Review Article

Narrative review: erector spinae block in spine surgery

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Background: Lumbar spine surgery is an ever-increasing procedure with multiple analgesia techniques utilized for postoperative pain control. More recently, erector spinae plane (ESP) blocks have been used to limit the use of opioids after surgery. The authors aimed to review the current literature on ESP blocks and its potential use in the outpatient setting.

Methods: Several randomized controlled trials were evaluated that compared erector spinae block to traditional anesthesia where the primary outcome of postoperative opioid use was assessed. Randomized control trials comparative studies were also evaluated to assess erector spinae block effect on outpatient procedures. Secondary outcomes include, postoperative pain, patient satisfaction, patient length of stay, and post-operative complications.

Key Content and Findings: Erector spinae block was found in general to lower postoperative opioid use compared to traditional anesthesia. In addition, the authors found improved patient satisfaction and less postoperative pain in the erector spinae cohort. Post-operative complications were lower in the erector spinae block group compared to traditional anesthesia, especially in regards to vomiting and nausea.

Conclusions: While these studies do possess their limitations due to the low number of randomized control studies on erector spinae block, early data does suggest that erector spinae block appears to be superior to that of traditional anesthesia for those undergoing spine surgery.

Keywords: Erector spinae block; lumbar surgery; orthopedics

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Introduction

Background

Chronic lower back pain is one of the leading causes of disability worldwide (1). Substantial heterogeneity among the available low back pain epidemiological studies may limit the ability to compare data. However, the most frequently quoted epidemiological studies cite a 1-year incidence of a first-ever episode of low back pain between 6.3% and 15.4%, while estimates of the 1-year incidence of any episode of low back pain range between 1.5% and 36% (2). With such varying causes of lower back pain, treatment options are vast with surgical intervention seen as a last resort behind a multimodal treatment regimen including a regular exercise program, weight loss, psychotherapy, injections, and medications (3). Despite this, the rate of lumbar spine surgery has steadily increased in recent decades with varying success in reducing back pain (1,4).

Rationale & knowledge gap

Recent increases in the number of cases arising from

chronic low back pain and the introduction of minimally invasive spine surgery has required clinical innovation and technological advances to expand rapidly (5). Surgeries ranging from single-level decompression to multi-stage extensive reconstruction often require unique planning and execution to provide the best outcome for patients (5). The traditional methods of anesthesia used are often either general anesthesia or regional anesthesia (5,6). A specific subset of regional anesthesia includes neuraxial anesthesia that is delivered usually in the epidural or subdural space surrounding the spinal cord, whereas other types of regional anesthesia are delivered directly to specific nerve plexus or nerves. Neuraxial anesthesia is often used during for surgical anesthesia while peripheral nerve root blocks are often used for postoperative analgesia (7).

Two types of regional anesthesia dominate in spine surgery: spinal anesthesia delivered via injection and epidural anesthesia delivered via catheter infusion (8). Spinal anesthesia is often considered superior to epidural anesthesia due to its single shot injection delivery, smaller dose, and shorter onset duration (9). Various advantages of regional anesthesia compared to general anesthesia in lower trunk procedures have been noted and include: reduced intraoperative blood loss, perioperative cardiac ischemic events, arterial/venous thrombosis, hypoxic episodes, and pulmonary complications (10,11). Shorter procedure times and a cleaner operative field are often seen when using regional anesthetics (12-14). Despite various advantages, this method is infrequently used due to anesthesiologist's preference for general anesthesia due to potential need for secure airway establishment and a lack of ability to easily extend the duration of an operation (15). Furthermore, a lower acceptance of the newer method by patients occurs due to their preference to be unaware during their procedure (15). Patients also seem to perceive general anesthesia as being safer than regional or neuraxial anesthesia (15,16). Regional and neuraxial anesthesia can also present with many side effects discouraging its use. These side effects include increased hypertension during recovery and increased risk for cauda equina syndrome for those with spinal stenosis and herniated disks (15). Contraindications most commonly include patient refusal, inability to stay still, localized sepsis, increased intracranial pressure leading to herniation risk, and patients with coagulopathies (9).

