

Comparison of Postoperative Analgesic Effects of Intravenous versus Perineural Dexamethasone Injection Combined with Ropivacaine in Thoracoscopy-Guided Thoracic Paravertebral Block for Thoracoscopic Radical Lung Cancer Resection: A Prospective Randomized Controlled Trial

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Background: As an adjuvant, dexamethasone can enhance the analgesic intensity and prolong the duration of nerve blocks. However, to date, no studies have compared the effectiveness of different administration routes of dexamethasone for thoracoscopy-guided thoracic paravertebral block (TTPB). This prospective randomized controlled study evaluated the postoperative analgesic effects of dexamethasone administered intravenously or perineurally in combination with ropivacaine for TTPB in patients undergoing radical lung cancer resection.

Methods: A total of 150 patients were randomly assigned to receive dexamethasone intravenously (Group I, n=75) or perineurally (Group D, n=75). Before wound closure, patients in Group I underwent TTPB with ropivacaine while receiving an intravenous dexamethasone injection, whereas patients in Group D received a perineural mixture of ropivacaine and dexamethasone. The primary outcome was the time to first postoperative rescue analgesia. Secondary outcomes included Visual Analogue Scale (VAS) scores, postoperative 48-hour sufentanil consumption in patient-controlled intravenous analgesia (PCIA), postoperative blood glucose levels, postoperative recovery parameters, and incidence of adverse events.

Results: Compared with Group I, Group D showed a significantly longer time to first postoperative rescue analgesia, lower VAS scores at all assessed time points, and reduced postoperative 48-hour sufentanil consumption. Group D also showed a smaller increase in postoperative blood glucose levels, an earlier time to first ambulation and a shorter postoperative hospital stay (all $P < 0.05$). However, the incidence of postoperative nausea was higher in Group D than in Group I ($P < 0.05$).

Conclusion: In TTPB, perineural dexamethasone administration with ropivacaine provided superior and longer-lasting analgesia compared with intravenous administration. Additionally, it accelerated postoperative recovery and shortened hospital stay.

Keywords: dexamethasone, ropivacaine, postoperative analgesia, paravertebral block

Background

Lung cancer is one of the most common types of cancer worldwide, with its incidence and mortality rates continuing to rise, posing a significant challenge to public health. Despite significant advances in the diagnosis and treatment of lung cancer in recent years, its 5-year survival rate remains low, particularly in advanced-stage patients.¹ For early- and mid-stage lung tumors, surgical resection remains the preferred treatment.² In recent years, thoracoscopic minimally invasive surgery has gradually become the mainstream approach. It has demonstrated significant advantages over conventional

thoracotomy, including reduced trauma, faster recovery, and a lower incidence of complications.^{3,4} However, postoperative pain from incisions and chest drainage tubes can still trigger a strong stress response,⁵ leading to reluctance to cough and expectorate, impaired early mobility, and an increased risk of complications. These factors may prolong the hospital stay, compromise surgical outcomes, and impose additional financial burdens on patients.⁶ Therefore, effective postoperative analgesia is essential for optimizing recovery, improving quality of life, and ensuring efficient healthcare resource utilization.

In postoperative analgesia, thoracic paravertebral nerve block (TPVB) has been widely used for pain management following thoracic surgeries, effectively mitigating the surgical stress response and enhancing pain management.⁷ Thoracoscopy-guided thoracic paravertebral block (TTPB) is an emerging technique that offers greater precision, safety, and efficacy compared with traditional ultrasound-guided approaches.⁸ Unlike ultrasound guidance, thoroscopic visualization enables direct intrapleural injection of anesthetic adjacent to the vertebral body on the surgical side, ensuring even drug distribution across multiple vertebral segments. This technique enhances the success rate and efficacy of the block, significantly reducing postoperative pain and related complications, thereby expediting recovery and improving overall surgical outcomes.⁹

Ropivacaine, a long-acting local anesthetic, is commonly used in thoracic paravertebral block to extend analgesic duration. However, its effect lasts only about 6 hours,¹⁰ which is insufficient for postoperative pain control. Studies suggest that dexamethasone, whether administered intravenously or perineurally, can enhance the analgesic effect of ropivacaine and prolong its duration in peripheral nerve blocks.^{11,12} However, no study has directly compared the postoperative analgesic effects of TTPB using ropivacaine combined with either intravenous or perineural dexamethasone in thoroscopic lung cancer resection. This study was aimed to evaluate and compare the analgesic duration, pain relief, opioid consumption, the incidence of adverse events, and overall recovery associated with these two administration routes, thereby identifying the optimal analgesic strategy to improve postoperative recovery and patient outcomes.

