Original Article

A randomized clinical trial: optimal strategies of paravertebral nerve block combined with general anesthesia for postoperative analgesia in patients undergoing lobectomy: a comparison of the effects of different approaches for serratus anterior plane block

Jianxu Er[1], Jing Xia[2], Ruifang Gao[3], Yonghao Yu[1]

[1]Department of Anesthesiology, Tianjin Medical University General Hospital Tianjin Research Institute of Anesthesiology, Tianjin, China; [2]Department of Pain, Tianjin Port Hospital, Tianjin, China; [3]Department of Anesthesiology, Tianjin Chest Hospital, Tianjin, China

Contributions: (I) Conception and design: J Er; (II) Administrative support: Y Yu; (III) Provision of study materials or patients: J Xia; (IV) Collection and assembly of data: R Gao; (V) Data analysis and interpretation: J Er; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Yonghao Yu. Department of Anesthesiology, Tianjin Medical University General Hospital Tianjin Research Institute of Anesthesiology, Tianjin 300052, China. Email: yuyonghao@126.com.

Background: To observe the analgesic effect of different ultrasound-guided methods of serratus anterior plane block (SAPB) after surgery in patients who have undergone thoracoscopic lobectomy with general anesthesia combined with thoracic paravertebral nerve block.

Methods: A total of 120 patients aged 18–65 years old scheduled for video-assisted thoracoscopic surgery (VATS) were selected. Patients were randomly divided into 3 groups: patient-controlled intravenous analgesia (PCIA) group, serratus anterior plane block (SPB) group and continuous serratus anterior plane block (CSPB) group (n=40 each). All patients were treated with general anesthesia combined with double-point (T4, T7) thoracic paravertebral block. The SPB group received an ultrasound-guided single serratus plane block. The CSPB group underwent the same procedure as the SPB group, with an epidural catheter inserted. Both the PCIA and SPB groups received PCIA after surgery. Patients in the CSPB group were connected to a continuous serratus block automatic analgesia pump after surgery.

Results: There were no significant differences among the 3 groups in terms of the general condition. Compared with the PCIA group, the resting and exercise VAS pain scores at T2, T3, T4, and T5 , cortisol level at T1, T4 and T5 in SPB group and CSPB group were lower ($P<0.05$), the times of the first analgesia were significantly prolonged, and the times of pressing the PCA pump and opioid use were significantly less in the SPB and CSPB groups, and the CSPB group used no opioids ($P<0.05$), the SPB group and CSPB group had shorter times of the first postoperative activity, longer mobilization distance and the total number of days in hospital was significantly lower ($P<0.05$). Postoperative complications in the SPB and CSPB groups were significantly less and the CSPB group had an even lower incidence of postoperative complications ($P<0.05$). Compared with the SPB group, active VAS pain scores at T4 and T5 were higher in the CSPB group ($P<0.05$). Compared with the PCIA group, the total QoR-40 score at T6 was significantly higher in the SPB and CSPB groups, and compared with the SPB group, this data was higher in the CSPB group ($P<0.05$).

Conclusions: Single ultrasound-guided SAPB combined with PCIA can provide a better analgesic effect, improve the quality of early postoperative recovery, and accelerate ERAS.

Trial Registration: Chinese Clinical Trial Registry ChiCTR2000041350.

Keywords: Serratus anterior plane block (SAPB); enhanced recovery after surgery; multimodal analgesia (MMA); video-assisted thoracoscopic surgery (VATS)

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Introduction

Lung cancer is the most common cause of cancer-related death at home and abroad (1). Lobectomy plus lymph node dissection is an effective method for the radical treatment of lung cancer (2). The current electronic thoracoscopy-assisted minimally invasive lobectomy technology [video-assisted thoracoscopic surgery (VATS)], with its small injury, less bleeding, and faster recovery advantages, has gradually replaced traditional thoracotomy lung resection (3,4), and is the most common surgical procedure for the treatment of lung cancer. However, studies have shown that patients who received VATS had moderate or even severe pain (5,6), and postoperative pain often leads to increased pulmonary complications, which thus prolongs hospital stay, increases medical costs, and affects the rapid postoperative recovery [enhanced recovery after surgery (ERAS)] of patients. Pain after thoracotomy means that the surgical incision has healed and the pain at the incision site persists for more than 2 months or repeated attacks after thoracotomy. This kind of pain is the most serious pain problem after surgery. Its particularity is that it can lead to a variety of serious complications, and may also develop into pain syndrome after thoracotomy.

