Effect of Combined Thoracic Paravertebral Block and General Anesthesia vs General Anesthesia Alone on Postoperative Stress and Pain in Patients Undergoing Laparoscopic Radical Nephrectomy

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Background: This single-center study compared the effect of combined thoracic paravertebral block (TPVB) and general anesthesia vs general anesthesia alone on postoperative stress and pain in patients undergoing laparoscopic radical nephrectomy.

Material/Methods: Patients undergoing laparoscopic radical nephrectomy were selected and randomized into a study group given TPVB combined with general anesthesia (n=43) and a reference group (n=43) given general anesthesia. The perioperative clinical indicators, blood pressure, pulse rate, visual analog scale (VAS) score, and adverse reactions were compared.

Results: Perioperative clinical indicators of the study group (other than operation duration) were superior to those of the reference group ($P<0.05$). At 90 min in the operation, systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate were lower than before anesthesia (t=7.691, 10.017, and 7.728, $P<0.05$). SBP, DBP, and pulse rate at 90 minutes during operation were significantly lower in the study group than in the reference group (t=7.582, 8.754, and 6.682, $P<0.01$). The study group had lower VAS scores both during activity and at rest 48 h after the operation than in the reference group (t=5.171 and 6.025, $P<0.001$). The total incidence of adverse reactions in the study group was lower than in the reference group ($\chi^2=5.018$, $P=0.024$).

Conclusions: The findings from this study from a single center showed that TPVB combined with general anesthesia for patients undergoing laparoscopic radical nephrectomy significantly reduced postoperative pain and stress.

Keywords: Adjuvants, Anesthesia • Anesthesia • Anesthesia and Analgesia

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Background

Renal cancer is the most common malignant tumor of the kidney, with locally advanced renal cancer accounting for a substantial proportion, for which laparoscopic radical nephrectomy is the most frequently used treatment method [1]. This technique outperforms the traditional open nephrectomy in terms of less postoperative pain, shorter hospital stay, and rapid recovery. Previous studies [2,3] have confirmed that laparoscopic radical nephrectomy under general anesthesia causes a perioperative stress response in patients due to factors such as anesthetic drugs, surgical stimulation, and pneumoperitoneum, which ultimately result in worse prognosis and recovery. Accordingly, optimization of surgical anesthesia remains an urgent problem [3]. Studies have demonstrated [4,5] that general anesthesia combined with thoracic paravertebral block (TPVB) can effectively reduce the postoperative stress response of patients undergoing laparoscopic cholecystectomy, and mitigate the pain of patients undergoing laparoscopic liver cancer resection [6]. The significant postoperative pain associated with open surgery has created a great need for an alternative method that provides adequate pain relief with minimal adverse effects. Gautam et al [7] showed that TPVB and thoracic epidural analgesia (EA) had similar efficacy and adverse effects on postoperative pain relief in patients undergoing open nephrectomy. Baik et al [8] showed that preoperative addition of a single TPVB intervention reduced postoperative pain scores and fentanyl dosage in patients undergoing nephrectomy and improved postoperative analgesia. A systematic review revealed that general anesthesia (GA) combined with continuous paravertebral block (CPVB) provides good postoperative analgesia by reducing the level of inflammation in patients during breast cancer surgery, and reduces adverse reaction rates [9]. Therefore, this study from a single center aimed to compare the effects of combined TPVB and general anesthesia vs general anesthesia alone on postoperative stress and pain in patients undergoing laparoscopic radical nephrectomy.

Material and Methods

This study was reviewed and approved by the Ethics Committee and all participants signed the informed consent form, with the ethics approval number of 2019-12-11. This study prospective randomized controlled study was conducted in our hospital from March 2020 to March 2021 to explore the effect of TPVB combined vs general anesthesia in laparoscopic radical nephrectomy.

