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Thoracic Paravertebral Block for Laparoscopic Adrenalectomy in Conn Syndrome: Case Report Manuscript

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ABSTRACT

Primary aldosteronism, also known as Conn syndrome, can complicate anesthetic management because of its association with hypertension and hypokalemia. Evidence regarding the use of thoracic paravertebral block (TPVB) for retroperitoneal laparoscopic adrenalectomy in patients with low body weight remains limited. This case report describes the administration of a three-level ultrasound-guided TPVB and the subsequent postoperative clinical course. We retrospectively reviewed the perioperative medical records of a 31-year-old woman weighing 38 kg who had primary aldosteronism and recurrent hypokalemia. Following the induction of general anesthesia, an ultrasound-guided left-sided TPVB was performed at the T6, T8, and T11 vertebral levels as part of a multimodal analgesic regimen. The injected solution contained 87.5 mg of bupivacaine (2.3 mg/kg), 175 µg of epinephrine, and 10 mg of dexamethasone. Postoperative pain scores, rescue analgesic requirements, and documented complications were assessed through postoperative day 2. The highest recorded pain score was 4/10 on postoperative day 1, and a pain score of 4/10 was also documented during ward transfer on postoperative day 2. No administration of rescue analgesia or block-related complications was documented during the observation period. However, the concurrent use of systemic analgesics limited the ability to attribute the observed postoperative pain outcomes specifically to the TPVB. The findings demonstrated the technical feasibility of a three-level ultrasound-guided TPVB as an adjunct to multimodal analgesia in this patient undergoing retroperitoneal laparoscopic adrenalectomy. Nevertheless, the findings from this single case cannot establish analgesic efficacy or safety. Future prospective comparative studies should evaluate postoperative analgesic outcomes and adverse events using standardized multimodal analgesic protocols, weight-adjusted local anesthetic dosing, and serial perioperative serum potassium measurements to further characterize the efficacy and safety of this approach.

INTRODUCTION

Primary aldosteronism is a common but frequently underdiagnosed cause of hypertension and is associated with a higher risk of cardiovascular complications than primary (essential) hypertension (Adler et al., 2025). Autonomous aldosterone secretion leads to

sodium retention and increased renal potassium excretion, potentially resulting in hypokalemia, metabolic alkalosis, and persistent hypertension, all of which have important implications for perioperative management (Domi et al., 2015). Laparoscopic adrenalectomy is the recommended surgical treatment for appropriately selected patients with unilateral primary aldosteronism (Funder et al., 2016; Ahmed & Hundemer, 2022). Anesthetic management primarily focuses on maintaining hemodynamic stability and correcting electrolyte and metabolic abnormalities (Domi et al., 2015). The retroperitoneal laparoscopic approach avoids entry into the peritoneal cavity and, according to a meta-analysis of 22 comparative studies, is associated with shorter hospital stays than transperitoneal laparoscopic adrenalectomy, with comparable complication rates (Constantinides et al., 2012). Nevertheless, despite its minimally invasive nature, postoperative pain at trocar insertion sites and in the flank region, particularly following surgery performed in the lateral decubitus position, remains an important consideration in multimodal analgesic management (Kianian et al., 2024).

Thoracic paravertebral block (TPVB) involves the administration of a local anesthetic into the thoracic paravertebral space, a wedge-shaped anatomical compartment adjacent to the vertebral bodies that contains spinal nerve roots, their rami, communicating branches, and the sympathetic chain. This technique produces predominantly ipsilateral segmental somatic and sympathetic blockade (Karmakar, 2001). Because sympathetic blockade is generally unilateral, TPVB may preserve greater hemodynamic stability than neuraxial techniques, particularly in normovolemic patients (Karmakar, 2001). Following thoracotomy, paravertebral blockade has demonstrated analgesic efficacy comparable to thoracic epidural analgesia, with lower incidences of hypotension, urinary retention, nausea, and vomiting (Davies et al., 2006; Fenta et al., 2023; Kanani et al., 2025). These characteristics make TPVB a potentially valuable regional analgesic technique for unilateral flank and upper abdominal procedures. However, evidence regarding its application in adrenal surgery remains limited.

Randomized controlled trials have investigated regional anesthetic techniques for postoperative analgesia following laparoscopic adrenalectomy. In a trial involving 72 patients, Yuan et al. (2021) demonstrated that transmuscular quadratus lumborum block reduced the median movement-evoked pain score at 12 hours postoperatively from 3 to 2 on an 11-point numeric rating scale (0–10; $p = 0.024$). More recently, Zhang et al. (2026) randomized 65 patients undergoing ambulatory laparoscopic partial adrenalectomy and administered TPVB postoperatively, before tracheal extubation. Patients who received TPVB demonstrated higher Quality of Recovery-15 (QoR-15) scores at 24 and 48 hours postoperatively and required less sufentanil during the first 48 postoperative hours.