Therefore, effective control of pain is an important part of accelerated rehabilitation surgery. Research suggests that thoracic nerve block [thoracic paravertebral block (TPVB)], higher security, can provide similar effects to thoracic epidural analgesia (TEA) for thoracoscopic surgery analgesia (7). However, it has been found in clinical work that the application of TPVB for postoperative analgesia after VATS also has some disadvantages: the single action time of TPVB is limited, the continuous catheters can be displaced and prolapse, and the incidence of incomplete block range is high (8), which does not meet the requirements of perioperative whole analgesia. At present, multimodal analgesia (MMA) is advocated in clinical anesthesia, and intravenous analgesia combined with regional nerve block is widely favored by anesthesiologists. In recent years, muscle plane block [serratus anterior plane block (SAPB)] has emerged as a new technology of regional nerve block, with a simple operation and less complications, and the anterior lateral chest wall nerve block effect more completely, gradually widely (9). However, there is no clinical consensus on single SAPB analgesia or continuous SAPB analgesia, as well as which method is more effective and has fewer complications when applied to MMA after VATS. This study intends to undertake a preliminary discussion on this issue.

We present the following article in accordance with the CONSORT reporting checklist (available at https://dx.doi.org/10.21037/apm-21-2597).

Methods

This randomized controlled trial was designed according to the Consolidated Standards of Reporting Trials (CONSORT) 2010 statement. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by institutional board of Tianjin Chest Hospital (No.: 2021KY-018-01) and informed consent was taken from all the patients. This study was a three-arm parallel study and allocation ratio was 1:1:1. A total of 120 patients, regardless of gender, with an American Society of Anesthesiologists (ASA) physical status classification of grade I–III, age 18–65 years old, and body mass index (BMI) 20–25, who planned to undergo thoracoscopic lobectomy in Tianjin Chest Hospital were selected. The exclusion criteria were as follows: allergy to local anesthetic drugs, severe abnormal coagulation function, systemic or puncture site infection, nerve injury, a history of long-term alcohol consumption, long-term use of psychotropic drugs and opioids, preoperative adjuvant chemotherapy or radiotherapy, not cooperative, involved in other clinical trials, and refusal to participate. Using the random number table method by computer, nurse generated the random allocation sequence, enrolled participants, and assigned participants to interventions, The generated random numbers and grouping contents were put into a sealed opaque envelope by the nurse and delivered to the anesthesiologist on the morning of the surgery. The patients were divided into the patient-controlled intravenous analgesia group (PCIA group), the single serratus anterior plane block group (SPB group), and the continuous serratus anterior plane block group (CSPB group), with 40 cases in each group. Routine preoperative preparation including electrocardiogram (ECG), heart rate (HR), oxygen saturation (SpO_2), and bispectral index (BIS) were monitored after entering the room, oxygen was inhaled by mask, and peripheral arterial and venous access was established. For the induction of anesthesia, midazolam 0.5–1.0 mg/kg, sufentanil 0.5–1.0 μg/kg, etomidate 0.2–0.3 mg/kg, and cisatracurium 0.3 mg/kg were used. After adequate oxygenation and denitrification, double-lumen bronchial intubation was performed. Fiberoptic bronchoscopy was used to determine the location of the

tracheal tube, which was then fixed, and the anesthesia machine was connected. The tidal volume was 6–8 mL/kg, frequency was 12–14 bpm, positive end-expiratory pressure (PEEP) was 4 mmHg, and oxygen concentration was 60–80%. After intubation, the patient was changed to the lateral decubitus position on the operative side, and the T4 and T7 TPVB on the affected side was guided by ultrasound. The 22 G puncture needle was inserted into the plane, and the corresponding paravertebral space was reached under direct ultrasound. A 10 mL dose of 0.4% ropivacaine was given at each point. For anesthesia maintenance, an intravenous target-controlled infusion (TCI) of propofol was used, the plasma target concentration was 1–2 μg/mL, and cisatracurium 5–10 mg was administered intermittently. Intraoperative blood pressure was maintained at 20% above or below the baseline, with a BIS of 40–60 and $PETCO_2$ 35–45 mmHg.