Erector spinae plane (ESP) block is a fairly novel method of anesthesia postoperatively for patients undergoing spine surgery. Forero *et al.* [2016] first conducted erector spinae block (ESB) for patients with neuropathic pain. As the patient is in the sitting, decubitus, or prone position, the surgeon uses ultrasound to guide the needle in a cephalo-caudal manner into the fascial plane between the transverse process and erector spinae muscles (17-19). The single shot appears to be the preferred method of administration (20). While many physicians assert that their patients have experienced immediate benefit and decreased pain medication consumption after ESB, the exact mechanism still remains unclear. As anesthesia is administered, it spreads in a cranial-caudal manner to act on the dorsal ramus (18). However, many studies indicate that the anesthesia can spread paravertebrally to also block the ventral rami and posterior epidural space (21,22). Ivanusic *et al.* [2018] conducted a cadaveric study demonstrating that the ESP block can spread laterally to block the lateral cutaneous nerve (23). The study demonstrates that ESP appears to be inadequate to cover the axillary region during axillary dissection (23,24). Ueshima *et al.*, supports Ivanusic's claims in that ESP block did not cover anterior branches of the intercostal nerves and should not be the sole technique for regional analgesia (24,25).

Many studies have used ESP block for several different indications at various levels of the spinal cord. At the thoracic level, ESP block is injected usually around the level of T5 vertebrae (26,27). Indications for ESP block in thoracic surgery include thoracotomy, pleurodesis, breast surgery, and minimally invasive lung resection (26-28). At the abdominal level, ESP block is typically injected around the T8–T10 vertebrae level (26,29). Indications for ESP block in abdominal surgery include hernia repair, and cholecystectomy (21,29). Lastly for lumbar spine surgery, ESP block is injected around the L3–L5 level typically at a dose of >3 mL to cover one vertebral column (30,31). The effect of ESP block is still not clearly understood in the context of spine surgery, leading to many recent randomized control trials.

Objective

There have been several prospective studies evaluating ESP blocks effectiveness in reducing postoperative pain and opioid consumption. This narrative review article aims to summarize the findings from the major prospective randomized control studies evaluating ESP block for postoperative pain after spine surgery, and its associated complications compared to traditional anesthesia. We

present this article in accordance with the Narrative Review reporting checklist (available at https://jss.amegroups.com/article/view/10.21037/jss-23-14/rc).

Methods

This review article summary of ESB for spine surgery was developed by using a PubMed search for randomized control trials, prospective studies and retrospective studies. The search terms "ESPB spine surgery", "ESB spine surgery", "ESB decompression", "ESB transforaminal lumbar interbody fusion", "ESPB", and "erector spinae plane block" free-text words were used. There was no parameter set on the years for search, nor any parameters set for papers only in English.

The strength and quality of the randomized control trials were assessed using NIH Quality Assessment of Controlled Intervention Studies with two different reviewers as per the guidelines (*Table 1*).

Main findings

Opioid consumption

Many studies have evaluated opioid consumption for postoperative pain in patients receiving traditional anesthesia compared to those receiving an ESP block (32-39). *Table 2* indicates that most prospective studies have demonstrated a statistically significant difference in opioid consumption in those receiving ESP block compared to traditional anesthesia (32-39). The pain-relieving effects of ESP block lowered opioid consumption compared to control and its effects lasted up to 48 hours post-surgery (32,34-39).

In terms of decompression surgery, Finnerty *et al.* [2021] found inconclusive evidence of a decrease in postoperative opioid consumption, as the cumulative mean [SD] of oxycodone consumption within 24 hours was 27 [18] mg in the control group and 19 [26] mg after block (P=0.20) (20). However, Finnerty *et al.* [2021] does report a higher intraoperative opioid consumption in the control group; mean (SD) 8.7 (4.8) mg as opposed to 5.7 (3.9) mg in the ESP block group (P=0.010) (20). To further evaluate decompression, Yayik *et al.* [2019] reports the 24-hour tramadol consumption in the control group was significantly higher compared with the ESB Group (370.33±73.27 and 268.33±71.44 mg; P<0.001, respectively) (40).

While these differences are statistically significant, they do not necessarily seem to confer a clinically significant result in the short-term. Thus, it may be prudent for more studies to evaluate the long-term effects of ESP block on opioid consumption, since many studies evaluating short-term effects seem to only find minimal short-term benefits that return to baseline after a maximum 2-day duration. In addition, opioid consumption may be affected by other multimodal agents used intraoperatively that may explain why reduced opioid consumption was only effective up to 48 hours postoperatively. The difference in regimens used in the ESP blocks makes it difficult to compare Randomized Controlled Trials (RCTs) due to the lack of a standardized regimen.