Despite these findings, important procedure-specific and patient-related questions remain. Yuan et al. (2021) investigated a different regional anesthetic technique, whereas Zhang et al. (2026) evaluated postoperative TPVB following partial adrenalectomy and reported outcomes for the broader surgical population. Neither trial specifically examined a multilevel TPVB administered before surgical incision in an adult patient with low body weight, primary aldosteronism, and recurrent hypokalemia undergoing retroperitoneal laparoscopic adrenalectomy. Furthermore, the targeted PubMed search described in this manuscript did not identify any case reports specifically documenting TPVB in patients with primary aldosteronism. These limitations highlight the need for additional clinical evidence

addressing the technical application, analgesic outcomes, and perioperative safety considerations of TPVB in this patient population.

This evidence gap has important implications for local anesthetic dosing and perioperative potassium monitoring. Low body weight may increase susceptibility to local anesthetic systemic toxicity (LAST), making careful consideration of the cumulative local anesthetic dose across multiple injection sites particularly important (Neal et al., 2018). The addition of epinephrine to the local anesthetic solution introduces another clinical consideration in patients with preexisting hypokalemia. Intravenous epinephrine has been shown to reduce plasma potassium concentrations through β_2-adrenergic stimulation, although the magnitude and clinical significance of potassium changes following paravertebral administration remain uncertain (Brown et al., 1983). Documenting the anesthetic management of a patient with these overlapping risk factors may therefore provide useful clinical insights into regional anesthesia planning, local anesthetic exposure, and electrolyte monitoring.

This case report describes the administration of a preincision, ultrasound-guided TPVB at three thoracic vertebral levels in a 31-year-old woman weighing 38 kg who underwent retroperitoneal laparoscopic adrenalectomy for primary aldosteronism. Following the induction of general anesthesia, the block was performed at the T6, T8, and T11 levels as part of a multimodal analgesic regimen. The distinctive clinical features of this case included the use of a three-level paravertebral blockade, an epinephrine-containing bupivacaine solution, and the presence of low body weight and recurrent hypokalemia. Together, these characteristics presented specific considerations regarding cumulative local anesthetic exposure, hemodynamic management, and perioperative electrolyte monitoring.

The purpose of this case report was to describe the incorporation of TPVB into the perioperative anesthetic management of a patient with primary aldosteronism and to document the subsequent clinical course. The primary objective was to report the highest recorded postoperative pain score on each day through postoperative day 2. Secondary objectives included documenting rescue analgesic requirements, postoperative nausea and vomiting, hemodynamic observations, and any recorded block-related complications. Additionally, the cumulative local anesthetic dose was expressed in milligrams per kilogram of actual body weight to facilitate interpretation of systemic exposure associated with the three injection sites.

This report contributes a detailed clinical account linking multilevel TPVB administration and weight-adjusted local anesthetic dosing with the perioperative monitoring requirements of a patient undergoing adrenalectomy for primary aldosteronism. The documented postoperative pain trajectory was interpreted in the context of concurrently administered systemic analgesics and available electrolyte measurements. This distinction is essential because postoperative recovery reflects the combined effects of the overall anesthetic and analgesic regimen rather than the isolated contribution of TPVB. Furthermore, the single-patient observational design precluded causal conclusions regarding the independent analgesic efficacy or safety of the block.

For anesthesiologists, this case provides a clinical reference for assessing weight-based local anesthetic exposure, determining appropriate intervals for perioperative potassium monitoring, and systematically documenting postoperative pain in patients with primary aldosteronism undergoing retroperitoneal adrenalectomy. It also identifies clinically relevant outcomes for future prospective comparisons between TPVB and alternative truncal regional

anesthetic techniques, including pain intensity at rest and during movement, rescue analgesic consumption, perioperative changes in serum potassium concentrations, and block-related adverse events. Systematic assessment of these outcomes in larger patient populations could help clarify the comparative effectiveness and safety of regional analgesic approaches and identify patients with primary aldosteronism who may derive the greatest benefit from TPVB.

METHOD

This single-patient case report was prepared in accordance with the CARE (CAse REport) guidelines. Clinical data were retrospectively extracted from the patient's medical records, including the preanesthetic assessment, anesthesia records, operative report, intensive care unit and ward observation charts, and laboratory and imaging findings. Laboratory results were reported using the measurement units adopted by the institutional laboratory.