Before awakening after surgery, the patients were maintained in the position during surgery. After aseptic preparation of the skin with iodophor, the SPB group patients the ultra-sound probe was placed over the midclavicular region of the thoracic cage in the sagittal plane, and then the subcutaneous tissue, latissimus dorsi, serratus anterior, intercostal muscle, and pleura superficial to the fourth and fifth ribs in the midaxillary line were identified. The superficial SAPB was targeted to the interfascial plane between the serratus anterior muscle and the latissimus dorsi muscle. Once again, there was no blood and no gas, and the remaining 0.375% ropivacaine was injected slowly, with 15 mL in total. In the CSPB group, the serratus anterior muscle was punctured by the same method, and 15 mL 0.375% ropivacaine was injected into the serratus anterior muscle, and then the epidural catheter was inserted. The depth of the catheter was 5 cm, and the position of the catheter was determined again by ultrasound after the skin was properly fixed. Patients in the 3 groups recovered after surgery, and the endotracheal tube was removed after reaching the indication of extubation. The analgesia pump was connected before returning to the postoperative care unit of thoracic surgery. Patients in the PCIA group and SPB group were connected to an intravenous controlled analgesia pump, and the formula was: sufentanil 2–3 μg/kg + butoranol 12 mg +0.9% sodium chloride injection to 150 mL, background dose was 2 mL/h, patient-controlled analgesia (PCA) dose was 2 mL, and the locking time was 15 min. The CSPB group was connected to a continuous serratus anterior block automatic analgesia pump, and the formula was: 0.5% ropivacaine normal saline 300 mL, background infusion dose 6 mL/h, PCA dose 6 mL, and locking time 45 min. The duration of self-controlled analgesia in the 3 groups was 48 h after surgery. For example, when Visual Analogue Scale (VAS) score >4, the self-controlled analgesia pump could be pressed once. If the analgesia was ineffective, an intramuscular morphine injection of 10 mg was administered for analgesia. Anesthesiologist was blinded after surgery, those assessing outcomes were completed by the ICU investigators.

The primary outcomes observed in this study included: (I) VAS scores at (T2), 6 h (T3), 12 h (T4), 24 h (T5) after intubation and 48 h (T6) after surgery; (II) the first postoperative analgesia time, the number of effective presses of the electronic analgesia pump 48h after the operation, the total amount of opioids used in the electronic analgesia pump, and the number of times of postoperative analgesia relief. The following contents are secondary outcomes: The general condition of the patients (gender, age, IBM), the duration of the operation, and the amount of intraoperative blood loss; Arterial partial pressure of oxygen (PaO_2), lactic acid (LAC), blood glucose (GLU) before surgery (T1), and 12 h (T4), 24 h (T5) after surgery; In addition, postoperative adverse reactions, such as nausea, vomiting, and dizziness, were recorded. One day before surgery (T0) and 48 h after surgery (T6), patients' quality of recovery (QoR-40) scores was also recorded, along with the time of the first postoperative activity and the total length of hospitalization (days). The incidence of chronic pain was assessed and recorded by telephone follow-up 2 months after surgery.

The sample size was calculated based on our pilot study, in which the mean VAS at 24 h after surgery was 4.8 in the PCIA group, with an approximate standard deviation of 1.1. A 1.5-point decrease in the VAS score was considered clinically significant. For a study power of 80% and an α value of 0.05, the required sample size per group was calculated to be 34. Given an estimated dropout rate of 15%, we recruited 40 patients (after applying the preoperative exclusion criteria) for each group.

This study was a double-blind trial, and patients and postoperative follow-up personnel were unaware of the patient groups. If severe adverse events were observed in participants during the study, physicians were expected to execute an emergency break and perform relevant treatments based on the situation.

Statistical analysis

SPSS19.0 software was used for statistical analysis.