Participants and Recruitment

From March 2020 to March 2021, a simple random sampling method was used to recruit 86 patients who were eligible for laparoscopic radical nephrectomy in the Oncology Department of our hospital. The patients all met the following criteria: had renal cancer without metastasis; aged 20-60 years old; ASA grade I-III; had not received chemotherapy, radiotherapy, or anti-tumor drug treatment; tolerated surgery and anesthesia well; could cooperate with surgical treatment; no infection at the puncture site; and signed an informed consent form. Patients meeting the following criteria were excluded from this study: severe cardiopulmonary diseases or lung infection; coagulation dysfunction; pregnant and lactating women; and allergy to the drugs used in this study.

Procedures

All patients were divided into the study group (n=43) and reference group (n=43) by randomly choosing a number card from 1-86 in a non-transparent box.

Ethic Rules

This study was conducted following the principles of the *Ethical Code of Human Medical Research* [7]. After being recruited, the patients were informed about the purpose, process, and confidentiality of the study, and all patients signed a consent form.

Anesthesia

Both groups of patients underwent anesthesia and surgery performed by the same group of senior physicians. After entering the operating room, a peripheral venous vascular access was established, heart rate and blood oxygen saturation were routinely monitored, and the arterial blood pressure was continuously monitored under local anesthesia by radial artery puncture and catheterization. Before induction of anesthesia, patients in the study group received TPVB using a method previously described [8]. The steps were as follows. With the patients in a lateral position, routine sterilization was performed, and the E3 ultrasound diagnostic system (manufacturer: Shenzhen Kaili Biomedical Technology Co., Ltd) was used to determine the location of the paravertebral space between T9 and T11, where puncture was performed by using a parasternal long-axis in-plane technique. The reference group was given 0.5% ropivacaine 0.5 ml/kg after determining the vertical spine plane, and the study group was given 0.5% ropivacaine 0.5 ml/kg in the T9 and T11 paravertebral space planes. After the tip of the needle reached the proper position where no blood or gas can be drawn after withdrawing the plunger of the syringe, 10 ml of 0.5% ropivacaine (SFDA approval number: H20113381 Manufacturer: Guangdong Jiabao Pharmaceutical Co., Ltd. Specification: 10 ml: 75 mg) was injected. Drug accumulation in the paravertebral space can be observed under ultrasound. Anesthesia induction was performed 20 min later, after measurement of the patient's blocking effect by

needle prick method. The specifics were as follows. Midazolam (SFDA approval number: H20031037; manufacturer: Jiangsu Enhua Pharmaceutical Co., Ltd.; specification: 2 ml: 2 mg) 0.03-0.05 mg/kg, Rocuronium Bromide (SFDA approval number: H20183109; manufacturer: Guangdong Jiabo Pharmaceutical Co., Ltd.; specification: 5 ml: 50 mg) 0.7 mg/kg, Etomidate (SFDA approval number: H32022379; manufacturer: Jiangsu Hengrui Pharmaceutical Co., Ltd.; specification: 10 ml: 20 mg) 0.2-0.3 mg/kg, and sufentanil (SFDA approval number: H20054256; manufacturer: Yichang Renfu Pharmaceutical Co., Ltd.; specification: 5 ml: 250 μg) 0.5 μ/kg were injected intravenously, followed by tracheal intubation after the patients lost consciousness for 3-4 min. mechanical ventilation was then performed after successful intubation, with the oxygen flow of 2 L/min, VT 6-8 ml/kg, ventilation frequency of 12 times/min, and maintenance of PETCO 235-40 mmHg. Intraoperative continuous target-controlled infusion of propofol (SFDA approval number: H20040300; manufacturer: Xi'an Libang Pharmaceutical Co., Ltd.; specification: 50 ml: 500 mg) at plasma target concentrations of 1-4 μg/ml with remifentanil (SFDA approval number: H20123422; manufacturer: Sinopharm Group Industrial Co., Ltd. Langfang Branch; specification: 1 mg) at effect compartment concentrations of 4-6 ng/ml was used to maintain anesthesia. Intermittent intravenous injection of cis-atracurium (SFDA approval number: H20090202; manufacturer: Zhejiang Xianju Pharmaceutical Co., Ltd.; specifications: 5 mg) was performed to maintain muscle relaxation. An anesthesia depth monitor (manufacturer: Shenzhen Taiji Medical Technology Co., Ltd.; Model: TD-3200A) was employed to monitor the patient's intraoperative anesthesia depth, which was maintained at the D-E level. After the operation was completed, an analgesic pump was connected to perform patient-controlled intravenous analgesia (PCIA), with the drug prepared as follows: 10 mg Tropisetron (SFDA approval number: H20060288; manufacturer: Hainan Lingkang Pharmaceutical Co., Ltd.; specification: 1 ml: 5 mg ×5 pieces/box) and sufentanil 2 μm/kg were diluted with normal saline to 100 ml, with a continuous infusion rate of 2 ml/h, PCA dose of 2 ml/time, and lockout time of 15 min. In the Postanesthesia Care Unit (PACU), if the patient's visual analog scale (VAS) score was >3 points, intravenous injection of oxycodone (SFDA approval number: H20090214 Manufacturer: Beijing Huasu Pharmaceutical Co., Ltd. Specification: 5 mg) 0.05-0.10 mg/kg was given to the patients for remedial analgesia.