Methods

Study Design and Population

This single-center, prospective, double-blind, randomized controlled clinical trial (Identifier: ChiCTR-ICR-2400086347) was registered with the Chinese Clinical Trial Registry on June 28, 2024. The study (KY2023SL340-01) was approved by the Research Ethics Committee of Ningbo Medical Centre Lihuili Hospital. The study adhered to the Consolidated Standards of Reporting Trials (CONSORT) guidelines.¹³ A total of 150 patients undergoing thoroscopic radical lung cancer surgery at the hospital between July 2024 and March 2025 were enrolled and all participants provided written informed consent.

Participants

Inclusion criteria were: (1) patients aged between 20 and 75 years; (2) American Society of Anesthesiologists (ASA) Grade II; (3) body mass index (BMI) between 18 and 30 kg/m²; and (4) provision of written informed consent. Exclusion criteria were as follows: (1) allergy to ropivacaine or dexamethasone; (2) abnormal blood coagulation, thoracic vertebral deformity or fracture, or diabetes; (3) severe pleural adhesions; (4) requirement for intraoperative conversion to open thoracotomy; and (5) patient refusal.

Randomization and Blinding

During the grouping process, patients were randomly assigned to different groups in a 1:1 ratio according to the computer-generated randomization sequence. Group allocation information was concealed within sequentially numbered, opaque, and sealed envelopes prepared by a designated nurse. A dedicated management team was established within the study to safeguard the allocation documents and prepare the corresponding study drugs for thoracic surgeons prior to TTPB procedures.

Patients received their group assignment records before the TTPB procedure, and the healthcare staff prepared the paravertebral block and study drugs accordingly. In the Group I, while the surgeons performed paravertebral block under

thoracoscope guidance, the anesthesiologists simultaneously administered dexamethasone intravenously. In Group D, the thoracic surgeon accurately administered a mixture of ropivacaine and dexamethasone for the paravertebral block under thoracoscopic guidance, the anesthesiologist simultaneously administered the same volume of normal saline intravenously. To strictly maintain blinding and ensure the objectivity and reliability of the study results, the surgeons, anesthesiologists, and nursing staff who participated in the surgery were not involved in postoperative follow-up, outcome assessment, or statistical analysis. Patients and postoperative assessment personnel were blinded to the administration method of dexamethasone. The combination of different dexamethasone administration routes and the TTPB procedure was performed intraoperatively. Patients were under general anesthesia, and postoperative assessment personnel did not participate in the surgery, both were blinded. Postoperative assessments and outcome evaluations were conducted by independent anesthesiology personnel not engaged in the surgical procedure.

Anesthesia Procedure

Standard monitoring included continuous electrocardiography, non-invasive blood pressure measurement, pulse oximetry (SpO₂), end-tidal carbon dioxide (ETCO₂) monitoring, and bispectral index (BIS) analysis. Radial artery and internal jugular vein catheterization were performed under local anesthesia. General anesthesia was induced with midazolam (0.05 mg/kg), propofol (2 mg/kg), sufentanil (0.4 µg/kg), and rocuronium (0.6 mg/kg). Following oral double-lumen intubation, fiberoptic bronchoscopy confirmed proper tube placement before initiating intermittent positive pressure ventilation. Tidal volumes were set at 8 mL/kg during two-lung ventilation (TLV) and 6 mL/kg during one-lung ventilation (OLV), with respiratory rates maintained at 10–14 breaths per minute and ETCO₂ controlled between 35 and 40 mmHg. Anesthesia was maintained with a continuous infusion of propofol (6–8 mg/kg/h), remifentanil (0.1–0.3 µg/kg/min), and rocuronium bromide (0.2 mg/kg every 30 minutes), with BIS monitoring (target range: 40–60) guiding intraoperative adjustments.

Surgical Procedure

A two-port thoracoscopic lobectomy was performed via incisions located at the 7th intercostal space along the midaxillary line and the 4th intercostal space between the midclavicular and anterior axillary lines. Malignancy was confirmed intraoperatively before completing the lobectomy. A 26F thoracic drain was inserted before chest wall closure.