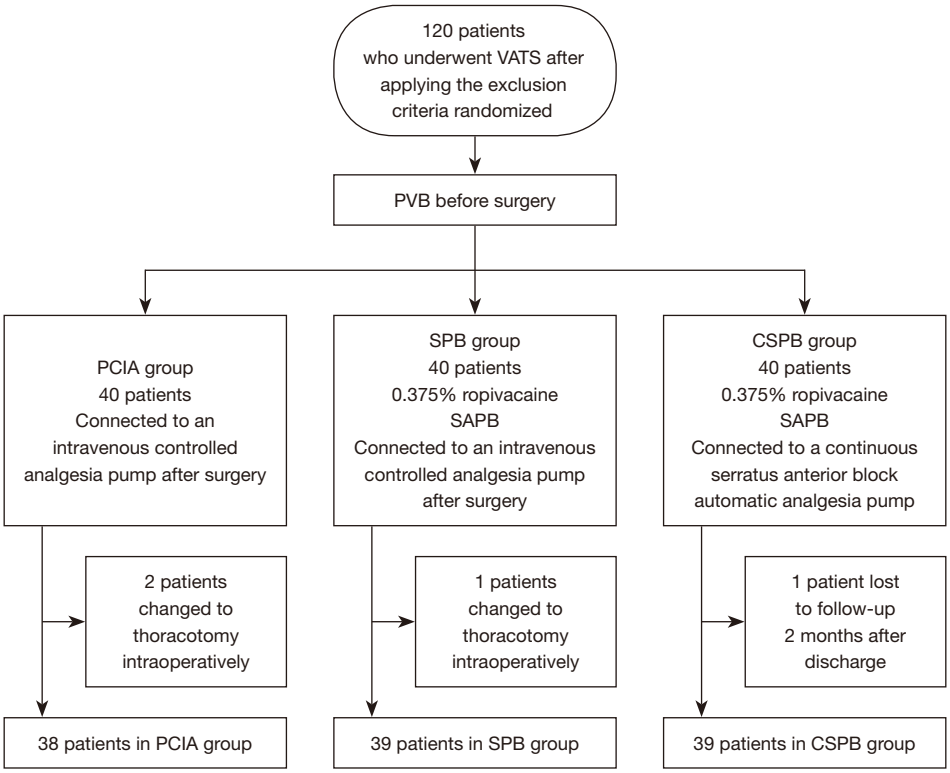

Figure 1 Participant enrollment. VATS, video-assisted thoracoscopic surgery; PVB, paravertebral block; PCIA, patient-controlled intravenous analgesia; SPB, serratus anterior plane block; SAPB, serratus anterior plane block; CSPB, continuous serratus anterior plane block.

Measurement data conforming to a normal distribution were expressed as mean ± standard deviation ($\bar{x}\pm s$), while measurement data with a skewed distribution were expressed as median and interquartile range (IQR). One-way ANOVA was used for comparisons between groups, and the *t*-test was used for pair comparisons. Enumeration data were expressed as percentages, and the chi-square test was used. P<0.05 was considered statistically significant.

Results

120 patients who underwent VATS after applying the exclusion criteria, 3 were changed to thoracotomy intraoperatively (2 in the PCIA group, 1 in the CSPB group), and 1 was lost to follow-up 2 months after discharge (SPB group). Finally, 116 patients completed the study from December 2020 to June 2021 (38 in the PCIA group, 39 in the SPB group, and 39 in the CSPB group), *Figure 1*. There was no significant difference in the general condition of the 3 groups (P>0.05), as shown in *Table 1*.

Compared with the PCIA group, resting and exercise VAS scores were significantly decreased in the SPB group and CSPB group at T2-5 (P<0.05). Compared with the CSPB group, the VAS score during exercise in the SPB group was significantly decreased at T4 and T5 (P<0.05). At other time points, VAS scores at rest and exercise showed no significant differences among the 3 groups (P>0.05), as shown in *Table 2*.