The primary outcome was postoperative pain intensity, assessed using the highest documented Numeric Rating Scale (NRS) score on each postoperative day through postoperative day 2. Secondary outcomes included rescue analgesic requirements, postoperative nausea and vomiting (PONV), hemodynamic parameters, and documented block-related complications, including vascular puncture, pneumothorax, hypotension, and signs of local anesthetic systemic toxicity (LAST). The administered doses of bupivacaine and epinephrine were calculated from the recorded injection volumes and drug concentrations and expressed in milligrams per kilogram and micrograms per kilogram of actual body weight, respectively. Given the single-patient design, the findings were summarized descriptively without inferential statistical analysis.

To contextualize the clinical findings, a literature search was conducted in PubMed on November 4, 2026, using the term “paravertebral” combined with “aldosteronism,” “Conn syndrome,” “aldosteronoma,” or “hyperaldosteronism,” without restrictions on publication date or language. Reference lists of relevant publications were also screened, and clinical guidelines concerning primary aldosteronism and local anesthetic systemic toxicity were reviewed.

RESULTS AND DISCUSSION

Case Description

A 31-year-old woman (38 kg, 150 cm, body mass index 16.9 kg/m²; American Society of Anesthesiologists physical status III) presented with intermittent flank pain, foamy urine, recurrent hypokalemia, and hypertension since young adulthood. She had two cesarean deliveries under spinal anesthesia with no recorded problems. Functional capacity exceeded 4 metabolic equivalents, and her airway was unremarkable.

Medications were diltiazem 200 mg daily, ramipril 5 mg daily, spironolactone 25 mg daily, and oral potassium chloride 1200 mg three times daily. Preanesthetic blood pressure was 163/105 mm Hg, heart rate 79 beats/min, and room-air oxygen saturation 98%. Investigations (Table 1) supported a functional left adrenal adenoma with primary aldosteronism.

Table 1. Preoperative investigations

Investigation	Result
Aldosterone screening	Plasma aldosterone 23 ng/dL; plasma renin activity 0.27 ng/mL/h; ratio 85.2 (high), measured during hypokalemia and before stopping spironolactone
Abdominal CT, 4-phase	Left adrenal lesion 2.4 × 2.2 × 1.3 cm, −3 HU, absolute washout 68%, relative washout 66%: suspected lipid-rich adenoma. Right adrenal normal. Bilateral Bosniak I renal cysts
Electrolytes	Sodium 138, potassium 3.3, chloride 110.9 mmol/L
Renal function	Urea 36.4 mg/dL, creatinine 1 mg/dL, eGFR 77.2 mL/min/1.73 m²
Hematology	Hemoglobin 11.9 g/dL, platelets 412,000/µL, PT 10.6 s (control 11.7), aPTT 36.8 s (control 31.2)
ECG and chest radiograph	Sinus rhythm 60 beats/min, no ST-T changes; heart and lungs normal

Abbreviations: aPTT, activated partial thromboplastin time; CT, computed tomography; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; HU, Hounsfield units; PT, prothrombin time.

A right internal jugular central venous catheter was placed. General anesthesia was induced with fentanyl 100 µg, propofol 100 mg, rocuronium 30 mg, and sevoflurane, and the trachea was intubated without difficulty. Maintenance used propofol (target 1–2 µg/mL) and remifentanil (target 1–2 ng/mL) infusions in air and oxygen, with fentanyl 50 µg and rocuronium 10 mg added. qCON and qNOX values stayed near 35–40 with a burst suppression ratio of 0.

After induction, left-sided ultrasound-guided PVB was performed at T6, T8, and T11 without a catheter (Figure 1). The total injectate was 35 mL of bupivacaine 0.25% with epinephrine 1:200,000 and dexamethasone 10 mg. This delivered bupivacaine 87.5 mg (2.3 mg/kg) and epinephrine 175 µg. No block complication was recorded.



Figure 1. Ultrasound image during paravertebral injection at the left T8 level

Additional intravenous drugs included dexamethasone 5 mg, tranexamic acid 500 mg, ceftriaxone 1 g, and ranitidine 50 mg. Acetaminophen 1 g and ketorolac 30 mg were given before the end of surgery. Retroperitoneal laparoscopic adrenalectomy was performed in the lumbotomy position, with blood loss of about 30 mL, fluids about 1000 mL, and urine output 80 mL. The patient went to the intensive care unit on acetaminophen 1 g and ketorolac 30 mg intravenously every 8 hours, with ondansetron as needed. Ketorolac was stopped once pain was controlled. The course is shown in Table 2.