Analgesia Methods

Before chest closure, a 5G scalp needle with extension tubing was inserted into the paravertebral space under thoracoscopic guidance, 1 cm lateral to the T5-T6 interspace and 0.5 cm below the parietal pleura (Figure 1). Following negative aspiration for blood or cerebrospinal fluid, Group I received 20 mL of 0.375% ropivacaine with an intravenous injection of 5 mL dexamethasone (0.1 mg/kg), whereas Group D received 20 mL of a solution containing both 0.1 mg/kg dexamethasone and 0.375% ropivacaine with an intravenous injection of 5 mL normal saline. After a five-minute observation period to rule out bleeding or hematoma formation, patient-controlled intravenous analgesia (PCIA) was initiated. The PCIA pump contained sufentanil (1.5 µg/kg) and tropisetron (5 mg), diluted in 0.9% saline to a total volume of 100 mL. PCIA settings included a loading dose of 2 mL, a background infusion rate of 1 mL/h, a bolus dose of 0.5 mL, and a 15-minute lockout interval. Rescue analgesia with flurbiprofen axetil (50 mg) was administered if the visual analog scale (VAS) score was ≥ 4 or if pain persisted despite PCIA activation.

Study Outcomes

The primary outcome was the time to first postoperative rescue analgesia. Secondary outcomes included VAS scores at six postoperative time points (1, 2, 6, 12, 24, and 48 hours), postoperative 48-hour sufentanil consumption in PCIA, postoperative blood glucose levels (measured at 1, 6, and 24 hours), time to first ambulation, and adverse events. VAS scores were measured at specific postoperative timepoints from T1 to T6 after surgery. For blood glucose measurements, the assessments were taken at T1, T2, and T3. The evaluation indicators for postoperative recovery status include: time to first ambulation (hours), chest tube removal time (days) and postoperative hospital stay time (days). The “time to first ambulation” refers to the duration (in hours) from the completion of surgery to the patient’s first attempt at walking, as

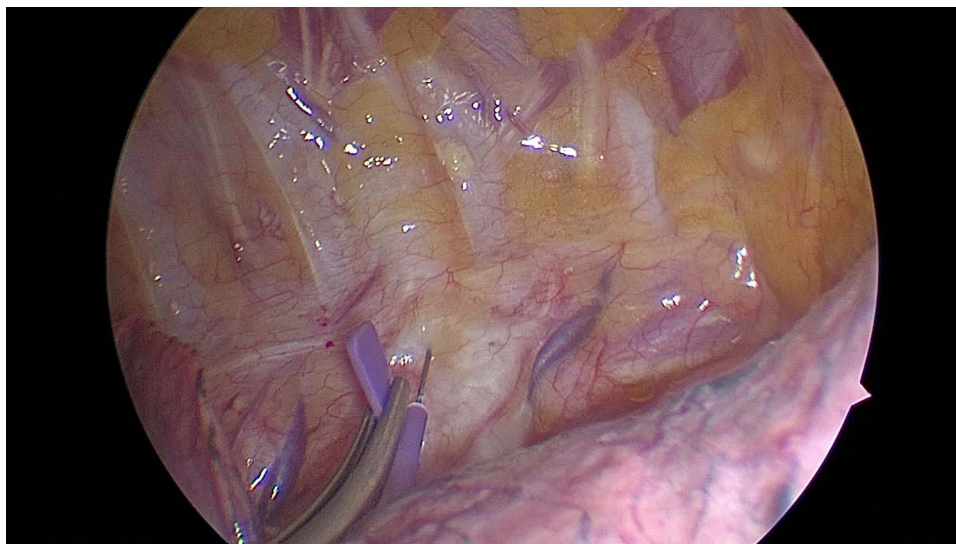


Figure 1 The TTPB is located in the fifth and sixth thoracic paravertebral spaces. The white raised area indicates the spread of local anaesthetic in the paravertebral space.

assessed by the attending nursing staff. This was recorded as the time elapsed until the patient was able to independently stand and walk with or without assistance. Postoperative adverse effects, including epidural spread, drowsiness, nausea, vomiting, respiratory depression, atelectasis, were assessed.