Compared with the PCIA group, the first analgesia time in the SPB group and CSPB group was significantly longer, the effective press times of the analgesia pump within 48h were significantly decreased, the number of times of postoperative analgesia was significantly decreased (P<0.05), and the consumption of sufentanil in the analgesia pump in the SPB group was significantly decreased (P<0.05). Compared with the SPB group, the consumption of sufentanil in the analgesia pump in the CSPB group was significantly decreased (P<0.05), however, there were no significant differences in the first analgesia time, the number of effective presses of the PCA pump, and the number of

Table 1 Comparison of the general condition of the three groups

Variables	PCIA group (n=38)	SPB group (n=39)	CSPB group (n=39)
Sex (M/F)	23/15	21/18	23/16
Age (year)	52.36±10.87	53.47±11.63	56.34±11.64
BMI (kg/m^2)	25.65±4.21	25.63±5.16	25.96±5.33
Operation time (min)	127.52±6.68	130.82±9.61	129.78±7.82
Intraoperative blood loss (mL)	42.31±7.76	40.63±10.21	40.12±10.36
QoR-40 score at T0	193.87±4.33	194.63±4.41	194.70±4.65

PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block; BMI, body mass index.

Table 2 Comparison of VAS scores during rest and exercise at different postoperative time points in the three groups

Variables	Groups	T2	T3	T4	T5	T6
Resting VAS	PCIA	2.4±0.7	3.1±0.4	3.5±0.3	3.1±0.5	2.2±0.6
	SPB	0.9±0.5[a]	1.2±0.4[a]	1.9±0.4[a]	2.2±0.4[a]	1.7±0.5
	CSPB	1.2±0.5[a]	1.4±0.5[a]	2.1± 0.3[a]	2.4±0.5[a]	1.8±0.5
Exercise VAS	PCIA	3.1±0.7	4.1±0.5	4.5±0.5	3.6±0.4	2.3±0.6
	SPB	1.8±0.6[a]	2.1±0.5[a]	2.7±0.6[a]	2.5±0.5[a]	2.1±0.7
	CSPB	1.9±0.6[a]	2.2±0.4[a]	3.3±0.3[ab]	3.1±0.5[ab]	2.2±0.7

[a], compared with the PCIA group, P<0.05; [b], P<0.05 compared with the SPB group. VAS, Visual Analogue Scale; PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block.

Table 3 Comparison of other pain-related indicators among the three groups

Groups	First analgesia time, h, M (IQR)	Cumulative times of PCA, M (IQR)	Cumulative dosage of sufentanil (μg)	Rescue analgesia (times)
PCIA group	5 (2.5)	4 (2.5)	165.2±6.5	0.85±0.75
SPB group	10 (7.0)[a]	2 (1.5)[a]	124.4±3.2[a]	0.05±0.22[a]
CSPB group	8 (10.0)[a]	2 (2.0)[a]	0[ab]	0.05±0.22[a]

[a], compared with the PCIA group, P<0.05; [b], P<0.05 compared with the SPB group. PCA, patient-controlled analgesia; PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block.

times of postoperative analgesia relief between the 2 groups (P>0.05), as shown in *Table 3*.

Blood gas analysis showed that the levels of Lac and Glu were increased at T4 and T5 compared with T1 (P<0.05), and there was no significant difference in the change of PaO_2 (P>0.05). Compared with PCIA group, the level of plasma cortisol in SPB group and CSPB group decreased significantly at these time point. There were no significant differences in PaO_2, Lac, and Glu among the 3 groups at each time point (P>0.05), as shown in *Table 4*.

Compared with the PCIA group, total QoR-40 scores, physical comfort, postoperative self-care ability, and pain scores in the SPB group and CSPB group were significantly increased at 48 h (T6) after surgery (P<0.05). Compared with the SPB group, the total QoR-40 score and the score of physical comfort in the CSPB group increased at T6, while the pain score decreased (P<0.05), as shown in *Table 5*.

Compared with the PCIA group, the incidence of nausea, vomiting and dizziness in the SPB group and CSPB group were significantly decreased (P<0.05). Compared with the

Table 4 Comparison of PaO_2, Lac, and Glu among the three groups

Variables	Groups	T1	T4	T5
PaO_2 (mmHg)	PCIA	92.72±3.46	90.51±2.57	91.61±3.21
	SPB	93.38±2.91	92.08±3.42	92.72±2.35
	CSPB	93.21±2.78	92.14±3.34	92.82±2.19
Lac (mmol/L)	PCIA	1.45±0.22	2.12±0.65*	1.83±0.43*
	SPB	1.31±0.56	1.95±0.36*	1.76±0.22*
	CSPB	1.37±0.47	2.01±0.32*	1.78±0.44*
Cortisol (nmol/L)	PCIA	678±22[b]	506±57[b]	548±47[b]
	SPB	378±38[a]	386±39[a]	321±45[a]
	CSPB	366±37[a]	377±32[a]	308±25[a]
Glu (g/L)	PCIA	6.42±1.43	7.62±1.51*	6.84±1.32*
	SPB	6.03±0.96	7.83±1.73*	7.12±1.43*
	CSPB	6.15±1.21	7.59±1.90*	7.09±1.56*