Patient pain score

Numerical rating scores (NRS) and visual analog scores (VAS) were the two most prominent methods of assessing patient pain among the studies comparing ESP block to control for spine surgery. In all studies evaluated, a significant statistical difference in post-operative pain was noted in both VAS and NRS (32,33,35-39). The debate remains as to how long the effects last on postoperative pain. Yeşiltaş *et al.* [2021] cited a statistically significant difference in pain between ESP block and the control group up until 12 hours post-operation (36). Ciftci *et al.* [2021] also found a significant statistical difference in VAS scores in ESB compared to control up to 16 hours post-operation (39). However, the majority of all studies found statistically significant differences in pain scores at all time points after surgery (39).

For studies on decompression surgery, the results were mixed in regard to 24 hours post-operation. For all time points prior to 24 hours, there was a statistically significant difference with those in the control group reporting a higher pain score than the ESP block. Yayik *et al.* [2019] reports VAS scale was statistically different at 24 hours in the control than ESP: at rest 2.83±1.51 *vs.* 2.00±1.36 (P=0.029) and on sitting 3.23±0.77 *vs.* 2.30±1.06 (P<0.001) (40). However, Finnerty *et al.* [2021] found no statistically significant difference 24 hours after surgery (20). A statistically significant difference at 12 postoperative hours was greater in control participants than block participants: at rest, 3.5 (2.6) *vs.* 2.1 (1.9) (P=0.021); and on sitting, 5.6 (2.5) *vs.* 2.5 (3.8) (P<0.001) (20).

Patient satisfaction

Singh *et al.* [2020] compared patient satisfaction outcomes in patients receiving ESP block preoperatively *vs* control

Table 1 NIH quality assessment

Quality assessment question	Singh *et al.* (32)	Asar *et al.* (33)	Nashibi *et al.* (34)	Vergari *et al.* (35)	Finnerty *et al.* (20)	Yeşiltaş *et al.* (36)	Yu *et al.* (37)	Zhu *et al.* (38)	Ciftci *et al.* (39)
1. Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	✔	✔	✔	✔	✔	✔	✔	✔	✔
2. Was the method of randomization adequate (i.e., use of randomly generated assignment)?	✔	✔	✔	✔	✔	✔	✔		✔
3. Was the treatment allocation concealed (so that assignments could not be predicted)?	✔	✔	✔	✔	✔	✔			
4. Were study participants and providers blinded to treatment group assignment?		✔	✔			✔			
5. Were the people assessing the outcomes blinded to the participants' group assignments?		✔	✔			✔			✔
6. Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?	✔	✔	✔	✔	✔	✔	✔	✔	✔
7. Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	✔	✔	✔	✔	✔	✔	✔	✔	✔
8. Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?	✔	✔	✔	✔	✔	✔	✔	✔	✔
9. Was there high adherence to the intervention protocols for each treatment group?	✔	✔	✔	✔	✔	✔	✔	✔	✔
10. Were other interventions avoided or similar in the groups (e.g., similar background treatments)?	✔	✔		✔	✔	✔	✔	✔	✔
11. Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	✔	✔	✔	✔	✔	✔	✔	✔	✔
12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	✔	✔	✔		✔	✔			✔
13. Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?							✔	✔	✔
14. Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?		✔	✔	✔	✔	✔	✔	✔	✔
Quality rating (out of 14)	10	13	12	11	11	13	10	9	12

NIH, National Institutes of Health; RCT, randomized controlled trial.

Table 2 Prospective studies evaluation opioid consumption with erector spinae blocks