Sample Size and Statistical Analysis

The sample size was calculated based on the primary outcome—time to first postoperative rescue analgesia. A pilot trial of 20 patients in each group showed mean (\pm standard deviation [SD]) times of 19.5 ± 2.6 hours in Group D and 21.1 ± 2.7 hours in Group I. To achieve a power of 0.8 with an alpha of 0.05, the required sample size was calculated to be 54 patients (27 in each group) using the MedSci Sample Size Tools. To account for potential missing data or dropouts, recruit at least 40 patients per group. Based on previous studies by Prangmalee, L et al¹¹ and Julian, A et al.¹² For the accuracy of the data, it is recommended to recruit 75 patients per group, randomized equally into two groups. All data were analyzed using SPSS version 26.0. The normality of continuous variables was assessed simultaneously using the Shapiro–Wilk test and visual inspection of histograms. Levene’s test was used to assess the homogeneity of variances. Normally distributed quantitative variables with homogeneous variance were presented as mean \pm standard deviation (SD) and compared using the Student’s *t*-test. Normally distributed but failed homogeneity of variance using Welch’s *t*-test. A linear mixed-effects model was used to analyze the repeated-measures data. A random intercept for participants (ID) was included, the first-order autoregressive (AR (1)) was adopted as the covariance structure for analysis, and the estimation method employed was restricted maximum likelihood (REML). When the data failed to meet the assumptions of normality, data were described using medians and interquartile ranges, with comparisons performed using the Mann–Whitney *U*-test. Categorical variables were expressed as frequencies and percentages and analyzed using either the chi-square test or Fisher’s exact test, as appropriate. A *P*-value of <0.05 was considered statistically significant.

Results

A total of 152 patients with eligibility, 2 patients refused to participate, 150 patients were randomized into Group I or Group D. During the study, three patients in Group D required conversion to open surgery, while two in Group I experienced severe pleural adhesions. These five patients were excluded from the final analysis. Consequently, 145 patients completed the study (Figure 2). There were no significant differences in baseline characteristics or surgical parameters between the two groups ($P > 0.05$, Table 1). There were no missing data in this study, all analyses were complete-case.

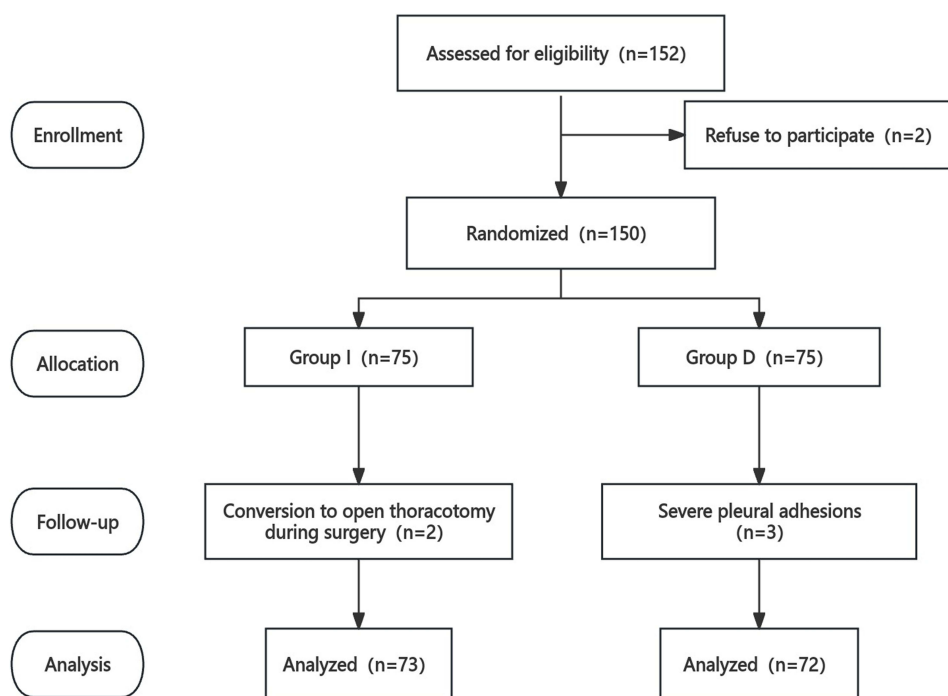


Figure 2 Flow chart of this study.

Primary Outcome

The time to first postoperative rescue analgesia of Group I was significantly shorter than that of Group D (17.2 (95% CI 16.7 – 17.7) ± 2.2 vs 21.9 (95% CI 21.4 – 22.4) ± 2.2 hours, $t(143) = -12.884$, $P < 0.001$, Table 2). The mean difference is -4.7 (95% CI -5.4 - -4.0).