Laparoscopic radical nephrectomy is routinely performed with a urinary catheter and gastric tube in place before surgery, as detailed below. **(1)** Trocar location selection. After satisfactory general anesthesia, with the patient in the lateral healthy-side position, the pneumoperitoneum was established by puncturing a pneumoperitoneum needle at the outer edge of the rectus abdominis muscle on the affected side, followed by the puncture of a 10 mm trocar and the placement of an observation scope. Under direct vision, two 12-mm trocars were punctured 3 cm below the costal margin in the ipsilateral midclavicular line and at the umbilicus level in the anterior axillary line, respectively, to establish the operating channel. **(2)** Renal pedicle vessel exposure and blockage. Left side: The retroperitoneum was incised longitudinally along the left Toldt line, superior to the splenorenal ligament and inferior to the iliac vessels. With the colon and spleen inverted to the midline side by gravity, the retroperitoneal fat was lifted and freed at the inferior pole of the kidney along the relatively avascular zone between the retroperitoneal fat and the perirenal fascia, up to the superior pole of the kidney and medially to the psoas major muscle, after which the renal vessels were then visible at the arterial pulses. The sheath of the renal vein was dissected by ultrasonic knife to free the renal vein, the genital vein, and the central adrenal vein, and the central vein and the genital vein were clamped by titanium clips. Subsequently, the renal artery above the inner renal vein was freed, then the artery and vein were clipped with Hem-O-lok forceps, 2 proximally and 1 distally, respectively, and then snipped. On the right side, the posterior peritoneum was incised longitudinally with an ultrasound knife up to the hepatocolic ligament and down to the cecum, and the right deltoid ligament and coronary ligament were cut off. With the colon inverted to the midline side by gravity, the extraperitoneal fat was lifted and freed medially by the same method, and the renal vein and artery were freed, clamped, and disconnected, similar to the operation of the left side. **(3)** Kidney excision. After treatment of the renal pedicle vessels, the medial and superior margins of the kidney were freed outside the perirenal fascia along the outer edge of the abdominal aorta on the left and along the outer edge of the inferior vena cava on the right. The ureter at the lower pole of the kidney was freed to the iliac vessels, and the distal end of the ureter was clamped using a titanium clip and dissected by ultrasound knife. After lifting the ureteral stump, the posterior lateral border of the kidney and the dorsal side were freed in sequence. In patients with tumors of the upper pole and middle part of the kidney, the ipsilateral adrenal gland was resected, and the kidney, perinephric fat, adrenal gland, lymph nodes at the hilum, upper ureter, and perinephric fascia were resected outside the perinephric fascia. The kidney was excised and placed in a specimen bag, and trocar incision was extended longitudinally at the midclavicular line to take out the kidney prior to routine suturing of the incision and retention of the abdominal drainage tube.