Table 2. Perioperative timeline

Time	Event
4 months before surgery	Aldosterone screening
2 months before surgery	Abdominal CT
6 days before surgery	Potassium 3.3 mmol/L on supplementation
Day of surgery	Anesthesia 4 h 10 min, surgery 2 h 15 min; intensive care admission
Postoperative day 1	Worst NRS 4, resolving spontaneously, sleep undisturbed; no nausea or vomiting; blood pressure 139/96 mm Hg; oral acetaminophen 1 g three times daily
Postoperative day 2	NRS 4 during transfer to the ward; no rescue analgesia since surgery

Abbreviations: CT, computed tomography; NRS, numeric rating scale (0–10).

This case shows that three-level PVB was feasible within multimodal analgesia for adrenalectomy in primary aldosteronism, but it also exposes specific dosing and monitoring concerns. The only adrenalectomy trial we found enrolled 65 patients having day-case partial adrenalectomy. PVB improved Quality of Recovery-15 scores and reduced sufentanil use and nausea, but it was given after surgery and not specifically in primary aldosteronism (Zhang et al., 2026). Transmuscular quadratus lumborum block also lowered movement pain at 12 hours after laparoscopic adrenalectomy (median NRS 2 vs 3) (Yuan et al., 2021). In a network meta-analysis of 27 nephrectomy trials, erector spinae and paravertebral blocks were most likely to reduce 24-hour pain and hospital stay, whereas lateral and transmuscular quadratus lumborum blocks were most likely to reduce opioid use (Huang et al., 2025). PVB is therefore one option, not an established standard.

The levels chosen should match the surgical field. Retroperitoneal adrenalectomy involves port sites and flank dissection in the lower thoracic dermatomes, and visceral afferents from the adrenal region travel with the splanchnic sympathetic fibers. Spread after a single large-volume paravertebral injection is variable, whereas small injections at several contiguous levels produce more reliable multisegmental coverage (Karmakar, 2001). In a randomized comparison involving 61 patients, four injections produced a mean vertical spread of 6.5 dermatomes and adequate sensory loss in 97% of patients, compared with 3.0 dermatomes and 11% after a single injection of the same total volume (Naja et al., 2006). A three-level technique from T6 to T11 is consistent with this evidence; however, because sensory testing was not performed in our patient, the actual extent of blockade is unknown.

Our analgesic outcome cannot be attributed to the block alone. The patient also received perineural and intravenous dexamethasone, acetaminophen, and ketorolac, and the surgery was minimally invasive. The block was placed under general anesthesia, and sensory coverage was not documented. Pain during ward transfer shows that dynamic pain still needs assessment.

Local anesthetic dose is the first lesson. Bupivacaine 2.3 mg/kg is close to commonly used limits, although epinephrine may slow absorption. The American Society of Regional

Anesthesia and Pain Medicine identifies small patient size and sarcopenia as risk factors for systemic toxicity (Neal et al., 2018). General anesthesia may also mask early symptoms. In patients of this size, we suggest calculating the dose per kilogram, injecting incrementally with aspiration, and monitoring after the block. Practical safeguards include immediate availability of lipid emulsion, ultrasound visualization of injectate spread, and limiting the cumulative dose when multiple injections are planned (Neal et al., 2018).

Hemodynamic management in primary aldosteronism differs from that in pheochromocytoma. Patients are frequently hypertensive and may have target-organ damage, but tumor handling does not cause catecholamine surges (Domi et al., 2015). The unilateral sympathetic block produced by PVB is less likely to cause hypotension than neuraxial techniques (Davies et al., 2006; Karmakar, 2001), which may be helpful in a patient treated with a calcium channel blocker and an angiotensin-converting enzyme inhibitor. Nevertheless, PVB can unmask hypovolemia (Karmakar, 2001), and volume status should be assessed before the block, particularly after preoperative diuretic or mineralocorticoid receptor antagonist therapy.

Epinephrine is the second. Epinephrine infused at 0.1 μg/kg/min lowered plasma potassium by 0.82 mEq/L in healthy volunteers through a β2-receptor effect (Brown et al., 1983). The effect of 175 μg given by paravertebral injection is unknown and may differ. It is nevertheless physiologically relevant in refractory hypokalemia, so intraoperative potassium measurement should be considered. The last available potassium in our patient was 3.3 mmol/L, 6 days before surgery. Because hypokalemia may also affect cardiac rhythm and neuromuscular blockade, quantitative neuromuscular monitoring is advisable.

