Effect of transversus abdominis plane block combined with low-dose dexmedetomidine on elderly patients undergoing laparoscopic colectomy

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Abstract

Introduction: *Colon cancer is a common malignancy, for which surgery is currently the preferred therapy.*
Aim: *To assess the effect of transversus abdominis plane block (TAPB) combined with low-dose dexmedetomidine on elderly patients undergoing laparoscopic colectomy.*
Material and methods: *Sixty-two elderly patients undergoing laparoscopic colectomy between March 2021 and March 2022 were randomly selected and equally divided into Group A (low-dose dexmedetomidine) and Group B (TAPB + low-dose dexmedetomidine) by the randomized double-blind method. The treatment outcomes were compared.*
Results: *The resting and active Visual Analogue Scale and Pittsburgh Sleep Quality Index scores were lower in Group B than those in Group A at 6 h, 1 day, 2 days and 3 days after operation ($p < 0.05$). The two groups had no significant differences in the levels of cluster of differentiation 4+ (CD4+), CD8+ and free Cor, CD4+/CD8+ ratio and NK cell level before anesthesia ($p > 0.05$). At 24 h after the operation, the level of CD4+, CD4+/CD8+ ratio and NK cell level were higher in Group B than those in Group A, and the levels of CD8+ and free Cor were lower in Group B ($p < 0.05$). Group B had higher partial pressure of oxygen ((45.52 ±11.14) mm Hg) and pH (7.42 ±0.06) ($p < 0.05$) and lower partial pressure of carbon dioxide ((4.05 ±0.32) mm Hg) than those of Group A ($p < 0.05$).*
Conclusions: *TAPB combined with low-dose dexmedetomidine can exert better anesthetic, analgesic and sedative effects, and ameliorate stress responses.*

Key words: *delirium, dexmedetomidine, elderly, laparoscopic colectomy, transversus abdominis plane block.*

Introduction

Colon cancer is a common malignancy. Patients have adverse symptoms such as abdominal distension and bloody stools in the early stage of the disease, and peritoneal effusion and other more serious symptoms gradually emerge as the disease deteriorates, seriously threatening patients' lives [1]. Currently, surgery is the preferred therapy for colon cancer. Laparoscopic colectomy is a typical minimally invasive surgery. However, both surgery and anesthesia, as potent stressors for elderly patients, induce severe stress responses, increase the activity of platelets and restrain the immune function. Meanwhile, it causes more intense postoperative pain than other types of laparoscopic surgery. Severe pain not only further aggravates the stress response but also decreases the immunity, thus affecting the prognosis. Therefore, it is of great clinical value to improve the effectiveness and safety of analgesia for elderly patients undergoing laparoscopic colectomy [2–4].

Traditional anesthetic drugs, such as midazolam, exert analgesic effects by acting on the gamma-am-

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inobutyric acid system, but they suppress the immune function. Nevertheless, anesthetic drugs have a more serious impact on the central nervous system of elderly patients, with a higher risk of postoperative delirium [5–9]. Delirium is a common clinical syndrome of acute temporary disturbance of neurological function, manifested as consciousness and cognitive dysfunction [10]. The central depressant effects (anti-anxiety and sedation) of dexmedetomidine are achieved through acting on the subcortical locus coeruleus rather than the cerebral cortex, which substantially reduces the incidence rate of postoperative delirium in elderly patients undergoing laparoscopic colectomy [11].

Transversus abdominis plane block (TAPB), which is essentially a regional block, refers to ultrasound-guided injection of local anesthetic drugs into the plane between the internal oblique fascia and the transversus abdominis fascia to block the anterior sensory nerves of the abdominal wall, which can achieve good anesthetic and analgesic effects [12]. TAPB combined with low-dose dexmedetomidine (an $\alpha 2$ adrenergic receptor agonist) can inhibit sympathetic nerves without a greater impact on the hemodynamic indicators, protect the nervous system, reduce the number of apoptotic brain cells, lower the incidence rate of postoperative delirium, and improve surgical safety [13].

