12], The heterogeneity was substantial when an I^2 value was over 50%. Subgroup analyses for the first outcomes based on using a patient-controlled analgesia device (PCA) or not was planned. Publication bias was evaluated using funnel plots. Statistical analyses were calculated using the Review Manager Version 5.3 (Nordic Cochrane Centre, Cochrane Collaboration)

Results

Study identification and characteristics

A total of 675 studies were obtained by the literature search. No further citations were found by hand searching.211 records were excluded for duplicate studies and a further 449 records removed by screening titles and abstracts. 15 full text publications remained were scrutinized for conclusive identified.4 of them were excluded because 2 did not report data of interest[13, 14], one was currently ongoing study[15],one was review article[16].Finally,11 RCT[17-27] satisfied our inclusion criteria. A flowchart of the literature search is shown in Fig. 1. The main characteristics of the 11 RCTs included are presented in Table 1.

Quality Assessment

Four trials at a low risk of bias, and 7 trials at an unclear risk of bias. The randomisation procedure was adequately generated in 10 trials, the concealment of treatment allocation was described in 6 trials. Since we subjectively judge the outcome measurement was little prone to be changed by lacking of blinding, all RCTs included were classified as low risk of bias at blinding of outcome assessments. Assessment of risk-of-bias summary of all RCTs are presented in (Fig.2).

Primary outcomes

All RCTs reported data for 24 h postoperative iv. opioid consumption in the study patients. Pooled analysis showed a significant reduction of opioid requirement with ESPB (95% CI -2.76 to -1.53; $P < .00001$; Fig3). There was substantial heterogeneity in the overall analysis of 24 h opioid consumption (P for heterogeneity $< .00001$; $I^2 = 88\%$). The heterogeneity remained when subgroup analysis based on the PCA administration was conducted. (Fig.4) Publication bias by appraisal of the funnel plot (Fig.5)

Secondary outcomes

Ultrasound-guided ESPB significantly decrease pain scores at the 1 h (95% CI -1.84 to -0.1; $P = .03$, $I^2 = 89\%$) and 6 h [95% CI -1.05 to -0.23; $P = .002$, $I^2 = 65\%$). Furthermore, No. need rescue analgesia requirement (95% CI 0.25 to 0.66; $P = .0002$, $I^2 = 67\%$) and time to first rescue analgesic (95% CI 1.89 to 7.22 ; $P = .0008$, $I^2 = 95\%$) was lower in the ESPB group. However, pain scores of the 12 h (95% CI -0.66 to 0.33; $P = .51$, $I^2 = 76\%$), 24 h (95% CI -1.78 to 0.12; $P = .09$, $I^2 = 94\%$) and PONV (95% CI 0.20 to 1.00; $P = .05$, $I^2 = 84\%$) did not achieve statistical significant significance. The outcomes of the selected trials are reported in Table 2.

Discussion

The main finding of this meta-analysis is that performing ESPB constitutes an effective postoperative analgesic for reducing opioid consumption 24 hours after surgery, pain scores at 1 h and 6 h following surgery. Furthermore, it has been shown there is a significant reduction on patients who need rescue analgesia and prolongation in the time to first request of rescue analgesia. However, PONV was not significantly lower in patients treated with ESPB.

The significant decrease postoperative opioid is of great value for patients to enhance comfortable feelings and recovery following surgery. PONV is one of opioid dose-related side effects, which is not conducive to the rapid recovery after surgery [28], one study reported the use of postoperative opioids is related to PONV with a high rate of 79% among 4 risk factors [29]

Therefore, we hypothesized that a decrease in opioid use could lessen PONV, however, on the contrary, the PONV difference was not statistically significant while opioid consumption and rescue analgesia reduced in our meta-analysis. The most likely Interpretation for this result was the PONV prophylaxis intraoperatively by applying antiemetic drugs such as iv. tropisetron or dexamethasone.

Despite ESPB has been successfully applied in postoperative analgesia with few adverse reactions, the mechanism of ESPB is still controversial. Altinpulluk EY [3], Forero M [2] and Chin KJ [30] observed an extensive spread to ventral rami and dorsal rami in the paravertebral space when ESPB is utilized, at the same time, Aponte A [31] found posterior rami of spinal nerves was diffused, while no spread to the paravertebral space and anterior rami. Elsharkawy H [32] described the paravertebral space infiltrated was not observed too. The optimum concentration and volume of LA in ESPB have not been described in the clinical guideline. Only one RCT [33] make a comparison between different concentration of bupivacaine. Therefore, future research should focus on investigating the pattern of LA spread and impact of LA concentration and volume in ESPB.

