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OPEN ACCESS JOURNALS

Clinical Case Reports: Open Access

Case Series | Vol 9 Iss 2
ISSN: 2582-5038
https://dx.doi.org/10.46527/2582-5038.359

Postoperative Pain Management Using Ultrasound-Guided Erector Spinae Plane Block in Abdominal Surgery: Insights from a Five-Patient Case Series

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Received: March 02, 2026; **Accepted:** March 30, 2026; **Published:** April 09, 2026

Abstract

Adequate postoperative pain management forms an important part of enhanced recovery following abdominal surgery. Somatic and visceral pain components can significantly impact comfort and recovery. The erector spinae plane block is a relatively new, simple, safe, and effective regional anesthetic technique that, when performed, has the capability of providing extensive analgesia with minimal side effects. The present case series describes five adults undergoing various forms of abdominal surgery, namely exploratory laparotomy, laparoscopic cholecystectomy, laparoscopic sleeve gastrectomy, incisional hernia repair, and open appendectomy, in whom ultrasound-guided ESPB at appropriate thoracic levels was performed as a part of the multimodal analgesic regimen. All patients had a preanesthetic evaluation and followed standard fasting protocols. Blocks were performed using either ropivacaine or bupivacaine in clinically safe doses, maintaining careful monitoring for hemodynamic stability. All five cases showed excellent intraoperative and postoperative analgesia as evidenced by stable vital parameters and a minimum requirement for rescue opioids, along with early postoperative mobilization. Block-related complications did not occur. These findings support that ESPB appears to be effective in providing both somatic and visceral pain relief, enhancing recovery, and forming a useful component in multimodal analgesia, especially in patients with comorbidities or contraindications to neuraxial techniques.

Keywords: ***Abdominal pain; Analgesics; Anesthesia; Opioid-sparing techniques; Postoperative care***

Citation: Sheth DJ. Postoperative Pain Management Using Ultrasound-Guided Erector Spinae Plane Block in Abdominal Surgery: Insights from a Five-Patient Case Series. Clin Case Rep Open Access. 2026;9(2):359.

1. Introduction

Effective perioperative analgesia following abdominal surgery remains a cornerstone of enhanced recovery and patient-centered care. Acute pain from abdominal surgeries involves both somatic components secondary to incision, retraction, or tissue trauma and visceral components related to the handling of organs and peritoneal irritation. Traditional opioid-based analgesia, though effective in the treatment of visceral pain, often falls short of providing adequate relief for somatic pain and is too frequently plagued by adverse effects, including nausea, vomiting, ileus, sedation, and respiratory depression. Regional anesthesia techniques represent an advance with benefits in both improved pain relief and opioid sparing, but may be limited by contraindications such as anticoagulation, technical complexity, or hemodynamic instability. Of particular promise among the alternatives is the ultrasound-guided erector spinae plane block. This technique, which involves depositing the local anesthetic in the fascial plane deep to the erector spinae muscle adjacent to the transverse process, thus provides somatic and visceral analgesia across multiple dermatomes through a simpler and safer approach [1-3].

There is an increasing number of studies that confirm the role of ESPB in abdominal surgeries. ESPB significantly decreases postoperative opioid consumption, reduces pain scores within the first 24 hours, and prolongs the time to the first rescue analgesic. Besides these advantages, the technique offers prolonged analgesia with minimal hemodynamic effects and low complication risks since the site of injection is located far from the pleura, major vessels, and nerves. Although the exact mechanism of visceral pain relief is still under investigation, ESPB gained wide acceptance for its application in multimodal analgesia in both open and laparoscopic abdominal surgeries. Its safety profile, ease of administration under ultrasound guidance, and reproducible results make it practical for the anesthesiologist looking to enhance recovery while minimizing opioid-related adverse events [4-6].

This is a case series on a group of five patients who had a variety of abdominal surgeries including open exploration, laparoscopic gallbladder removal, laparoscopic gastric sleeve surgery, incisional hernia medical repair and removal of an appendectomy to demonstrate that an ESPB applies to routine surgical patients and is beneficial as part of a multimodal analgesia, provides significant relief of pain following surgery without the need for extended treatment with opioids, and allows for normal recovery following surgery without major complications. The reports demonstrate consistent low postoperative pain scores measured by the numeric rating scale (NRS), rare use of rescue opioid medication, stable hemodynamic status during and after surgery, a large dermatomal map of areas with a complete absence of sensation corresponding to the location of the surgery, early mobility after surgery and an accelerated return towards functional performance, high patient satisfaction and no adverse or long-term effects from the block reported at follow-up.