Article	Type of study	#Subjects	Groups	Anesthesia used per phase	Opioid consumption	Patient reported pain	Patient satisfaction (talk about scale)	LOS/PLOS	Postoperative complications	Adjuvants used
Singh *et al.*, 2019 (32)	RCT	40	Control; ESPB group received bilateral 20 mL of 0.5% bupivacaine	Induction: propofol + morphine; intubation: vecuronium; maintenance: isoflurane + nitrous oxide + oxygen	The cumulative morphine requirement in the 24 h after surgery was significantly lower in the ESP block compared with that in the control group (1.4±1.5 *vs.* 7.2±2.0 mg; P<0.001)	Numerica Rating Scale Pain scores immediately after surgery (P=0.001), 6 h (P=0.002), and 8 h (P=0.001) after surgery significantly different between control and ESP group	Patients in the ESP block group were more satisfied than those in the control group; the mean satisfaction scores were 5.5 (0.74) and 7.7 (0.45) in the control and ESP block groups, respectively (P<0.0001)	N/A	2 patients in the control group developed nausea and vomiting; 0 patient in the ESP group had any post-operative complications	Fentanyl used in intraoperative analgesia
Asar *et al.*, 2021 (33)	RCT	78	Control; ESPB group received bilateral 10 mL 0.5% bupivacaine + 5 mL of 2% lidocaine, + 5 mL of 0.9% NaCl	Induction: propofol + fentanyl + rocuronium; maintenance: sevoflurane + oxygen	Opioid (paracetamol) consumption (P=0.0003), PCA button pressing number (P=0.000), Rescue diclofenac (P=0.043), Meperidine requirement in PACU (P=0.046), and Total morphine consumption (P=0.000) all statistically significant lower in ESPB	Numerical Rating Scale numbers statistically significant at 6 (P=0.000), 12 (P=0.000), and 24 h post-operation (P=0.007)	N/A	N/A	Not statistically significant	Tramodol + paracetamol IV were applied to both groups 30 min before the end of surgery; remifentanil used in Intraoperative analgesia; control group received sugammadex at end of surgery
Nashibi *et al.*, 2022 (34)	RCT	40	Control; ESPB group received bilateral 20 mL of 0.25% bupivacaine	Induction: propofol, atracurium, and lidocaine; maintenance: propofol + atracurium	Meperidine consumption was 57.50±45.95 mg in control group and 22.50±32.34 in ESP block which was statistically higher in control group (P=0.01)	Numerical Rating Scale Pain scores statistically significant at all times (1, 2, 4, 6, 12, 24 h post-operation)	N/A	N/A	Not statistically significant	Premedication: midazolam + fentanyl for all patients; IV morphine at beginning of surgery for both groups; IV paracetamol at end of surgery for both groups
Vergari *et al.*, 2022 (35)	RCT	60	Control; ESPB group received bilateral 40 mL of 0.375% ropivacaine	Induction: propofol + sufentanil; intubation: rocuronium; maintenance: propofol + sufentanil	Total sufentanil tablets consumption of 17±6 and 10±3 mg at 48 h for control group and ESPB group, respectively (P<0.001)	Numerical Rating Scale Pain values statistically significant: 1.9±1.5 in ESPB group and 5.9±1.6 in control group (P<0.001)	N/A	Statistically significant: 30 (100%) patients in the control group and 22 (73.3%) in ESPB group were discharged after 72 hours (P=0.005)	No complications in either group	NR
Finnerty *et al.*, 2021 (20)	RCT	60	Control; ESPB group received bilateral 40 mL levobupivacaine 0.25%	Induction: propofol + fentanyl; intubation: neuromuscular blockade; maintenance: sevoflurane + oxygen	The cumulative mean oxycodone consumption to 24 h was 27±18 mg in the control group and 19±26 mg after block, P=0.20; not statistically significant	Mean pain at 12 h postoperative was greater in control participants than block participants: at rest, 3.5±2.6 *vs.* 2.1±1.9, P=0.021; and on sitting, 5.6±2.5 *vs.* 2.5±3.8, P<0.001	N/A	N/A	Not statistically significant	IV paracetamol and dexketoprofen given to all patients unless contraindicated; IV ondasetron and dexamethasone for anti-emesis; IV oxycodone to reduce systolic blood pressure
Yeşiltaş *et al.*, 2021 (36)	RCT	56	Control; ESPB group received bilateral 20-mL of 0.25% bupivacaine and 1.0% lidocaine	Sedation: midazolam; induction: fentanyl citrate + propofol + rocuronium; maintenance: sevoflurane + remifentanil; facilitation of dissecting muscles bilaterally: rocuronium	Morphine consumption was stastisctially significantly higher in the controls within the first postoperative 24-h in the ESPB participants (44.75±12.3 *vs.* 33.75±6.81 mg, P<0.001)	Except for postoperative 24th-hour VAS (P=0.127), all postoperative VAS scores recorded at all time-points (0, 1, 2, 6 and 12 h) were significantly higher in the controls (P<0.05)	Patient satisfaction scores were on average 4.54±0.8 in ESPB *vs.* 3.14±1.3 in the control group (P<0.001)	PLOS was significantly longer in the control participants than ESPB participants (3.3±0.98 *vs.* 1.71±0.76 days, P<0.001)	Not statistically significant	Atropine for symptomatic bradycardia; IV paracetamol + tramadol 30 min before end of surgery
Yu *et al.*, 2021 (37)	RCT	80	Control; ESPB received bilateral 30 mL of 0.25% bupivacaine	Induction: sufentanil + propofol; intubation: rocuronium; maintenance: propofol + remifentanil	Significantly fewer patients required sufentanil in the ESP-PCA group than in the PCA group (all P<0.0001); pethidine for rescue analgesia in PCA group was significantly higher than that in ESP-PCA group (245±13.13 *vs.* 96.25±13.68 mg, P=0.0001)	Numeric Rating Scale Pain at rest and during movement at 6, 12, and 24 h was lower in the ESP-PCA group (P<0.001, P<0.001, P<0.0016 at rest; all P<0.001 during movement)	N/A	Post HLOS statistically significant (12.38±0.315 in ESP-PCA *vs.* 14.78±0.333 days in PCA, P=0.0001)	Post operative nausea was statistically significant (P=0.001) 4 people (10%) in ESP-PCA *vs.* 17 people (42%) in PCA; post operative vomiting was statistically significant (P=0.001) 3 people (7.5%) in ESP-PCA *vs.* 16 people (40%) in PCA	IV infusion of colloidal solution before induction; tropisetron IV to prevent nausea
Zhu *et al.*, 2021 (38)	RCT	40	Control; ESPB received bilateral 20 mL 0.375% ropivacaine	Induction: sufentanil + rocuronium + propofol; maintenance: propofol + remifentanil	Oxycodone consumption in the first 48 h after surgery was significantly lower in the ropivacaine group than in the saline group [23.10 mg total (22.56–39.20) and 36.4 mg total (18.2–30.46)] respectively (P<0.05)	Rest and exercise VAS after surgery were significantly lower in the ropivacaine group than in the saline group (P<0.05)	N/A	N/A	Not statistically significant	IV sufentanil + flurbiprofen + tropisetron given 15 min before end of surgery
Ciftci *et al.*, 2020 (39)	RCT	90	Control; ESPB received bilateral 20 mL of 0.25% bupivacaine; mTLIP block received bilateral 20 mL of 0.25% bupivacaine	Sedation: midazolam; induction: propofol + fentanyl + rocuronium; maintenance: sevoflurane	Postoperative opioid consumption at all time intervals were significantly lower both in ESPB and mTLIP groups compared with the control group 250 mg [150–375], 263 [150–375] and 375 [245–550] respectively (P<0.05)	Passive VAS score at the PACU, 2nd, 4th, and 8th hours, and active VAS score at the postanesthesia care unit, 2nd, 4th, 8th, and 16th hours were significantly lower in the ESPB and mTLIP groups compared with the control group (P<0.05)	N/A	N/A	Nausea only post-operative complication in which there was statistically significant difference between the ESPB (3/27 subjects) and mTLIP (3/27 subjects) group versus the control group (13/17 subjects) (P<0.001)	IV paracetamol + ramadol were given at the end of the surgery to all patients; remifentanil used for intraoperative analgesia