Several factors may account for the extensive heterogeneity of the analysis. First, various severity of illness and surgery types (open and endoscopic surgeries) are undoubtedly play an important role in heterogeneity, Second, opioid (fentanyl, tramadol, morphine and so on) doses were not converted to morphine-equivalent doses which could make a wide dissimilarity between the data. Besides, utilizing supplementary analgesics such as paracetamol[25, 26]added an extra heterogeneity, Last, a short of clinical studies to use this technique make a difference among those studies.

Several notable limitations should be considered when interpreting the results. Firstly, the trials included have a modest sample size which could magnify the treatment effect. Secondly, the substantial heterogeneous make our results less convincing. Furthermore, owing to all patients were under GA surgeries, sensory blocking could not be evaluated adequately to detect potential block failures in all trails included.

Conclusion

In summary, ESPB block provide an effective analgesic and serve as a promising alternative option for postoperative pain management. However, the results should be interpreted cautiously since insufficient evidence, although accumulating. Further large-scale RCTs are required to support our results.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

The authors declare that they have no competing interests

Funding

Not applicable.

Authors' contributions

JH and JC L participated in the entire procedure including the design and coordination of the study, the literature search, data extraction, performed the statistical analysis, drafted the manuscript, revised submitted the manuscript. All authors read and approved the final manuscript.

Acknowledgements

Not applicable.

Authors' information

First Affiliated Hospital of Guangxi Medical University,6 shuangyong Road, Nanning 530021, Guangxi Zhuang Autonomous Region, P.R. china.

Jiao Huang, Jingchen Liu

Corresponding author: Jingchen Liu

Abbreviations

ESPB: erector Spinae Plane Block;

GA: general anesthesia;

LA: local anesthetic;

RCTs: randomized controlled trials;

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta Analyses;

RCTs: American Society of Anesthesiologists;

PONV: postoperative nausea or vomiting RRs: relative risks;

SD: standard deviation;

SMDs: confidence intervals (CIs) standardized mean differences;

PCA: patient-controlled analgesia device

References

1. Chin KJ, Adhikary S, Sarwani N, Forero M: The analgesic efficacy of pre-operative bilateral erector spinae plane (ESP) blocks in patients having ventral hernia repair. *Anaesthesia* 2017, 72(4):452-460.
2. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ: The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain. *Regional anesthesia and pain medicine* 2016, 41(5):621-627.
3. Altinpulluk EY, Ozdilek A, Colakoglu N, Beyoglu CA, Ertas A, Uzel M, Yildirim FG, Altindas F: Bilateral postoperative ultrasound-guided erector spinae plane block in open abdominal hysterectomy: a case series and cadaveric investigation. *Romanian journal of anaesthesia and intensive care* 2019, 26(1):83-88.
4. Ahiskalioglu A, Alici HA, Ciftci B, Celik M, Karaca O: Continuous ultrasound guided erector spinae plane block for the management of chronic pain. *Anaesthesia, critical care & pain medicine* 2019, 38(4):395-396.
5. Ahiskalioglu A, Kocak AO, Doymus O, Sengun E, Celik M, Alici HA: Erector spinae plane block for bilateral lumbar transverse process fracture in emergency department: A new indication. *The American journal of emergency medicine* 2018, 36(10):1927.e1923-1927.e1924.
6. Bang S, Chung J, Kwon W, Yoo S, Soh H, Lee SM: Erector spinae plane block for multimodal analgesia after wide midline laparotomy: A case report. *Medicine* 2019, 98(20):e15654.
7. Aydin ME, Ahiskalioglu A, Tekin E, Ozkaya F, Ahiskalioglu EO, Bayramoglu A: Relief of refractory renal colic in emergency department: A novel indication for ultrasound guided erector spinae plane block. *The American journal of emergency medicine* 2019, 37(4):794.e791-794.e793.