2. Case Series

2.1 Case 1

A 50-year-old female, American Society of Anesthesiologists (ASA) Physical Status (PS) II, presented with lower abdominal pain and progressive distension for 3 months. She was diagnosed with a right ovarian mass and scheduled for an elective open lower-midline exploratory laparotomy. She had a 5-year history of hypertension, well-controlled on amlodipine 5 mg once daily. Her body mass index (BMI) was 30 kg/m^2. Pre-anesthetic evaluation revealed a Mallampati grade II airway, normal electrocardiogram (ECG) and echocardiogram, and unremarkable systemic examination. Baseline investigations revealed a

hemoglobin (Hb) level of 12.5 g/dL and a serum creatinine level of 0.8 mg/dL. She was kept nil per os (NPO) for solids 8 hours and clear fluids 2 hours prior to induction. After informed consent, a bilateral ultrasound-guided ESPB was performed at the T8 level with 20 mL of 0.5% ropivacaine on each side (total 40 mL). General anesthesia (GA) was induced with propofol 2 mg/kg, fentanyl 2 µg/kg, and rocuronium 0.6 mg/kg, and maintained with sevoflurane 1.5%-2%. Multimodal analgesia consisted of intravenous (IV) paracetamol 1 g at incision and IV ketorolac 30 mg at closure. Postoperatively, she received paracetamol 1 g every 6 hours and ibuprofen 400 mg every 8 hours. There were no block-related complications. By postoperative day (POD) 7, she was ambulatory, and by POD 10, she was pain-free with no chronic pain or paresthesia.

Postoperative evaluation of pain using the NRS 0-10 scale was conducted at specified time intervals, and it was found that the NRS scores did not exceed 3 at rest and 4 on movement during the first 24 hours. No rescue opioids were necessary. Heart rate and mean arterial pressure were maintained within +/-20% of baseline throughout surgery, with no need for pressor support. Sensory blockade correlated with T6-T12 dermatomes. Following surgery, patients had an uneventful course of recovery; therefore, satisfaction with pain management was high at the time of follow-up.

2.2 Case 2

A 65-year-old male, ASA-PS III, with coronary artery disease (CAD) of 8 years' duration (drug-eluting stent inserted 2 years ago; aspirin withheld 5 days preoperatively) and type 2 diabetes mellitus (DM) of 10 years' duration controlled with metformin 500mg thrice daily, presented with right upper quadrant pain and dyspepsia for 2 weeks, diagnosed as chronic calculous cholecystitis. His BMI was 26 kg/m². Pre-anesthetic evaluation revealed a Mallampati grade II airway, a stable cardiovascular examination, an Hb level of 13 g/dL, and a serum creatinine level of 1.0 mg/dL. The patient was kept NPO for 6 hours for solids and 2 hours for clear fluids. An ultrasound-guided right-sided ESPB was performed at T7 before induction using 30 mL of 0.375% ropivacaine. GA was induced with propofol 2 mg/kg, fentanyl 2 µg/kg (130 µg), and rocuronium 0.5 mg/kg, maintained with sevoflurane 1.8%. No local infiltration was done at the port sites. Postoperatively, analgesia included paracetamol 1 g IV every 6 hours and oral naproxen 500 mg every 12 hours. The patient resumed activity by POD 7 and was pain-free by POD 12.

From the first 24 hours post-surgery, NRS pain scores were ≤3 for restful state and ≤4 when active, and there was no need for 'rescue' opioids. Although no ischemic changes were observed during any period after surgery, hemodynamic parameters were stable throughout the entire surgical and post-surgical periods. An area of sensory block at T6-T9 was confirmed post-surgery; therefore, recovery from surgery was uncomplicated and confirmed to be free of any adverse effects from the block.