LOS, length of stay; PLOS, patient length of stay; RCT, randomized controlled trials; ESPB, erector spinae plane block; PCA, patient-controlled analgesia; PACU, post-anesthesia care unit; IV, intravenous; VAS, visual analog scale; mTLIP, modified-thoracolumbar interfascial plane.

group who received no ESP block preoperatively for elective lumbar spine surgery. Both groups received general anesthesia. Singh measured patient satisfaction qualitatively ranging from 0 (very unsatisfied) to 11 (most satisfied). The average satisfaction score was for the ESP block group was 7.7±0.45 compared to 5.5±0.74 for the control group (P<0.0001) (32). Yeşiltaş *et al.* [2021] compared patient satisfaction outcomes in patients receiving ESP block *vs.* control group who received an injection of saline intraoperatively during posterior spinal instrumentation and fusion for spondylolisthesis. Patient satisfaction was measured via the applied procedure and hospital care with the scales score ranging from 1 (not satisfied at all) to 5 (very much satisfied). The average satisfaction score for the ESP block group was 4.54±0.8 compared to 3.14±1.3 in the control group (P<0.001) (36).

The improvement in patient satisfaction should be considered with some hesitance due to the conflicting evidence of patient satisfaction on mortality (41,42). In addition, patient satisfaction does not necessarily correlate with better outcomes.