Aim

In this study, the effect of TAPB combined with low-dose dexmedetomidine on elderly patients undergoing laparoscopic colectomy was assessed.

Material and methods

General data

This study has been approved by the ethics committee of our hospital (approval No. JPH202103002), and written informed consent has been obtained from all patients. Sixty-two elderly patients undergoing laparoscopic colectomy from March 2021 to March 2022 were randomly selected and equally divided into Group A and Group B by a randomized double-blind method.

Methods

All patients were fasted for 8 h preoperatively and given 250 ml of glucose 2 h before the operation. After the patient entered the operating room, venous access was established, and vital signs (including heart rate (HR), pulse, and blood pressure) were monitored. Then laparoscopic colectomy was performed under general intravenous anesthesia.

Methods for Group A

Low-dose dexmedetomidine was used for Group A. Specifically, dexmedetomidine (Yangtze River Pharmaceutical Group Co., Ltd., NMPA H20183219, batch No.: 20041231) was pumped at a loading dose of 1 μg/kg for 15 min during anesthesia induction. During the operation, dexmedetomidine was continuously pumped at 0.2–0.7 $\mu g\ kg^{-1} \cdot h^{-1}$ until 30 min before the end of the operation. During general anesthesia induction, the patient was given high-flow oxygen for 3 min, and then atracurium (0.1–0.15 mg/kg) + propofol (2.0–2.5 mg/kg) + sufentanil (0.2–0.5 μg/kg). After tracheal intubation, mechanical ventilation was performed with a respiratory rate (RR) of 10–14 times/min and a tidal volume of 8 ml/kg. During the operation, propofol (4–8 mg/kg) and sufentanil (0.15–0.3 μg/kg) were continuously pumped every hour, and atracurium was administered intermittently until the end of the operation.

Methods for Group B

Group B received TAPB + low-dose dexmedetomidine (same as above). Anesthesia induction was performed by intravenous injection of sufentanil (0.2–0.5 μg/kg), atracurium (0.1 mg/kg) and propofol (1.5 mg/kg). After tracheal intubation, the puncture site of the transversus abdominis plane was located under the guidance of ultrasound, clearly displaying the external oblique, internal oblique and transversus abdominis muscles. A puncture needle was inserted between the internal oblique and transversus abdominis muscles. When no blood return was seen with the needle slowly withdrawn, 2% ropivacaine (20 ml) was injected on each side. After the drug fully diffused to the transversus abdominis plane, the contralateral transversus abdominis plane was blocked in the same way. During the operation, propofol (4–8 mg/kg) and sufentanil (0.1–0.2 μg/kg) were continuously pumped every hour and discontinued 10 min before the end of suture. Rocuronium bromide (0.2 mg/kg) was intravenously injected when needed to maintain muscle relaxation. After the operation, a patient-controlled intravenous analgesia pump (200 µg of sufentanil + 200 ml of normal saline) was used.

Measurement of hemodynamic indicators

Hemodynamic indicators (mean arterial pressure (MAP), HR, pulse oxygen saturation (SpO_2), and RR) were recorded and compared at different time points (before anesthesia (T_0), at extubation (T_1), 8 h after the operation (T_2), 24 h after the operation (T_3), and 48 h after the operation (T_4)) [14].

Observation of postoperative delirium [15]

The incidence rate, duration and clinical manifestations (dysphoria, disorientation, gibberish, obnubilation, sleep disorder, and auditory hallucinations) of postoperative delirium were evaluated.

Detection of stress response indicators [16]

Stress response indicators (adrenocorticotropic hormone (ACTH), cortisol (Cor), and angiotensin II (Ang-II)) were recorded and compared at different time points (before anesthesia induction, after anesthesia induction, at extubation, and 1 h after extubation).