8. Moher D, Liberati A, Tetzlaff J, Altman DG: Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Bmj* 2009, 339:b2535.
9. Cochrane handbook for systematic reviews of interventions version 6. <https://training.cochrane.org/handbook>
10. Hozo SP, Djulbegovic B, Hozo I: Estimating the mean and variance from the median, range, and the size of a sample. *BMC Med Res Methodol* 2005, 5:13.
11. Higgins JP, Altman DG, Gotzsche PC, Juni P, Moher D, Oxman AD, Savovic J, Schulz KF, Weeks L, Sterne JA: The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *Bmj* 2011, 343:d5928.
12. Higgins JP, Thompson SG, Deeks JJ, Altman DG: Measuring inconsistency in meta-analyses. *Bmj* 2003, 327(7414):557-560.
13. Krishna SN, Chauhan S, Bhoi D, Kaushal B, Hasija S, Sangdup T, Bisoi AK: Bilateral Erector Spinae Plane Block for Acute Post-Surgical Pain in Adult Cardiac Surgical Patients: A Randomized Controlled Trial. *Journal of cardiothoracic and vascular anesthesia* 2019, 33(2):368-375.
14. Macaire P, Ho N, Nguyen T, Nguyen B, Vu V, Quach C, Roques V, Capdevila X: Ultrasound-Guided Continuous Thoracic Erector Spinae Plane Block Within an Enhanced Recovery Program Is Associated with Decreased Opioid Consumption and Improved Patient Postoperative Rehabilitation After Open Cardiac Surgery-A Patient-Matched, Controlled Before-and-After Study. *Journal of cardiothoracic and vascular anesthesia* 2019, 33(6):1659-1667.
15. Breebaart MB, Van Aken D, De Fre O, Sermeus L, Kamerling N, de Jong L, Michielsen J, Roelant E, Saldien V, Versyck B: A prospective randomized double-blind trial of the efficacy of a bilateral lumbar erector spinae block on the 24h morphine consumption after posterior lumbar inter-body fusion surgery. *Trials* 2019, 20(1):441.
16. Urits I, Charipova K, Gress K, Laughlin P, Orhurhu V, Kaye AD, Viswanath O: Expanding Role of the Erector Spinae Plane Block for Postoperative and Chronic Pain Management. *Current pain and headache reports* 2019, 23(10):71.
17. Singh S, Choudhary NK, Lalin D, Verma VK: Bilateral Ultrasound-guided Erector Spinae Plane Block for Postoperative Analgesia in Lumbar Spine Surgery: A Randomized Control Trial. *Journal of neurosurgical anesthesiology* 2019.
18. Tulgar S, Kose HC, Selvi O, Senturk O, Thomas DT, Ermis MN, Ozer Z: Comparison of Ultrasound-Guided Lumbar Erector Spinae Plane Block and Transmuscular Quadratus Lumborum Block for Postoperative Analgesia in Hip and Proximal Femur Surgery: A Prospective Randomized Feasibility Study. *Anesthesia, essays and researches* 2018, 12(4):825-831.
19. Ciftci B, Ekinci M, Celik EC, Tukac IC, Bayrak Y, Atalay YO: Efficacy of an Ultrasound-Guided Erector Spinae Plane Block for Postoperative Analgesia Management After Video-Assisted Thoracic Surgery: A Prospective Randomized Study. *Journal of cardiothoracic and vascular anesthesia* 2019.
20. Gurkan Y, Aksu C, Kus A, Yorukoglu UH: Erector spinae plane block and thoracic paravertebral block for breast surgery compared to IV-morphine: A randomized controlled trial. *Journal of clinical anesthesia* 2019, 59:84-88.
21. Hamed MA, Goda AS, Basiony MM, Fargaly OS, Abdelhady MA: Erector spinae plane block for postoperative analgesia in patients undergoing total abdominal hysterectomy: a randomized controlled study original study. *Journal of pain research* 2019, 12:1393-1398.
22. Tulgar S, Kapakli MS, Senturk O, Selvi O, Serifsoy TE, Ozer Z: Evaluation of ultrasound-guided erector spinae plane block for postoperative analgesia in laparoscopic cholecystectomy: A prospective, randomized, controlled clinical trial. *Journal of clinical anesthesia* 2018, 49:101-106.
23. Yayik AM, Cesur S, Ozturk F, Ahiskalioglu A, Ay AN, Celik EC, Karaavci NC: Postoperative Analgesic Efficacy of the Ultrasound-Guided Erector Spinae Plane Block in Patients Undergoing Lumbar Spinal Decompression Surgery: A Randomized Controlled Study. *World Neurosurg* 2019, 126:e779-e785.