2.3 Case 3

A 42-year-old female, ASA-PS II, with morbid obesity (BMI 35 kg/m²) for 5 years, was scheduled for elective laparoscopic sleeve gastrectomy. She had no comorbidities. During the pre-anesthetic assessment, her airway examination revealed a Mallampati grade III, and her systemic examination was otherwise normal. She was NPO for 8 hours for solids and 2 hours for clear fluids. It was planned to perform a bilateral continuous ESPB catheter technique for prolonged analgesia. After the induction of GA, the bilateral catheters were placed under ultrasound guidance at the T9 level. Each side received an initial bolus of 20 mL 0.25% bupivacaine followed by a continuous infusion of 0.2% ropivacaine at 6 mL/hour for 48 hours. GA was

induced with propofol 2 mg/kg, fentanyl 1.5 µg/kg, and rocuronium 0.6 mg/kg, maintained with desflurane 4%-6%. For postoperative analgesia, she received paracetamol 1 g IV every 6 hours and oral celecoxib 200 mg every 12 hours. Catheters were removed after 48 hours without issues. She ambulated on postoperative day 1; her wounds were healthy by postoperative day 7.

The NRS postoperative pain ratings did not exceed a rest score of two (2) or a movement score of three during the infusion period. No additional opiate medication was necessary to meet analgesic needs. Vital signs remained stable and were within normal parameters. The catheter insertion sites were free of contamination and showed no signs of infection, leaking, or neurologic injury. All milestones related to early ambulation and improved recovery were reached.

2.4 Case 4

A 70-year-old male, ASA-PS III, with a history of chronic obstructive pulmonary disease (COPD) (GOLD stage II) for 12 years on a foracort inhaler and coronary artery bypass graft (CABG) 5 years ago, on aspirin 75 mg, and clopidogrel 75 mg, presented with an 8-month history of an enlarging incisional hernia. His BMI was 25 kg/m^2. Pre-anesthetic evaluation revealed an airway of Mallampati grade II, stable respiratory and cardiovascular findings, Hb 13.2 g/dL, and serum creatinine 1.1 mg/dL. NPO was maintained for 8 hours for solids and 2 hours for clear fluids. A left-sided ESPB was performed at T10 using 25 mL of 0.5% bupivacaine before induction. GA was induced with propofol 2 mg/kg, fentanyl 2 µg/kg, and rocuronium 0.5 mg/kg, maintained with sevoflurane 2%. Postoperative analgesia included paracetamol 1 g IV every 6 hours and oral ibuprofen 400 mg every 8 hours. Respiratory function remained stable; incentive spirometry was encouraged. No complication was encountered. On POD 7, his recovery was satisfactory, and by POD 14, he was pain-free and breathing comfortably.

The patient's NRS pain scores were ≤3 for the first 24 hours and did not require the use of opioid rescue medication. The patient's hemodynamics and respiratory parameters remained stable, with no exacerbation of COPD. Sensory block coverage was consistent with the location of surgery. The recovery was uneventful, with preserved pulmonary function.

2.5 Case 5

A 48-year-old female, ASA-PS II, with hypothyroidism treated for 7 years on levothyroxine 50 µg daily (euthyroid status confirmed preoperatively), presented with right lower abdominal pain and fever for 2 days. Ultrasound suggested complicated appendicitis, and she was scheduled for a semi-urgent open appendectomy via a right lower quadrant grid-iron incision. Her BMI was 27 kg/m². Preanesthetic evaluation revealed a Mallampati grade II airway, stable vitals, Hb 12.8 g/dL, and serum creatinine 0.9 mg/dL. She was kept NPO for 6 hours for solids and 2 hours for clear fluids. A right-sided ESPB was performed at T9 using 20 mL of 0.5% ropivacaine before induction of anesthesia. GA was induced with propofol 2 mg/kg, fentanyl 2 µg/kg, and rocuronium 0.6 mg/kg, maintained with sevoflurane 2%. At wound closure, the surgeon infiltrated 10 mL of 0.25% bupivacaine. In the postoperative period, she received IV paracetamol 1 g every 6 hours. A small superficial bruise noted at the block site resolved spontaneously. By POD 7, she resumed light work and was pain-free by POD 9.

All postoperative NRS ratings were <=3 at rest and <=4 during motion; no extra opioids were given to manage discomfort. Patient's cardiovascular stability was sustained. The area of superficial bruising did not increase in size and did not require any

treatment, as it resolved completely without intervention. Follow-up evaluations indicated that pain had completely subsided and that there were no residual sensory deficits.