Effectiveness Evaluation

Clinical Data

The clinical data were recorded, including: name, age, sex, place of residence, marital status, education level, smoking history, drinking history, and underlying diseases.

Table 1. Comparison of clinical data between the 2 groups of patients [$\overline{\chi}\pm s$, n(%)].

	Study group (n=43)	Reference group (n=43)	χ^2/t	P
Sex			0.047	0.828
Male	25 (58.14%)	24 (55.81%)		
Female	18 (41.86%)	19 (44.19%)		
Mean age ($\overline{x}\pm s$, year)	43.27±4.57	43.31±4.76	0.040	0.968
BMI(kg/m^2)	21.73±1.63	21.76±1.72	0.083	0.934
Tumor diameter (cm)	5.82±2.12	5.78±2.08	0.088	0.930
Tumor location			0.187	0.665
Left	21 (48.84%)	19 (44.19%)		
Right	22 (51.16%)	24 (55.81%)		
Underlying illness				
Diabetes	15 (34.88%)	18 (41.86%)	0.443	0.506
Hypertension	20 (46.51%)	21 (48.84%)	0.047	0.829
Marital Status				
Unmarried	3 (6.98%)	4 (9.30%)	0.156	0.693
Married	38 (88.37%)	36 (83.72%)	0.387	0.534
Divorced	2 (4.65%)	3 (6.98%)	0.212	0.645
Drinking			0.187	0.665
Yes	22 (51.16%)	24 (55.81%)		
No	21 (48.84%)	19 (44.19%)		
Smoking			0.443	0.506
Yes	18 (41.86%)	15 (34.88%)		
No	25 (58.14%)	28 (65.12%)		
Place of residence			0.434	0.510
Township	16 (37.21%)	19 (44.19%)		
Rural area	27 (34.88%)	24 (55.81%)		
Educational background				
College degree and above	12 (27.91%)	10 (23.26%)	0.244	0.621
High school	26 (60.47%)	26 (60.47%)	0.000	1.000
Middle school or below	5 (11.63%)	7 (16.28%)	0.387	0.534

Perioperative Clinical Indicators

The clinical indicators were accurately recorded by medical staff, including: operation time, vasoactive drug use rate, postoperative hospital stay, intestinal recovery time, analgesic recovery rate, and PACU stay time. Intestinal recovery time refers to the first exhaust time in each group of patients. The visual analog scale (VAS) scores ≤4 points were considered acceptable, and intravenous tramadol 100 mg remedial analgesia was administered for VAS scores >4 points. Those who received remedial analgesia were excluded from the follow-up study.

Blood Pressure and Pulse Rate

The blood pressure, including systolic blood pressure (SBP) and diastolic blood pressure (DBP), and pulse rate of the 2 groups of patients before anesthesia and at 90 min during the operation were measured.

VAS Score

A 10-cm line was drawn on a paper, with 0 at one end of the line indicating no pain and 10 at the other end indicating severe pain. The patient was asked to mark the line to indicate the level of pain based on self-perception [9-11].

Table 2. Comparison of perioperative clinical indicators between the 2 groups [$\bar{\chi}\pm$s, n(%)].

Indexes	Study group (n=43)	Reference group (n=43)	χ^2/t	P
Operation duration(min)	154.61±18.72	143.26±19.72	2.737	0.008
Use rate of vasoactive drugs (%)	8 (18.60)	43 (100.00)	59.020	<0.001
Postoperative hospital stay(d)	7.27±2.35	10.92±2.18	7.467	<0.001
Bowel recovery time(h)	8.94±2.65	15.72±3.67	9.822	<0.001
Analgesia remedy rate(%)	3 (6.98)	14 (32.56)	8.871	0.003
PACU stay time(min)	82.35±17.93	91.23±18.72	2.246	0.027

PACU – Postanesthesia Care Unit.

Adverse Reactions

The occurrence of clinical adverse reactions in the 2 groups of patients after surgery were recorded and compared.