24. Aksu C, Kuş A, Yörükoğlu HU, Kılıç CT, Gürkan Y: The Effect of Erector Spinae Plane Block on Postoperative Pain Following Laparoscopic Cholecystectomy: A Randomized Controlled Study. *JARSS* 2019, 27(1):9-14.
25. Gurkan Y, Aksu C, Kus A, Yorukoglu UH, Kilic CT: Ultrasound guided erector spinae plane block reduces postoperative opioid consumption following breast surgery: A randomized controlled study. *Journal of clinical anesthesia* 2018, 50:65-68.
26. Abu Elyazed MM, Mostafa SF, Abdelghany MS, Eid GM: Ultrasound-Guided Erector Spinae Plane Block in Patients Undergoing Open Epigastric Hernia Repair: A Prospective Randomized Controlled Study. *Anesthesia and analgesia* 2019, 129(1):235-240.
27. Singh S, Kumar G, Akhileshwar: Ultrasound-guided erector spinae plane block for postoperative analgesia in modified radical mastectomy: A randomised control study. *Indian journal of anaesthesia* 2019, 63(3):200-204.
28. Jørgensen H, Wetterslev J, Møiniche S, Dahl JB: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery. In: *Cochrane Database Syst. rev.* 2000; 2000: 4:CD001893.
29. Apfel CC, Laara E, Koivuranta M, Greim CA, Roewer N: A simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross-validations between two centers. *Anesthesiology* 1999, 91(3):693-700.
30. Chin KJ, Malhas L, Perlas A: The Erector Spinae Plane Block Provides Visceral Abdominal Analgesia in Bariatric Surgery: A Report of 3 Cases. *Regional anesthesia and pain medicine* 2017, 42(3):372-376.
31. Aponte A, Sala-Blanch X, Prats-Galino A, Masdeu J, Moreno LA, Sermeus LA: Anatomical evaluation of the extent of spread in the erector spinae plane block: a cadaveric study. *Canadian journal of anaesthesia = Journal canadien d'anesthésie* 2019, 66(8):886-893.
32. Elsharkawy H, Bajracharya GR, El-Boghdadly K, Drake RL, Mariano ER: Comparing two posterior quadratus lumborum block approaches with low thoracic erector spinae plane block: an anatomic study. *Regional anesthesia and pain medicine* 2019.
33. Altıparmak B, Korkmaz Toker M, Uysal AI, Gumus Demirbilek S: Comparison of the efficacy of erector spinae plane block performed with different concentrations of bupivacaine on postoperative analgesia after mastectomy surgery: randomized, prospective, double blinded trial. *BMC anesthesiology* 2019, 19(1):31.

Tables

Table1: main characteristics of randomized controlled trials included in the meta-analysis.

Table2: Outcome data of RCTs included in the meta-analysis.

Figures

	No. Of patients	Surgical procedure	ASA Patient Characteristics	ESPB group	Control group	GA induction
Abu Elyazed et al (2019)	60(30/30)	Midline epigastric hernia repair	I-II 18-65 years of age	Bilateral ultrasound-Guided at the level of transverse process using 10 mL of bupivacaine 0.25% on each side	Bilateral sham erector spina T7 plane block using 1 mL of normal saline	Propofol 2-2.5 mg/kg and fentanyl 1µg/kg, Cisatracurium 0.15mg/kg
Tulgar et al (2018)	30(15/15)	Laparoscopic cholecystectomy	I-II 18-65 years of age	Bilateral ultrasound-Guided at the level of transverse process using 10 mL of bupivacaine 0.375% on each side	Received no intervention	Propofol 2-3 mg kg ⁻¹ , fentanyl 100 µg and rocuronium bromide 0.6 mg kg ⁻¹
Gürkan et al (2018)	50(25/25)	Elective breast cancer surgery	I-II Aged 20-65 years	Ultrasound (US)-guided ESP block with 20 ml 0.25% bupivacaine at the T4 vertebral level	Received no intervention	Propofol (2-3 mg kg ⁻¹) and fentanyl (2 mg kg ⁻¹) iv, rocuronium 0.6 mg kg ⁻¹
Singh et al (2019)	40(20/20)	Elective lumbar spine surgery	I-II 18-65 years of age	Ultrasound (US)-guided ESP block with total 20 ml 0.5% bupivacaine at the T10 vertebral level	Received no intervention	Propofol 2 to3 mg/kg, morphine 0.1 mg/kg and vecuronium 0.1 mg/kg
Gürkan et al (2019)	50(25/25)	Elective unilateral breast surgery	I-II Aged 18-65 years	Ultrasound (US) guided ESP block with 20 ml	Received no intervention	Propofol (2-3 mg kg ⁻¹) and fentanyl