Patient length of stay (PLOS)

Vergari *et al.* [2022] compared LOS in patients receiving bilateral ESP block with 0.375% ropivacaine *vs* control group who received 0.375% ropivacaine via wound infiltration (35). Both patient groups underwent elective lumbar arthrodesis. After 72 hours, 73.3% (22/30) of patients in ESP block group were discharged compared to 100% (30/30) of patients in the control group (P=0.005) (35). Yeşiltaş *et al.* [2021] showed that ESP block group had significantly shorter LOS at 1.71± 0.76 days compared to the control group whose LOS was 3.3±0.98 days (P<0.001) (36). Yu *et al.* [2021] compared LOS in patients who received posterior internal fixation for lumbar spinal fractures and were divided into either a patient-controlled analgesia (PCA) group or a combined PCA-ESB group. In the combined PCA-ESB group the average LOS was 12.38±0.315 days compared to LOS of 14.78±0.333 days in PCA only group (P=0.0001) (37). We hypothesize ESP block may lead to decreased PLOS due to decreased postoperative complications and better pain control. General anesthesia can lead to multiple side effects such as longer rehabilitation time, arrythmias, nausea, and dizziness. Although there is a statistically significance in the PLOS in many of the studies, these results aren't necessarily clinically significant. More studies evaluating ESP block on PLOS are needed due to the mixed results of the various RCTs.

Post-operative complications

The investigations into postoperative complications in ESP block as compared to control groups yielded similar results. The majority found statistically significant differences in the ESP block group compared to control. Yu *et al.* [2021] found a statistically significant difference between the number of patients that experienced postoperative nausea with 4 patients (10%) in the ESP block group experiencing nausea *vs.* 17 patients (42%) in the control group (P=0.001) (37). Furthermore, Yu *et al.* [2021] saw a statistically significant difference between the number of patients that experienced postoperative vomiting with 3 patients (7.5%) in the ESP block group experiencing vomiting *vs.* 16 patients (40%) in the control group (P=0.001) (37). Singh *et al.* [2020] found that 2 patients in the control group developed both nausea and vomiting whereas 0 patients in the ESP block group had any postoperative complications (32). Ciftci *et al.* [2020] compared postoperative complications that occurred in procedures using ESP block, modified thoracolumbar interfascial plane block (mTLIP), and a control group. The only statistically significant postoperative complication found among the groups was nausea, with the ESP block and mLTIP groups both having 3/27 patients experiencing the complication and the control group having 13/17 patients experiencing the complication (P<0.001) (39). No complications of spinal nerve injury, hematoma, infections, lower extremity sensory, or motor dysfunction were present in patients postoperatively in either the control or ESP block groups (32,37,39). Therefore, ESP block may confer an advantage over other regional anesthetics due to the minimal side effects detected thus far in randomized control trials.

Limitations and strengths

One major limitation of many of the prospective studies evaluated was the small sample size as almost all had less than 100 subjects. In addition, in many studies the control group received no block or sham, but instead just received no block which could impact subjective outcomes like patient reported pain and patient satisfaction. While ESP block does seem to confer advantages over traditional methods of anesthesia, larger studies are needed to

determine the validity of these claims. In addition, each study uses a different multimodal pain regiment listed in *Table 2*. Therefore, there is potential for cofounding of perioperative analgesic differences making a comparison of the various RCTs potentially difficult. As this paper is a narrative review of the literature, the findings presented here should be read with caution. Narrative reviews present more opportunities for biases which may impact the validity of the findings we have presented.

Conclusions

There is a growing amount of evidence that erector spinae block confers advantages over traditional methods of anesthesia for spine surgery. The primary outcome of opioid consumption on the ESP block cohort does seem to differ significantly from those on traditional anesthesia. In addition, secondary outcomes such as patient satisfaction, patient reported pain, length of stay, and less postoperative complications appear superior in the ESP block cohort compared to the general anesthesia cohort. However, in regard to length of stay, Yeşiltaş *et al.* [2021] was the only study that showed LOS increased significantly in the erector spinae group compared to the control. However, Yeşiltaş used freehand guidance whereas all other studies used ultrasound guidance as described by Forero [2016] that is more accurate, raising questions of the validity of the study (17,36). More prospective randomized control studies evaluating erector spinae block in spine surgery as well as its postoperative complications are needed before any generalizations can be made.

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