3. Discussion

ESPB has been increasingly used in multimodal analgesia strategies aimed at reducing opioid consumption and enhancing recovery. The mechanism of ESPB includes deposition of local anesthetic in the fascial plane deep to the erector spinae muscle with diffusion to the dorsal and ventral rami of the spinal nerves and, less frequently, into the paravertebral or epidural spaces. This dual somatic-visceral analgesic effect makes ESPB especially suited for abdominal surgeries where pain arises both from incision-related somatic injury and visceral organ manipulation [6,7].

Compared with epidural or paravertebral blocks, ESPB has several advantages, including technical ease under ultrasound guidance, minimal hemodynamic instability, and a reduced risk of complications such as dural puncture, pneumothorax, or extensive motor blockade. Sensory supply to the abdominal wall is derived from the anterior and lateral cutaneous branches of the thoracoabdominal nerves (T6-T12) and the iliohypogastric and ilioinguinal nerves (L1). Extensive dermatomal spread can be achieved with ESPB at the appropriate thoracic levels, effectively covering the surgical field. During abdominal surgery, injections between T7 and T10 can provide sufficient analgesia for upper and midline incisions, whereas injections placed lower, around T9 to T11, are preferred for lower abdominal surgery. Adequate coverage of these dermatomes provides satisfactory analgesia during both open and laparoscopic surgeries [2,8].

With ESPB, consistent postoperative comfort, reduced opioid requirement, early mobilization, and discharge within ERAS protocols can be expected. In abdominal surgeries, several anesthetic challenges are commonly encountered, and ESPB aids in overcoming many such challenges. In obese patients, the increased depth of the target plane makes ultrasound visualization of the transverse process and needle tip difficult; this is managed by the use of a low-frequency curvilinear probe, which enhances resolution at depth, and by ensuring optimal patient positioning, usually in the lateral decubitus posture, to widen the acoustic window [9,10].

Real-time ultrasound guidance with in-plane needle advancement ensures the appropriate deposition of local anesthetic, thereby minimizing the risk of vascular puncture or intramuscular injection. Such patients usually have a multitude of comorbidities such as coronary artery disease, chronic obstructive pulmonary disease, diabetes mellitus, and obesity. The goals, therefore, in such patients would be the maintenance of hemodynamic stability and avoidance of excessive opioid administration. ESPB is a very effective solution in providing stable analgesia without sympathetic blockade or hypotension associated with epidural anesthesia. Besides, it reduces the demand for systemic opioids and thus avoids the related side effects such as respiratory depression, sedation, nausea, and vomiting. This, in turn, would result in smoother intraoperative hemodynamics and improved postoperative recovery, especially in elderly or high-risk patients. The level and side of the block should be chosen in concert with the surgical incision [7,10].

The complications that may arise with ESPB are local anesthetic systemic toxicity, unintentional epidural or intrathecal spread, vascular puncture, and motor weakness. Most of these complications can be avoided by proper dose calculation, repeated aspiration during the injection, incremental administration of local anesthetic, and close postoperative monitoring. Real-time

ultrasound imaging makes the block much safer by continuously providing information about both the needle's position and the pattern of local anesthetic spread. Not only is the advantage of ESPB confined to analgesia, but it also forms a part of the improvement in early recovery by way of deep breathing and early mobilization, along with a decrease in opioid-related side effects. It enhances pulmonary function and may reduce the incidence of postoperative pulmonary complications due to better pain control, thereby increasing patient satisfaction. As part of multimodal analgesia, ESPB contributes to a well-balanced approach to perioperative care, marrying efficacy and comfort for the patient with safety [2,6,11].

Despite these advantages, several limitations remain. There is inter-individual variation in the spread of local anesthetics, and incomplete analgesia may be present, especially regarding visceral pain. The determination of the standardization of the optimum volume, concentration, and injection level for the technique in specific abdominal surgeries remains to be established. The need still exists for a large number of well-designed clinical trials aimed at establishing evidence-based protocols in various abdominal procedures, not only for ESPB but also to establish the long-term benefits, which include the possible prevention of chronic postoperative pain. The ESPB is a safe and versatile regional anesthetic technique that may be applied to a wide range of abdominal surgeries. It provides effective somatic and visceral pain control, reduces opioid requirements, maintains hemodynamic stability, and promotes early recovery. With proper patient selection, appropriate ultrasound guidance, and technique, ESPB forms an important component of multimodal analgesia, leading to improved intraoperative and postoperative outcomes in abdominal surgical practice [2,6,11].