0.25%
bupivacaine
at the T4
vertebral level

(2 µg kg⁻¹) iv
and
rocuronium 0.6
mg kg⁻¹

Singh et al (2019)	40(20/20)	Modified radical mastectomy	I-II	Female patients between 20 -55 years	Ultrasound (US)-guided ESP block with total 20 ml 0.5% bupivacaine at the T5 vertebral level	Received no intervention	Propofol 2-3 mg kg ⁻¹ □ morphine 0.1 mg kg ⁻¹ □ and vecuronium 0.1 mg kg ⁻¹
Aksu et al (2019)	46(23/23)	Laparoscopic Cholecystectomy	I-II	20-75 years of age	Ultrasound (US) guided ESP block with 20 ml 0.25% bupivacaine at the T5-6 vertebral level	Received no intervention	Propofol (2-3 mg kg ⁻¹) and fentanyl (2 mg kg ⁻¹) iv and Rocuronium (0.6 mg kg ⁻¹) IV
Ciftci et al (2019)	60(30/30)	Video-Assisted Thoracic surgery	I-II	18-65 years of age	Ultrasound guided Bilateral ESP block with 20ml of 0.375% bupivacaine at the T5 vertebral level	Received no intervention	Propofol (2-2.5 mg/kg) and fentanyl (1-1.5 mg/kg) and rocuronium bromide (0.6mg/kg)
Yayik et al (2019)	60(30/30)	Lumbar Spinal Decompression Surgery	I-□	18-65 years of age	Ultrasound guided Bilateral ESP block with 0.25% bupivacaine 20 mL at the L3 vertebral level	No intervention was performed	2 mg/kg IV propofol □ 0.6 mg/kg IV rocuronium and 2 mcg/kg IV fentanyl
Hamed et al (2019)	60(30/30)	Abdominal hysterectomy	I-□	Women aged 40-70 years old and weighed	Ultrasound-guided ESPB at T9 vertebrae level with	Underwent the same procedure	Fentanyl 2 mcg.kg ⁻¹ and propofol 2 mg.kg ¹

50-90 kg 20 ml but had a Followed by
 bupivacaine 0.5% sham injection 0.5 mg.kg-1
 (20 ml of saline)

[Tulgar et al \(2018\)](#) 40(20/20) Hip and proximal femur surgery I-□ Aged 18-65 years Ultrasound-guided ESPB at T9 vertebrae same level with 20 ml bupivacaine 0.5%, 10 ml lidocaine 2%, 10 ml normal saline Underwent the procedure but had no block Propofol 2-3mg/kg, fentanyl 100 µg and rocuronium bromide 0.6 mg/kg.

Outcome	Studies include	RR or Std.mean difference [95%CI]	P-value for statistical significance	P-value for heterogeneity	I ² test for heterogeneity
Opioid consumption in the first 24 hour(mg)	17-27	-2.15[-2.76,-1.53]	<0.00001	<0.00001	88%
VAS/NRS scores at the 1st hour	17,18,20,24,27	-0.97[-1.84,-0.1]	0.03	<0.00001	89%
VAS/NRS scores at the 6th hour	17,18,20,21,24,25,27	-0.64[-1.05,-0.23]	0.002	0.01	65%
VAS/NRS scores at the 12th hour	17,18,20,21,24,25,27	-0.16[-0.66,0.33]	0.51	0.0008	76%
VAS/NRS scores at the 24th hour	17-21,25,27,	-0.83[-1.78,0.12]	0.09	0.0001	94%
Rescue analgesia requirement(n)	18,19,22,23,26	0.41[0.25,0.66]	0.0002	0.006	67%
Time to first rescue analgesic(min)	17,23,26	4.56[1.89,7.22]	0.0008	0.00001	95%
POVN(postoperative nausea and vomiting)	17-19,21,24-27	0.45[0.20,1.00]	0.05	<0.00001	84%