Perineural dexamethasone is off-label. A meta-analysis of peripheral nerve blocks found 3.77 hours longer analgesia than with intravenous dexamethasone, with high heterogeneity, and these data are not specific to PVB (Chong et al., 2017). Our patient received 15 mg in total by both routes. Dexamethasone also has antiemetic effects, which may have contributed to the absence of postoperative nausea and vomiting in our patient.

In a large series from before routine ultrasound use, failure occurred in 6.1% of adults, vascular puncture in 6.8%, hypotension in 4.0%, and pneumothorax in 0.5% (Naja & Lönnqvist, 2001). Pneumothorax after this operation has two possible sources, the block and retroperitoneal dissection, which argues for a low threshold for chest imaging.

Ultrasound guidance may reduce some of these risks. In a 5-year retrospective review of 529 patients who received 2163 ultrasound-guided paravertebral injections for breast surgery, pneumothorax was identified in 2 patients and no local anesthetic systemic toxicity was recorded (Niesen et al., 2020). These data come from a different surgical population and may not apply directly to patients undergoing retroperitoneal surgery in the lumbotomy position.

Primary aldosteronism also shapes postoperative care. The 2016 Endocrine Society guideline allowed patients younger than 35 years with spontaneous hypokalemia, marked aldosterone excess, and a unilateral adenoma to proceed to surgery without adrenal venous sampling (Funder et al., 2016). The 2025 update suggests sampling before choosing treatment, and a 1-mg dexamethasone suppression test in patients with an adenoma (Adler et al., 2025). Neither is recorded in our case, which preceded that update.

After adrenalectomy, biochemical hypoaldosteronism occurred in 48% of patients in one cohort, with prolonged hyperkalemia in 4.5% (Queiroz et al., 2024). Another series reported

postoperative hyperkalemia in 16% (Fischer et al., 2012). Median eGFR fell 13% on postoperative day 1 and 20% at 12 months in a third (Stahl et al., 2026). Potassium supplements and spironolactone therefore need review after surgery, and nonsteroidal anti-inflammatory drugs should be brief, as in our patient, particularly after preoperative ramipril and spironolactone.

The 2016 guideline recommended measuring plasma potassium and aldosterone shortly after surgery, withdrawing potassium supplementation on the first postoperative day, discontinuing spironolactone, and monitoring plasma potassium weekly for at least 4 weeks while maintaining a generous sodium intake to avoid hyperkalemia (Funder et al., 2016). For anesthesiologists, this means that intravenous fluids, potassium-containing solutions, and nephrotoxic drugs should be reviewed in the immediate postoperative period, and that analgesic plans favoring regional techniques may help limit exposure to nonsteroidal anti-inflammatory drugs.

This report has limitations: it describes a single patient without a comparator, pain was summarized only as the worst daily score, and sensory blockade was not assessed. Trials in primary aldosteronism are needed before any recommendation on PVB can be made.

CONCLUSION

A three-level ultrasound-guided thoracic paravertebral block (TPVB) was successfully performed as part of a multimodal analgesic regimen for retroperitoneal laparoscopic adrenalectomy in a 38-kg woman with primary aldosteronism (Conn syndrome) and recurrent hypokalemia. The highest documented postoperative pain score was 4/10 on postoperative day 1, with a score of 4/10 also recorded during ward transfer on postoperative day 2. No rescue analgesic administration or block-related complications were documented through postoperative day 2. These findings demonstrated the technical feasibility of multilevel TPVB in this clinical setting. However, the concurrent administration of systemic analgesics and the single-patient observational design precluded definitive conclusions regarding the independent analgesic efficacy and safety of the block.

Future prospective studies should compare TPVB with alternative regional analgesic techniques within standardized multimodal analgesic regimens. Outcome assessments should include pain intensity at rest and during movement, rescue opioid consumption, and the incidence of block-related adverse events. Further investigations should consider including patients with low body weight or preoperative hypokalemia and systematically documenting weight-adjusted local anesthetic doses, epinephrine exposure, serial perioperative serum potassium concentrations, and postoperative renal function. These measures could provide a more comprehensive understanding of the comparative analgesic benefits, potential complications, and overall safety profile of TPVB in patients undergoing retroperitoneal laparoscopic adrenalectomy.

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CONFLICT OF INTEREST

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AUTHOR CONTRIBUTIONS

All authors contributed equally at every stage of preparing this work. Tasks were divided fairly, from conceiving the initial idea and conducting the analysis to writing and refining the manuscript, so that no single author played a larger role than the others.

GENERATIVE AI STATEMENT

In preparing this manuscript, the author used Artificial Intelligence (AI) in a limited capacity, solely to check grammar and refine language use. AI was not involved in any way in data collection, substantive analysis, or the drawing of the study's conclusions.

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