Secondary Outcomes

In contrast with Group I, Group D required a lower postoperative 48-hour sufentanil consumption in PCIA (63.7 (95% CI 62.5 – 64.9) ± 5.5 vs 52.4 (95% CI 51.5 – 53.4) ± 4.0 μg) (Welch's t -test), $t(131.485) = 14.277$, $P < 0.001$ (two-sided). The mean difference is 11.3 (95% CI 9.8 – 12.8). From T1 to T6 at different postoperative time points, the VAS scores of Group I were higher than those of Group D (both at rest and during coughing) (Figures 3 and 4). The VAS (at rest) at T1 1.8 (95% CI 1.6 – 1.9) vs 1.5 (95% CI 1.3 – 1.6), mean differences 0.3 (95% CI 0.1 – 0.5 , $P = 0.001$); T2 2.6 (95% CI

Table 1 Characteristics of the Patients and Surgery

	I Group (n = 73)	D Group (n = 72)	P value
Gender			0.868
Male	42 (57.5%)	40 (55.6%)	
Female	31 (42.5%)	32 (44.4%)	
Age (years)	57.5 ± 10.1	58.2 ± 9.6	0.682
BMI (kg/m^2)	23.9 ± 2.7	23.7 ± 2.8	0.585
Surgical site			0.736
Left	28 (38.4%)	30 (41.7%)	
Right	45 (61.6%)	42 (58.3%)	
Surgery time (minutes)	123.4 ± 10.6	125.1 ± 11.9	0.362
Sufentanil (μg)	37.3 ± 3.2	36.8 ± 3.5	0.388
Remifentanil (μg)	806.0 ± 36.6	798.3 ± 38.5	0.219

Note: Data are presented as numbers or mean \pm SD.

Abbreviation: BMI, Body mass index (kg/m^2).

Table 2 Comparison of Postoperative Analgesic Effect Between Two Groups

	I Group (n = 73)	D Group (n = 72)	Mean Differences (95% CI)	P value
First postoperative rescue analgesia (hours)	17.2 ± 2.2	21.9 ± 2.2	-4.7 (-5.4 - -4.0)	< 0.001
48h PCIA sufentanil consumption (µg)	63.7 ± 5.5	52.4 ± 4.0	11.3 (9.8–12.8)	< 0.001

Note: Data are presented as mean ± SD.

Abbreviation: PCIA, Patient-controlled intravenous analgesia pump.

2.5–2.8) vs 2.3 (95% CI 2.2–2.5), mean differences 0.3 (95% CI 0.1–0.5, $P = 0.007$); T3 3.0 (95% CI 2.9–3.2) vs 2.7 (95% CI 2.6–2.9), mean differences 0.3 (95% CI 0.1–0.5, $P = 0.015$); T4 3.0 (95% CI 2.9–3.2) vs 2.8 (95% CI 2.6–2.9), mean differences 0.3 (95% CI 0.1–0.5, $P = 0.030$); T5 2.7 (95% CI 2.5–2.9) vs 2.3 (95% CI 2.2–2.5), mean differences 0.4 (95% CI 0.2–0.6, $P < 0.001$); T6 2.5 (95% CI 2.3–2.6) vs 2.0 (95% CI 1.9–2.2), mean differences 0.4 (95% CI 0.2–0.6, $P < 0.001$). The VAS (during coughing) at T1 3.2 (95% CI 3.0–3.4) vs 2.4 (95% CI 2.3–2.6), mean differences 0.8 (95% CI 0.5–1.0, $P < 0.001$); T2 3.6 (95% CI 3.5–3.8) vs 2.8 (95% CI 2.6–3.0), mean differences 0.9 (95% CI 0.6–1.1, $P < 0.001$); T3 3.5 (95% CI 3.3–3.7) vs 3.0 (95% CI 2.8–3.2), mean differences 0.5 (95% CI 0.2–0.8, $P < 0.001$); T4 3.4 (95% CI 3.2–3.6) vs 3.0 (95% CI 2.9–3.2), mean differences 0.4 (95% CI 0.1–0.6, $P = 0.006$); T5 3.3 (95% CI 3.1–3.4) vs 2.8 (95% CI 2.6–3.0), mean differences 0.5 (95% CI 0.2–0.7, $P < 0.001$); T6 3.2 (95% CI 3.0–3.4) vs 2.4 (95% CI 2.3–2.6), mean differences 0.8 (95% CI 0.5–1.0, $P < 0.001$). The blood glucose at T0 4.9 (95% CI 4.8–5.0) vs 5.0 (95% CI 4.9–5.1), mean differences -0.1 (95% CI -0.1–0.2, $P = 0.618$). There was no statistically