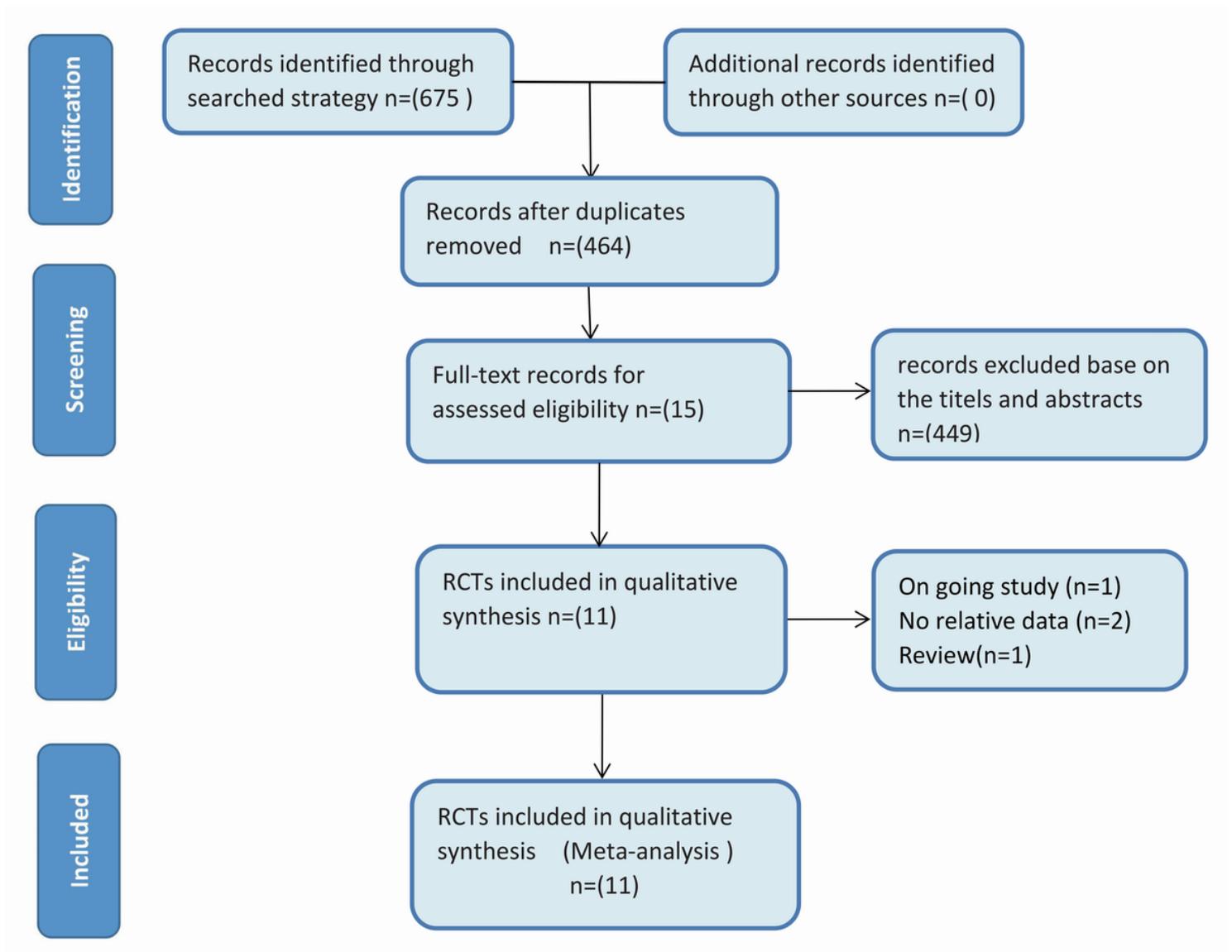


Figure 1

PRISMA flow diagram showing literature search results.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Abu Elyazed 2019	+	+	+	+	?	+	+
Aksu 2019	+	+	?	+	+	+	+
Ciftci 2019	+	?	+	+	+	+	+
Gürkan 2018	+	?	?	+	+	+	+
Gürkan 2019	+	+	+	+	+	+	+
Hamed 2019	+	+	+	+	+	+	+
Singh2019	+	?	+	+	+	+	+
Singh 2019	+	?	+	+	+	+	+
Tulgar 2018	+	+	+	+	+	+	+
Tulgar 2018	+	+	+	+	+	+	+
Yayik 2019	?	?	?	+	+	+	+

Figure 2

Risk of bias.