*, compared with T1, P<0.05; [a], compared with the PCIA group, P<0.05; [b], P<0.05 compared with the SPB group. PaO_2, partial arterial oxygen pressure; Lac, lactic acid level; Glu, blood glucose level; PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block.

Table 5 Comparison of QoR-40 scores 48 h after surgery in the three groups

Groups	Total	Emotional state	Physical comfort	Psychological support	Self-care ability	Pain
PCIA	171.3±7.1	41.0±1.3	46.9±4.7	30.0±2.4	20.3±1.2	27.8±1.9
SPB	185.1±4.1[a]	42.4±1.0	53.8±1.7[a]	32.5±2.2	24.0±0.8[a]	34.2±0.9[a]
CSPB	188.6±3.6[ab]	42.5±1.8	58.0±1.1[ab]	31.5±1.7	24.1±0.6[a]	32.1±0.7[ab]

[a], compared with the PCIA group, P<0.05; [b], P<0.05 compared with the SPB group. PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block.

Table 6 Comparison of the incidence of postoperative adverse reactions and postoperative chronic pain in the three groups [number of cases (percentage)]

Groups	Nausea and vomiting	Dizziness	Chronic pain
PCIA	12 (31.6)	10 (26.3)	7 (18.4)
SPB	7 (17.9)[a]	6 (15.4)[a]	6 (15.3)
CSPB	3 (7.7)[ab]	2 (5.1)[ab]	7 (17.9)

[a], compared with the PCIA group, P<0.05; [b], P<0.05 compared with the SPB group. PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block.

SPB group, the incidence of PONV and dizziness in the CSPB group was lower (P<0.05). There was no significant difference in the incidence of chronic pain among the 3 groups (P>0.05), as shown in *Table 6*.

Compared with the PCIA group, the SPB group and CSPB group had shorter times of the first postoperative activity, longer mobilization distance and the total number of days in hospital was significantly lower (P<0.05). Compared with the SPB group, the CSPB group had a longer time for the first postoperative activity and a longer

Table 7 Comparison of postoperative recovery indexes in the three groups

Groups	First postoperative activity (h)	mobilization distance (m)	Length of stay (day)
PCIA	17.5±2.1	22.5±2.5	12.5±2.6
SPB	6.5±3.2[a]	27.5±2.9[a]	7.9±1.8[a]
CSPB	10.3±2.9[ab]	31.5±3.2[a]	9.2±2.1[ab]

[a], compared with the PCIA group, P<0.05; [b], P<0.05 compared with the SPB group. PCIA, patient-controlled intravenous analgesia; SPB, single serratus anterior plane block; CSPB, continuous serratus anterior plane block.

total length of hospital stay (P>0.05), as shown in *Table* 7.

Discussion

Moderate to severe pain occurs in 78% of patients after thoracic surgery (8). PCIA, mainly with opioid infusion, is associated with postoperative nausea and vomiting, respiratory depression, and intestinal obstruction (9). TEA has been known as the gold standard for thoracotomy postoperative analgesia. However, it is difficult to puncture the middle and high epidural block, with obvious intraoperative circulation fluctuation, postoperative urinary retention, nerve injury, and other complications (10) that limit its use. Studies have shown that TPVB, can provide similar effects to TEA in terms of thoracoscopic surgery analgesia (11). However, it has been found in clinical work that the application of TPVB in postoperative analgesia after VATS also has some disadvantages: the single time of action of TPVB is limited, the continuous catheters can be displaced and prolapse, and the incidence of incomplete block range is high (12), which does not meet the requirements of perioperative whole analgesia. New approaches to the TPVB for breast surgery have been proposed: the retrolaminar block (RLB) and the mid-point transverse process to pleura block (MTP block). In both cases, the local anesthetic is injected near the paravertebral space providing similar effect. A clear limitation of these techniques appears the inability to place a catheter for continuous postoperative infusion. At the current time, we do not recommend RLB and MTP blocks for pain management after VATS. Studies have shown that when TPVB is not feasible, both SAPB and ICNB can be regarded as the second choice (13).