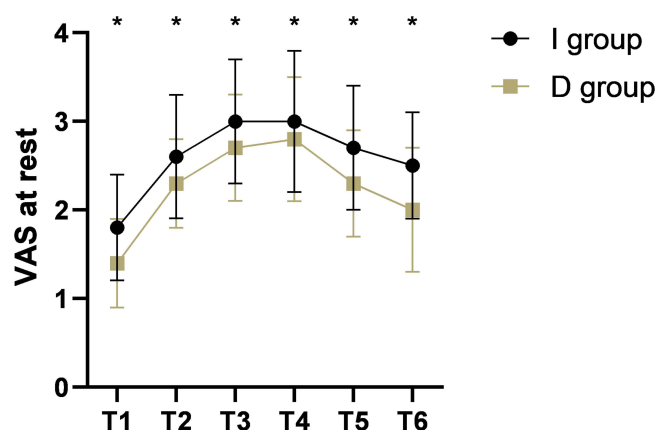


Figure 3 Comparison of VAS scores at rest between two groups.

Notes: Data are presented as mean ± standard deviation (SD). * $P < 0.05$, indicating a significant difference between groups.

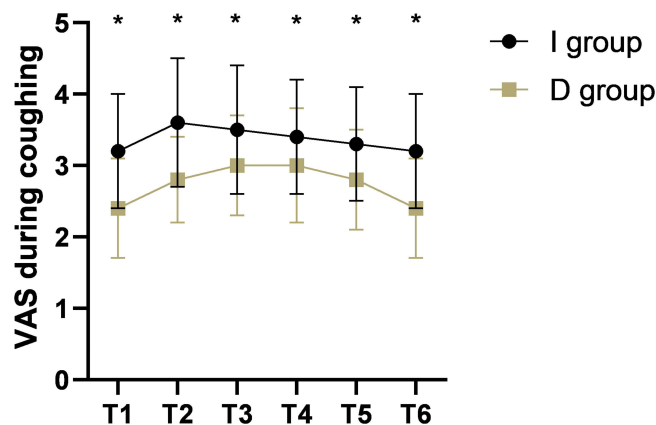


Figure 4 Comparison of VAS scores during coughing between two groups.

Notes: Data are presented as mean ± standard deviation (SD). * $P < 0.05$, indicating a significant difference between groups.

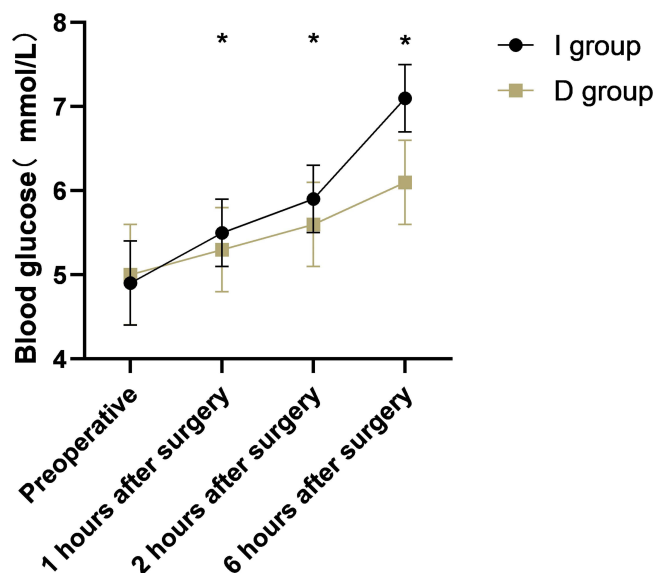


Figure 5 Comparison of preoperative and postoperative blood glucose between two groups.