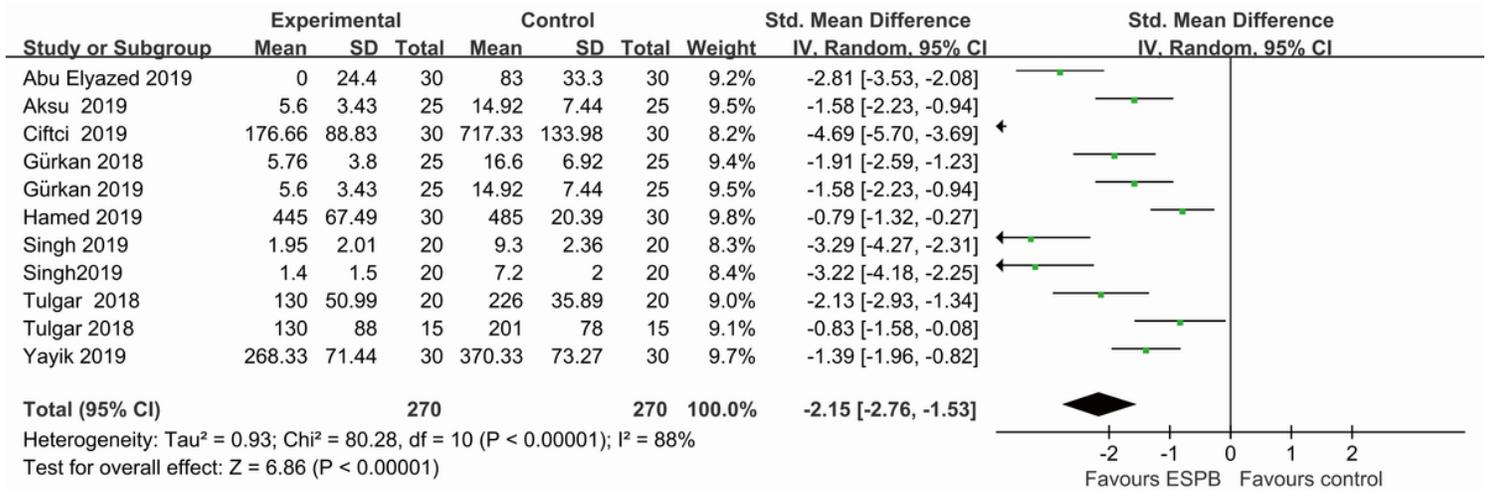


Figure 3

Forest plots of morphine consumption during the first 24 hour after surgery.

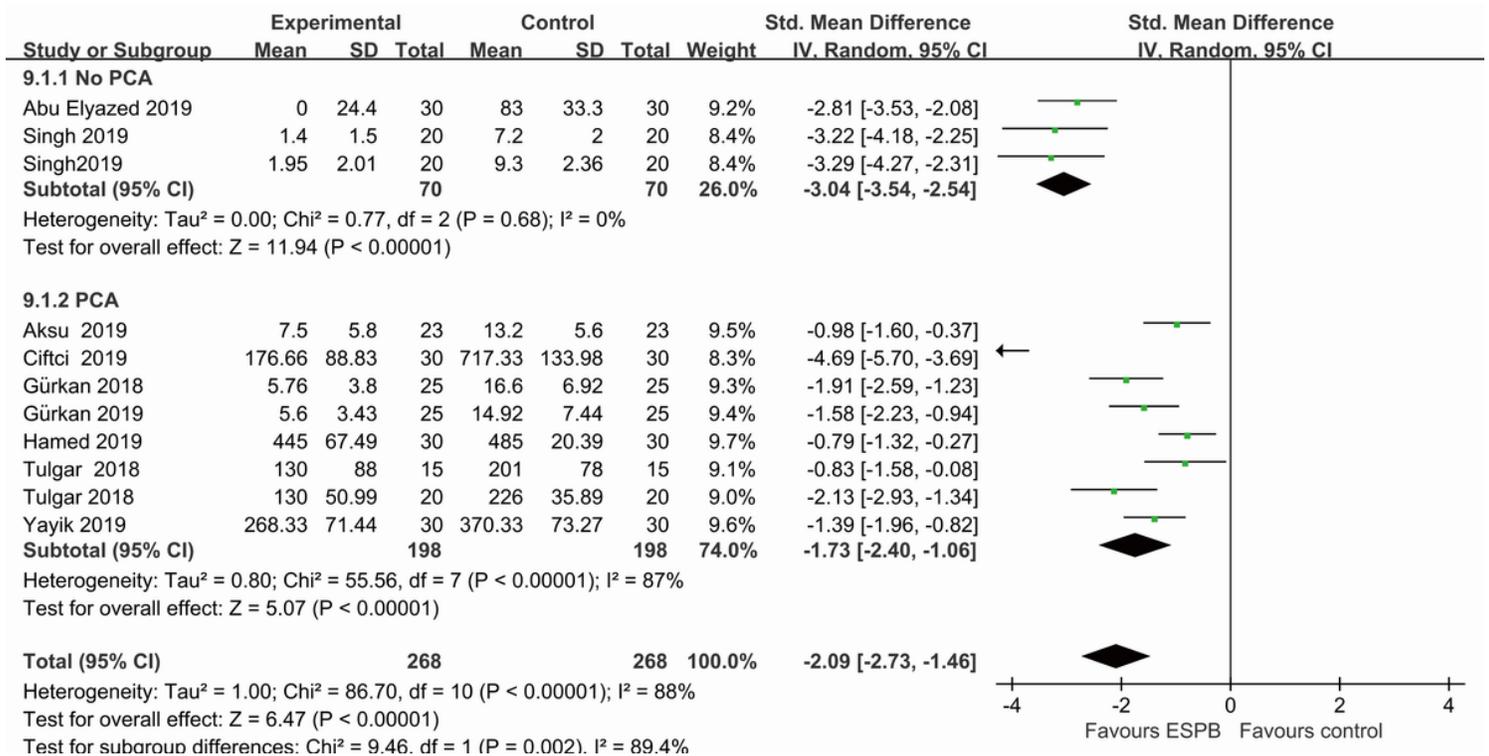


Figure 4

Forest plots showing the subgroup analysis of the primary outcome (in the first 24 h morphine consumption) according to PCA