Observation of adverse reactions [17]

The adverse reactions during anesthesia recovery (tachycardia, bucking, and restlessness) and after the operation (bradycardia, hypotension, and hypoxemia) were recorded, and the incidence rate was calculated.

Assessment of Visual Analogue Scale (VAS) and Pittsburgh Sleep Quality Index (PSQI) scores [18]

The pain at rest and activity were evaluated using VAS at different time points (6 h, 1 day, 2 days and 3 days after the operation). The total score was 10 points, and a higher score meant severer pain. Additionally, the sleep quality was evaluated using the PSQI at different time points (6 h, 1 day, 2 days and 3 days after the operation). The total score was 21 points, and a higher score corresponded to a poorer sleep quality.

Measurement of laboratory indicators [19]

Before anesthesia and 24 h after the operation, 3 ml of peripheral blood was collected, added to a test tube containing anticoagulant and centrifuged at 3000 rpm for 15 min, after which the supernatant was taken. The levels of cluster of differentiation 4^+ ($CD4^+$), $CD8^+$, $CD4^+/CD8^+$ ratio and NK cells in serum were measured by flow cytometry. The level of free Cor was measured by chemiluminescence assay.

Detection of blood oxygen metabolism indicators [20]

Partial pressure of oxygen (PaO_2), partial pressure of carbon dioxide ($PaCO_2$) and pH were detected and compared.

Statistical analysis

SPSS 21.0 software was used for statistical analysis. The normally distributed measurement data were described by mean ± standard deviation ($\bar{x} \pm s$), and compared by the paired *t*-test within the same group and by the independent-samples *t*-test between two groups. The count data were described by frequency (*n*) and percentage (%), and analyzed by the χ^2 test or Fisher's exact probability test. $P < 0.05$ was considered statistically significant.

Results

General data

The general data were comparable between the two groups ($p > 0.05$) (Table I).

Hemodynamic indicators

MAP and HR had no statistically significant differences between the two groups at T_0 and T_1 ($p > 0.05$), but they were higher in Group B ((85.14 ±8.92)/(86.92 ±9.31)/(85.31 ±8.64) mm Hg, (71.42 ±5.84)/(69.48 ±6.54)/(67.62 ±8.62) beats/min) than those in Group A at T_2, T_3, and T_4 ($p < 0.05$). SpO_2 had no statistically significant difference between the two groups at T_0, T_1, T_2, T_3, and T_4 ($p > 0.05$). There was no statistically significant difference in the RR between the two groups at T_0 ($p > 0.05$), but Group B had a lower RR ((18.14 ±1.85)/(16.92 ±1.83)/(16.62 ±1.95)/(16.25 ±1.94) times/min) than Group A at T_1, T_2, T_3, and T_4 ($p < 0.05$) (Table II).

Incidence of postoperative delirium

The incidence rate of postoperative delirium in Group B (3.23%) was lower than that in Group A (22.58%) ($\chi^2 = 5.166$, $p = 0.023$), and the duration of delirium in Group B ((0.76 ±0.31) days) was

Table I. General data (*n* (%), ($\bar{x}$ ± s))

Basic data	Group B (*n* = 31)	Group A (*n* = 31)	t/χ^2	*P*-value
Gender:				
Male	20 (64.52)	18 (58.06)	0.271	0.602
Female	11 (35.48)	13 (41.94)		
Age [years]	71.52 ±3.47	71.85 ±3.52	0.371	0.711
TNM stage:				
I	8 (25.81)	10 (32.26)	0.313	0.575
II	14 (45.16)	11 (35.48)	0.603	0.437
III	9 (29.03)	10 (32.26)	0.075	0.782
Body mass index [kg/m^2]	22.15 ±2.23	22.21 ±2.28	0.104	0.916
Years of education [years]	11.82 ±3.37	11.88 ±3.50	0.068	0.945
Operation time [min]	152.63 ±43.48	155.24 ±45.13	0.231	0.817
Wakefulness time [min]	23.34 ±10.47	23.12 ±10.23	0.083	0.933
Infusion volume [ml]	3275.84 ±115.62	3250.35 ±120.87	0.848	0.399
Blood loss [ml]	410.56 ±21.86	420.84 ±23.19	1.795	0.077
Anesthesia time [min]	165.81 ±18.45	165.26 ±21.38	0.108	0.914
Spontaneous respiration recovery time [min]	12.46 ±5.13	12.58 ±4.56	0.097	0.922
Extubation time [min]	19.36 ±5.94	19.21 ±4.97	0.107	0.914