Statistical Analysis

The data in the present study were statistically analyzed and processed using SPSS21.0 software, and GraphPad Prism 7 (GraphPad Software, San Diego, USA) was used to plot graphics. Count data are presented by [n (%)], and analyzed by χ^2 test; measurement data are expressed as ($\bar{\chi}\pm$s), and examined by *t* test. A *P* value of <0.05 was deemed statistically significant.

Results

Comparison of Clinical Data Between the 2 Groups

From March 2020 to March 2021, a total of 86 patients were enrolled in the study, and all patients completed data collection. The sex, mean age, BMI, tumor diameter,

tumor location, underlying illness, marital status, drinking, smoking, place of residence, and educational background were homogenous (*P*>0.05) (**Table 1**).

Comparison of Perioperative Clinical Indicators Between the 2 Groups

Operation duration, use rate of vasoactive drugs, postoperative hospital stay, bowel recovery time, analgesia remedy rate, and PACU stay time of the study group, but not operation duration, were superior to those of the reference group (*P*<0.05) (**Table 2**).

Comparison of Blood Pressure and Pulse Rate Before Anesthesia and at 90 Min During Operation Between the 2 Groups

The SBP levels of the patients in the study group were (118.35±8.67) mmHg before anesthesia and (120.54±7.35) mmHg at 90 min during the operation. The SBP levels of the patients in the reference group were (119.17±8.74) mmHg before anesthesia and (132.64±7.45) mmHg at 90 min during the operation.
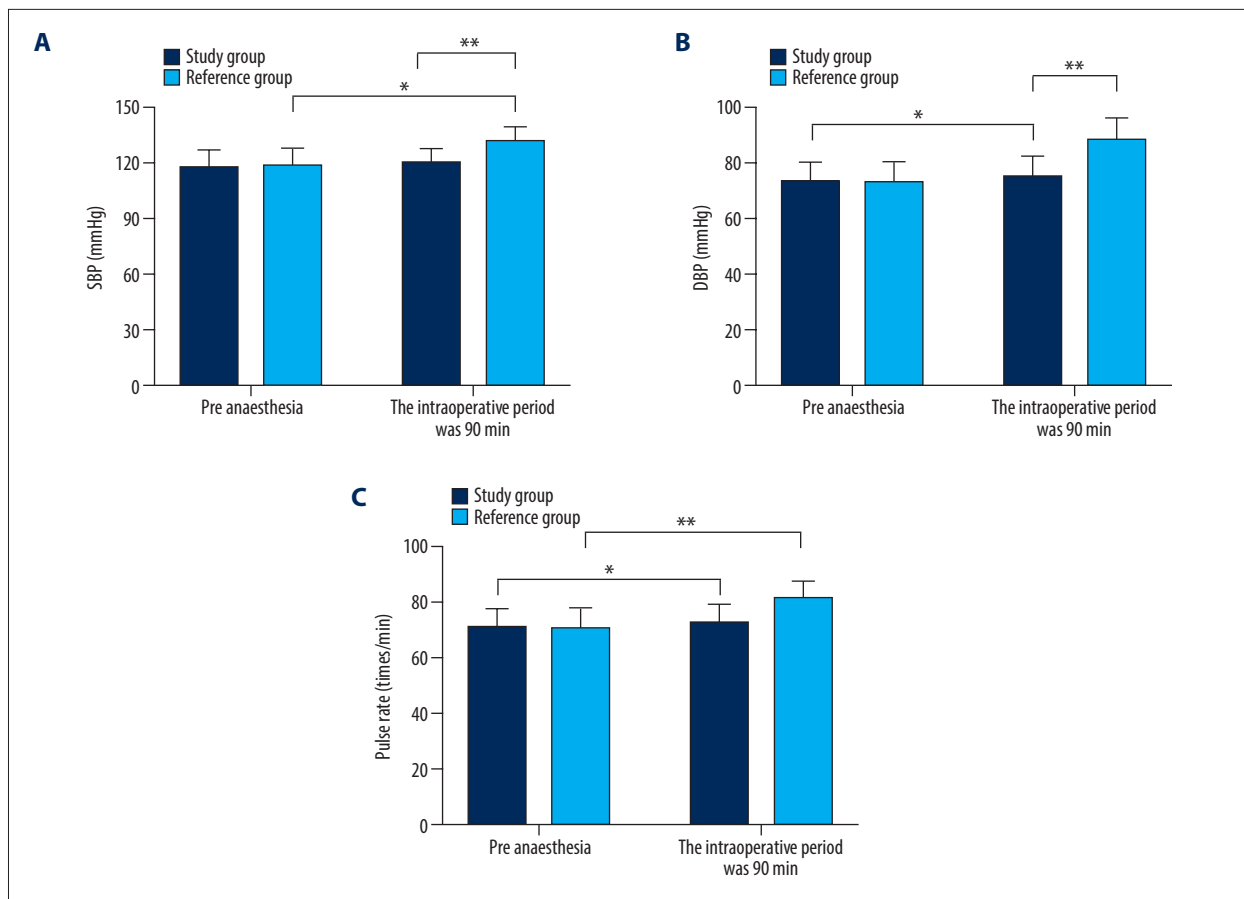
The DBP levels of the patients in the study group were (73.64±6.35) mmHg before anesthesia and (75.25±6.96) mmHg at 90 min during the operation. The DBP levels of the patients in the reference group were (74.12±6.19) mmHg before anesthesia and (88.59±7.17) mmHg at 90 min during the operation. The pulse rates of the patients in the study group were (71.33±6.54) beats/min before anesthesia and (73.14±6.39) beats/min at 90 min during the operation. The pulse rates of the patients in the reference group were (71.52±6.63) times/min and (82.17±6.14) times/min, respectively. At 90 min in operation, the levels of systolic blood pressure (SBP) and diastolic blood pressure (DBP) and pulse rate were lower than those before anesthesia (t=7.691, 10.017, and 7.728, respectively, *P*<0.05). Significantly lower levels of SBP and DBP and pulse rate at 90 min during operation were found in the study group than in the reference group (t=7.582, 8.754, and 6.682, *P*<0.01) (**Figure 1**).