Notes: Data are presented as mean \pm standard deviation (SD). * $P < 0.05$, indicating a significant difference between groups.

significant difference in the baseline blood glucose between the two groups. The blood glucose at T1 5.5 (95% CI 5.4–5.6) vs 5.3 (95% CI 5.2–5.4), mean differences 0.2 (95% CI 0.1–0.3, $P = 0.009$); T2 5.9 (95% CI 5.8–6.0) vs 5.6 (95% CI 5.5–5.7), mean differences 0.3 (95% CI 0.1–0.4, $P < 0.001$); T3 7.1 (95% CI 7.0–7.2) vs 6.1 (95% CI 6.0–6.2), mean differences 1.0 (95% CI 0.9–1.0, $P < 0.001$) in Group I was significantly higher than in Group D. (Figure 5). For the repeated-measures outcome of VAS (at rest), the group \times time interaction effect was not statistically significant ($F = 0.5$, $P = 0.797$). For the repeated-measures outcome of VAS (during coughing), the group \times time interaction effect was statistically significant ($F = 2.4$, $P = 0.035$). For the repeated-measures outcome of blood glucose, the group \times time interaction effect was highly statistically significant ($F = 34.2$, $P < 0.001$). Additionally, Group D had a higher incidence of postoperative nausea ($P < 0.05$). Other postoperative adverse effects were not significantly different (Table 3). Group I achieved later ambulation than those in Group D (9.0 (95% CI 8.8–9.3) \pm 1.0 vs 8.6 (95% CI 8.4–8.7) \pm 0.8 hours, $t(143) = 3.156$, $P = 0.002$, Table 4). There was no statistically significant difference in the chest tube removal time between Group I and Group D (3.7 (95% CI 3.9–3.9) \pm 0.8 vs 3.6 (95% CI 3.5–3.8) \pm 0.7 days, $t(143) = 0.273$, $P = 0.783$, Table 4). The postoperative hospital stay time in Group I was longer than that in Group D (6.1 (95% CI 5.8–6.3) \pm 1.0 vs 5.7 (95% CI 5.5–6.0) \pm 0.9 days, $t(143) = 2.148$, $P = 0.033$, Table 4).

Table 3 Comparison of Adverse Reactions After Surgery Between Two Groups

	I Group (n = 73)	D Group (n = 72)	P value
Epidural spread	0 (0%)	0 (0%)	1.000
Drowsiness	4 (5.5%)	4 (5.6%)	1.000
Nausea	5 (6.8%)	13 (18.1%)	0.047
Vomit	4 (5.5%)	9 (12.5%)	0.158
Respiratory depression	4 (5.5%)	4 (5.6%)	1.000
Atelectasis	3 (4.1%)	2 (2.8%)	1.000

Note: Data are presented as numbers.

Table 4 Comparison of Postoperative Recovery Status Between Two Groups

	I Group (n = 73)	D Group (n = 72)	Mean Differences (95% CI)	P value
First ambulation time (hours)	9.0 ± 1.0	8.6 ± 0.8	0.5 (0.2–0.8)	0.002
Chest tube removal time (days)	3.7 ± 0.8	3.6 ± 0.7	0.1 (–0.2–0.3)	0.785
Postoperative hospital stay time (days)	6.1 ± 1.0	5.7 ± 0.9	0.3 (0.1–0.7)	0.033

Note: Data are presented as mean ± SD.

Discussion

Patients undergoing thoracoscopic radical resection for lung cancer commonly experience significant postoperative pain. Effective analgesia facilitates early diaphragmatic movement, coughing, and expectoration, thereby reducing the risk of pulmonary complications such as impaired lung function impairment and infections.⁹ Traditionally, PCIA with opioid analgesics has been the primary approach. However, prolonged opioid use is associated with adverse effects, including nausea, vomiting, and respiratory depression. To address these issues, multimodal analgesic strategies that combine PCIA with regional nerve blocks are increasingly recommended to optimize pain control while minimizing opioid consumption and promoting early recovery.¹⁴

TPVB is a well-established technique for postoperative analgesia following thoracic surgery.¹⁵ By delivering local anesthetics into the thoracic paravertebral space, TPVB provides effective unilateral blockade of sensory, motor, and sympathetic nerves.¹⁶ Previous studies have demonstrated that TPVB provides analgesia comparable to thoracic epidural analgesia while offering better hemodynamic stability and reducing postoperative pulmonary complications. Compared with percutaneous ultrasound-guided TPVB, TTPB improves block precision and success rates while minimizing complications such as bleeding.^{8,17} However, the duration of a single-shot TPVB is limited—typically lasting only 6 hours,¹⁰ which is insufficient for postoperative pain control. Studies suggest that dexamethasone, whether administered intravenously or perineurally, can enhance the analgesic effect of ropivacaine and prolong its duration in peripheral nerve blocks.^{11,12} However, no study has directly compared the postoperative analgesic effects of TTPB using ropivacaine combined with either intravenous or perineural dexamethasone in thoracoscopic lung cancer resection. This study was aimed to evaluate and compare the analgesic duration, pain relief, opioid consumption, the incidence of adverse events, and overall recovery associated with these two administration routes, thereby identifying the optimal analgesic strategy to improve postoperative recovery and patient outcomes.