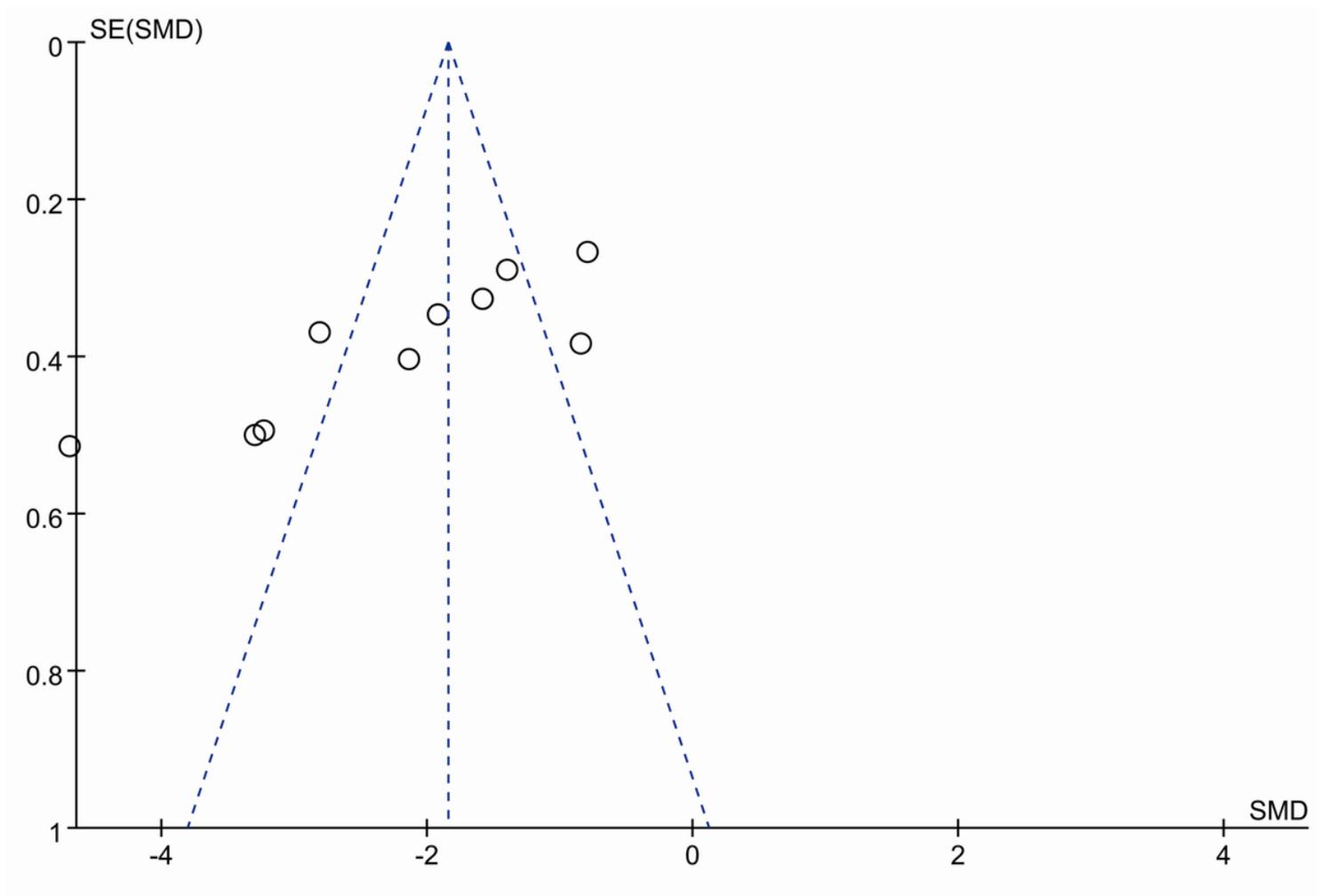


Figure 5

Funnel plot evaluating publication bias.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [PRISMAchecklist.doc](#)