Comparison of Pain Scores Between the 2 Groups at 48 h After Surgery

The study group had a considerably lower VAS scores at rest and activity 48 h after the operation compared with the reference group (*P*<0.001) (**Figure 2**).

The VAS scores of the study group and the reference group at activity 48 h after the operation were (3.15±0.34) points and (3.57±0.41) points, respectively. The VAS scores of the study

Figure 1. Comparison of blood pressure and pulse rate changes in the 2 groups before anesthesia and at 90 min during the operation (x±s). (**A**) Comparison of the changes in the systolic blood pressure (SBP) level of the 2 groups before anesthesia and at 90 min during the operation. The SBP levels of the patients in the study group were (118.35±8.67) mmHg and (120.54±7.35) mmHg before anesthesia and at 90 min during the operation. The SBP levels of the patients in the reference group were (119.17±8.74) mmHg and (132.64±7.45) mmHg before anesthesia and at 90 min during the operation. * Indicates that there is a significant difference in the SBP level of patients in the reference group before anesthesia and at 90 min during the operation (t=7.691, *P*<0.05); ** indicates that there is a significant difference in the SBP level at 90 minutes during the operation between the 2 groups (t=7.582, *P*<0.01). (**B**) Shows the comparison of the changes in the diastolic blood pressure (DBP) levels between the 2 groups before anesthesia and at 90 min during the operation. The DBP levels of the patients in the study group were (73.64±6.35) mmHg and (75.25±6.96) mmHg before anesthesia and at 90 min during the operation. The DBP levels of the patients in the reference group were (74.12±6.19) mmHg and (88.59±7.17) mmHg before anesthesia and at 90 min during the operation. * Indicates that there is a significant difference in the DBP level of the reference group before anesthesia and at 90 min during the operation (t=10.017, *P*<0.05); ** indicates that there is a significant difference between the 2 groups in DBP levels at 90 min during the operation (t=8.754, P<0.01).(**C**) Comparison of the pulse rate changes of the 2 groups before anesthesia and 90 min during the operation. The pulse rates of the patients in the study group were (71.33±6.54) beats/min and (73.14±6.39) beats/min before anesthesia and during the operation. The pulse rates of the patients in the reference group were (71.52±6.63) times/min, (82.17±6.14) times/min. * Indicates that there is a significant difference in the pulse rate in the reference group before anesthesia and 90 min during the operation (t=7.728, *P*<0.05); ** indicates that there is a significant difference in pulse rate at 90 min between the 2 groups (t=6.682, *P*<0.01).