As a potent glucocorticoid, dexamethasone exhibits potent anti-inflammatory, immunosuppressive, anti-allergic, and analgesic properties.¹⁸ It has been increasingly used as an adjuvant to local anesthetics.^{19,20} Ropivacaine, a long-acting amide local anesthetic, blocks neuronal sodium channels, inhibiting neurotransmitter transmission and producing anesthesia.²¹ When combined, dexamethasone and ropivacaine prolong nerve block duration and enhance analgesia without pharmacological interference.^{22,23} Dexamethasone can be administered either intravenously or perineurally as an adjuvant to local anesthetics, and both methods significantly extend the analgesic duration.^{24,25} This effect is attributed to dexamethasone's ability to promote anti-inflammatory mediator release, suppress inflammatory pathways, inhibit bradykinin activity, and reduce prostaglandin synthesis.²⁶ Additionally, dexamethasone induces vasoconstriction, slowing ropivacaine absorption and further prolonging nerve block duration. It also decreases vascular permeability, reducing tissue edema and postoperative pain.²⁷

In the present study, compared with Group I, patients in Group D had a significantly longer time to first rescue analgesia, lower sufentanil consumption in PCIA within 48 hours postoperatively, and lower VAS scores at all time points. These findings suggest that perineural dexamethasone combined with ropivacaine for paravertebral nerve block provides superior and longer-lasting analgesia compared to intravenous administration. The shorter duration of effect in the intravenous group may be attributed to faster systemic distribution and metabolism.

Interestingly, postoperative nausea was less frequent in Group I than in Group D, which may reflect the more rapid central nervous system penetration of intravenously administered dexamethasone, this is consistent with the research results of Wei G et al.²⁸ Research suggests it may inhibit dopamine and 5-hydroxytryptamine receptor signaling, reducing the vomiting reflex, while also blocking vagal afferent transmission to the vomiting center and decreasing nerve impulses

from gastrointestinal inflammation.^{29,30} Conversely, Group I showed higher postoperative blood glucose levels at all time points. This is because intravenously administered dexamethasone enters systemic circulation more rapidly, exerting its metabolic effects sooner. As a glucocorticoid, dexamethasone promotes gluconeogenesis and inhibits insulin secretion, leading to elevated blood glucose. Additionally, it enhances the effects of other hyperglycemic hormones, including glucagon, growth hormone, and adrenaline, further increasing blood sugar levels.^{31,32}

Compared with Group I, Group D had a shorter time to first ambulation and a reduced postoperative hospital stay. These findings underscore the benefits of superior analgesia in promoting early mobilization and enhancing recovery, consistent with previous findings.³³

There were certain limitations in our study. Firstly, it did not evaluate the analgesic effects of different dexamethasone doses or explore other nerve block approaches, such as multi-segment TTPB. Secondly, patients with diabetes were excluded due to the known hyperglycemic effects of DEX; further studies are warranted to evaluate safety in this population. Thirdly, longer-term outcomes were not assessed.

Conclusion

For patients undergoing thoracoscopic radical lung cancer resection, perineural injection of dexamethasone in TTPB with ropivacaine provided superior postoperative analgesic effects, prolonged nerve block duration, and had a smaller impact on blood glucose levels compared to intravenous administration. Additionally, it reduced hospital stay and promoted faster postoperative recovery.

Abbreviations

TTPB, Thoracoscopy-guided thoracic paravertebral block; TPVB, Thoracic paravertebral nerve block; ASA, American Society of Anesthesiologists; SpO₂, Pulse oximetry; PaO₂, Arterial partial pressure of oxygen; PaCO₂, Partial pressure of carbon dioxide; ETCO₂, End-tidal carbon dioxide; TLV, Two-lung ventilation; OLV, One-lung ventilation; BIS, Bispectral index; VAS, Visual analogue scale; PCIA, Patient-controlled intravenous analgesia pump.

Data Sharing Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

This research project was approved by the Ethics Committee of the Lihuli Hospital, Affiliated to Ningbo University (Approval number: KY2023SL340-01). All participants included in the study signed their informed consents.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

All authors declare that they have no competing interests in this work.

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