TABLE 1. provides a summary of reported cases and studies in which ESPB was used for abdominal surgeries. It outlines the anesthetic management approaches and highlights the key clinical takeaways from each case or study.

Author	Description of case/study	Anesthetic management	Takeaway points
Coviello et al., 2020 (Italy) [7]	25-year-old woman undergoing scapular lipoma excision; prior intraoperative awareness; ESPB chosen instead of PVB; achieved T5–L1 spread with stable course and strong postoperative analgesia.	ESPB at T7 with 20 mL 0.75% ropivacaine and dexamethasone; dexmedetomidine sedation; no opioids or complications.	ESPB provided safe anesthesia and avoided GA and PVB risks.
Kamel et al., 2020 (Egypt) [12]	Randomized trial in 48 women post abdominal hysterectomy comparing bilateral ESPB with TAP block; ESPB showed lower pain scores, longer analgesia, reduced morphine, and higher satisfaction.	Bilateral ESPB at T9 using 20 mL 0.375% bupivacaine with adrenaline per side; the TAP block group received an identical mixture.	ESPB showed a superior analgesic profile compared to the TAP block.
Prasath et al., 2021 (India) [13]	Randomized study in 64 inguinal hernia repairs; ESPB produced significantly longer analgesia and lower tramadol needs than TAP block.	ESPB or TAP block performed postoperatively; analgesia duration 460.8 minutes vs 282 minutes; opioid needs were markedly lower with ESPB.	ESPB offered longer analgesia with reduced opioids.

Engineer et al., 2022 (India) [8]	Randomized study of 60 laparoscopic cholecystectomy patients; ESPB showed lower pain scores for 12 hours, longer time to rescue analgesia, and reduced total analgesic use vs oblique subcostal TAP block.	Ultrasound-guided ESPB or oblique subcostal TAP block; postoperative scores and requirements monitored for 24 hours.	ESPB resulted in longer and better-quality analgesia with less medication.
Khanchandani et al., 2024 (India) [14]	Randomized study of 60 abdominal surgeries; ESPB produced lower VAS scores at 1, 2, and 24 hours, less tramadol use, and longer rescue time compared with TAP block.	ESPB or TAP block using 15 mL 0.25% bupivacaine per side; rescue tramadol for VAS > 5; ESPB had longer analgesia and reduced opioids.	ESPB offered better pain control and decreased tramadol consumption.
Present case series (5 cases)	Five abdominal surgeries including ovarian mass laparotomy, chronic cholecystitis, sleeve gastrectomy with ESPB catheters, incisional hernia repair, and open appendectomy; patients ASA II–III, including obesity, CAD, COPD, diabetes, hypothyroidism; all received ESPB at levels T7–T10 (single-shot or continuous) with ropivacaine or bupivacaine; all showed stable intraoperative course, early mobilization, minimal complications, and good pain control.	ESPB performed either unilateral, bilateral, or continuous catheter (20–40 mL 0.25–0.5% LA or 0.2% infusion at 6 mL/h for 48 hours); GA with standard induction (propofol, fentanyl, rocuronium) and sevoflurane/desflurane maintenance; multimodal postoperative analgesia (paracetamol and NSAIDs); all recovered without major block-related issues.	ESPB consistently provided effective analgesia, reduced opioid use, and supported early recovery across varied abdominal surgeries.

Table/Figure 1 – ESPB in Abdominal Surgery - Anesthetic Management and Important Takeaways.

4. Conclusion

ESPB is a safe, simple, and effective regional anesthetic technique, providing excellent postoperative analgesia in abdominal surgery. It ensures somatic and visceral pain relief, reduces opioid consumption, and assures hemodynamic stability, suitable even for a patient with multiple comorbidities. It enhances recovery and promotes early ambulation as part of a multimodal analgesia and leads to better overall patient satisfaction. With appropriate technique and ultrasound guidance, ESPB serves as a useful adjuvant in modern anesthetic practice for abdominal surgery.

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