group and the reference group at rest 48 h after the operation were (2.74±0.31) points and (3.13±0.29) points, respectively. The study group had remarkably lower VAS scores at activity and at rest 48 h after the operation than the reference group (t=5.171 and 6.025, *P*<0.001).

Comparison of the Adverse Reactions of the 2 Groups

The total incidence of adverse reactions in the study group was clearly lower than that in the reference group (χ^2=5.018, *P*=0.024) (**Table 3**).
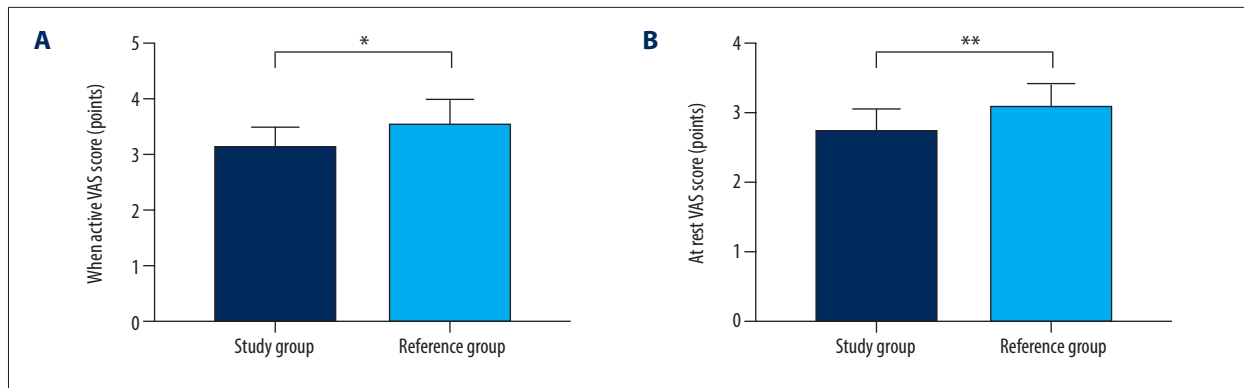
Figure 2. Comparison of pain scores between the 2 groups in different states at 48 h after surgery ($\overline{x}\pm s$). (**A**) Comparison of the visual analog scale (VAS) scores of the 2 groups of patients at activity 48 h after the operation. The VAS scores of the study group and the reference group at activity 48 h after the operation were (3.15±0.34) points and (3.57±0.41) points respectively. * Indicates that there is a significant difference in the VAS scores between the 2 groups at activity 48 h after the operation (t=5.171, $P<0.05$). (**B**) Comparison of the VAS scores of the 2 groups of patients at rest 48 h after the operation. The VAS scores of the study group and the reference group at rest 48 h after the operation were (2.74±0.31) points and (3.13±0.29) points, respectively; ** indicates that there is a significant difference in the VAS scores at rest 48 h after the operation between the 2 groups (t=6.025, $P<0.01$).

Table 3. Comparison of postoperative adverse reactions between the 2 groups [n(%)].