Serratus anterior plane block and intercostal nerve block are attractive options for multimodal analgesia in patients undergoing thoracoscopic surgery. Intercostal nerve block can effectively block the nociceptive stimulation of intercostal nerve, but it needs multi-intercostal multi-point injection to give local anesthetic drugs, and the drug dosage is high, which is easy to produce drug poisoning reaction. Anterior serratus muscle plane block can block not only the lateral cortex of intercostal nerve, but also the long thoracic nerve, only single-point injection is needed and the range is more extensive. Ultrasound-guided SAPB involves injection of local anesthetic into the serratus anterior plane to block the lateral cutaneous branch of the T2-T9 intercostal nerve and provide anterolateral and partial posterior analgesia of the chest wall (9), which is suitable for postoperative analgesia after thoracoscopic surgery. Therefore, it is feasible and reliable to use intravenous anesthesia combined with TPVB for intraoperative analgesia, and to use SAPB or PCIA for postoperative analgesia.

In this study, it was found that the VAS scores of the SPB group and CSPB group were lower than those of the PCIA group at all time points except 48h after surgery (P<0.05). Furthermore, the time of first postoperative activity was shortened and the total length of hospitalization was reduced, which confirmed that single and continuous SAPB as a component of postoperative analgesia of VATS could provide a good analgesic effect for patients in the early postoperative stage, and could accelerate patients' recovery. This is consistent with the research results of Magoon *et al.* (14) and Yang *et al.* (15). Hanley *et al.* (16) compared the effects of continuous SAPB and continuous TPVB on postoperative analgesia after VATS surgery, and the results showed that continuous SAPB, as part of the MMA program, did not have an inferior analgesic effect within 48h after surgery, which confirmed the effectiveness of continuous SAPB in postoperative analgesia. However, Vig *et al.* (17) conducted continuous SAPB for 10 patients undergoing lateral thoracotomy, and 4 patients still needed additional pump injection for analgesia after surgery. Therefore, the authors believed that continuous SAPB had significant individual differences in alleviating postoperative pain after lateral thoracotomy. In this study, the VAS score of patients in the SPB group was lower than that in the

CSPB group at 12 and 24 h after surgery (P<0.05), the total QoR-40 score in the SPB group was significantly higher than that in the CSPB group at 48 h after surgery, and the score of physical comfort was higher (P<0.05), which was consistent with the results of Vig *et al.* (17). It is suggested that continuous SAPB is inferior to single SAPB+PCIA in VATS surgery. The authors analyzed the significant differences in postoperative analgesic effects of continuous SAPB in different studies, which may be related to the following factors: (I) the superficial chest position, shallow and small fascial space, and different muscle mass, which may easily lead to the catheter falling out or the placement of the catheter is not ideal; (II) the surgical incision may destroy the fascial plane, thereby changing the distribution of drugs (17); (III) no consensus has been reached on the administration concentration and volume of SAPB, which affects the outcome. Subsequent studies are still needed to determine the optimal administration and catheterization methods of SAPB.

There are some limitations in this study: (I) this study is a single-center study with a small sample size. Postoperative follow-up was only performed 2 months after surgery, and longer follow-up was not conducted; (II) in this study, the internationally accepted VAS score was adopted for the evaluation of postoperative pain in the 3 groups of patients, but it is highly subjective. More objective indicators, such as the determination and comparison of inflammatory factors generated under pain stimulation, should be included.

In conclusion, ultrasonic-guided single SAPB combined with intravenous self-controlled analgesia, as a component of MMA after thoracoscopic lobotomy, has a good analgesic effect, fewer adverse reactions, and high patient comfort, which can improve the quality of early postoperative recovery and accelerate the perioperative recovery process of patients.

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Footnote

Reporting Checklist: The authors have completed the CONSORT reporting checklist. Available at https://dx.doi.org/10.21037/apm-21-2597

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/apm-21-2597). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Review Boards of Tianjin Chest Hospital (No.: 2021KY-018-01). Written informed consent was obtained from each patient and their guardian.

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