Groups	n	Nausea and vomiting	Weak breathe	Cardiovascular diseases	Itchy skin	Total incidence
Study group	43	1 (2.33%)	0 (0.00)	0 (0.00)	1 (2.33%)	4.65% (2/43)
Reference group	43	3 (6.98%)	2 (4.65%)	1 (2.33%)	3 (6.98%)	20.93% (9/43)
χ^2						5.108
P						0.024

Discussion

The prevalence of renal cancer in urinary system tumors is second only to bladder cancer. Recent statistics report that renal cancer accounts for about 2-3% of adult malignant tumors, and the ratio in males and females is approximately 2: 1, with a strong predominance in rural areas, and population aged 50-70 years old [12-14]. Laparoscopic radical nephrectomy is currently the mainstay treatment of locally advanced renal cancer, which has advantages of less trauma and faster postoperative recovery compared with traditional open surgery. General anesthesia is a commonly used anesthesia program for this minimally invasive surgery [15], yet accumulating studies have shown that general anesthesia can cause body stress response after surgery due to factors such as anesthetics and pneumoperitoneum, which consequently requires analgesia [16,17], and this was also confirmed by HOSKIN et al [18]. Interestingly, Abboud et al [19] found that TPVB can produce a robust analgesic effect, featured by unilateral block during laparoscopic lung surgery. With regard to general anesthesia, the application of TPVB in patients undergoing general anesthesia for thoracoscopic lung surgery facilitates the suppression of postoperative pain and achieves a low opioid anesthetic pattern. To the best of our knowledge, the various perioperative clinical indicators of patients after surgery are the key indicators that reflect the recovery of functions of the body [20]. The results of this study show that the perioperative indicators of the study group, other than operation time, were superior to those of the reference group, as TPVB requires mechanical ventilation and other operations during the implementation process, which prolongs the operation time. However, the patient's analgesic recovery rate and postoperative hospital stay were remarkably lower than in those who only received general anesthesia, indicating that general anesthesia combined with TPVB is conducive to rapid recovery after laparoscopic radical nephrectomy. The stress response is a non-specific defense response that is clinically characterized by sympathetic nerve excitement and enhancement of hypothalamus-anterior pituitary-adrenal cortex function induced by the stimulation of various factors during the operation. In general, with a strong physical stress response caused by pain, patients are predisposed to elevated blood pressure and heart rate. It has been reported [21] that the optimization and upgrade of the anesthesia regimen can effectively reduce the patient's body stress response. Remarkably,

this study confirmed that the introduction of TPVB combined with general anesthesia into laparoscopic radical nephrectomy generated little impact on the blood pressure and pulse rate of the patients, while the blood pressure and pulse rate at 90 min during the operation for patients under general anesthesia were higher than those before anesthesia, and this result was corroborated by a modified radical mastectomy for breast cancer trail conducted by Tveit et al [22]. Clinical studies [23-25] have found that a single-point injection of 10-15 ml of local anesthetic in the thoracic intervertebral space can block 2-3 thoracic vertebral segments. This study used the T_9-T_{11} two-point block method, which can effectively meet the needs of retroperitoneal laparoscopy. The onset time of local injection of ropivacaine was 10-15 min, and the anesthesia level was measured 20 min after administration in this study to ensure the full effect of TPVB before general anesthesia induction in patients. Furthermore, this study reported higher VAS scores of patients at rest and at activity 48 h after surgery in patients receiving general anesthesia alone, indicating that combined anesthesia is more conducive to reducing postoperative pain and accelerating postoperative recovery. Since the patients were recovering from surgery, short-term postoperative VAS

scores at 0 h, 1 h, 3 h, 6 h, 12 h, and 24 h were not obtained, and since the medical setting was primarily patient-based, this study mainly focused on obtaining data at 48 h postoperatively. The limitations of this study are that was a single-center study with a small sample size, the bias of the randomized grouping method, and the lack of long-term follow-up, which will be further expanded in the future to extend the follow-up period to obtain more clinical data.

Conclusions

The findings from this single-center study showed that TPVB combined with general anesthesia for patients undergoing laparoscopic radical nephrectomy significantly reduced postoperative pain and stress.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors, who confirm that the images are original with no duplication and have not been previously published in whole or in part

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