Table II. Hemodynamic indicators ($\bar{x}$ ± s), *n* = 31)

Group	Group	T_0	T_1	T_2	T_3	T_4
MAP [mm Hg]	Group A	94.95 ±8.64	93.32 ±7.91	85.14 ±8.92*	86.92 ±9.31*	85.31 ±8.64*
	Group B	95.06 ±8.72	95.28 ±8.31	93.38 ±7.86	92.86 ±9.63	90.37 ±8.62*
HR [beats/min]	Group A	72.24 ±9.16	87.46 ±8.75*	71.42 ±5.84	69.48 ±6.54	67.62 ±8.62*
	Group B	73.02 ±8.92	90.64 ±8.73*	76.68 ±9.24	74.95 ±10.62	73.25 ±9.13
SpO_2 (%)	Group A	99.23 ±2.24	98.92 ±2.14	97.95 ±2.76	97.62 ±3.14	97.15 ±2.46
	Group B	99.42 ±2.61	98.48 ±2.63	97.86 ±3.21	96.13 ±3.32	97.65 ±2.91
RR [times/min]	Group A	18.92 ±1.83	18.45 ±1.72	18.35 ±1.76	17.86 ±2.15*	17.75 ±1.74*
	Group B	18.64 ±1.92	18.14 ±1.85	16.92 ±1.83*	16.62 ±1.95*	16.25 ±1.94*
MAP	*t*	0.049	0.951	3.858	2.469	2.308
	P	0.960	0.345	0.000	0.016	0.024
HR	*t*	0.339	1.432	2.679	2.441	2.496
	P	0.735	0.157	0.009	0.017	0.015
SpO_2	*t*	0.307	0.722	0.118	1.815	0.730
	P	0.759	0.472	0.906	0.074	0.467
RR	*t*	0.587	2.226	3.135	2.378	3.204
	P	0.557	0.029	0.002	0.020	0.002

*T_0 – before anesthesia, T_1 – at extubation, T_2 – 8 h after operation, T_3 – 24 h after operation, T_4 – 48 h after operation. *P < 0.05 vs. T_0. HR – heart rate, MAP – mean arterial pressure, RR – respiratory rate, SpO_2 – pulse oxygen saturation.*

Table III. Incidence of postoperative delirium ($\bar{x}$ ± s, *n*)

Group	*N*	Incidence rate	Duration [days]	Clinical manifestation					
				Dysphoria	Disorientation	Gibberish	Obnubilation	Sleep disorder	Auditory hallucinations
Group B	31	1 (3.23)	0.76 ±0.31	0 (0.00)	1 (3.23)	0 (0.00)	0 (0.00)	1 (3.23)	0 (0.00)
Group A	31	7 (22.58)	2.05 ±0.68	4 (12.90)	3 (9.68)	2 (6.45)	1 (3.23)	6 (19.35)	4 (12.90)
t/χ^2	–	5.166	9.610	4.275	1.069	2.066	1.016	4.026	4.275
P-value	–	0.023	0.000	0.038	0.301	0.150	0.313	0.044	0.038

Table IV. Stress response indicators ($\bar{x}$ ± s, *n* = 31)

Indicator	Group	Before anesthesia induction	After anesthesia induction	At extubation	1 h after extubation
ACTH [pmol/l]	Group A	5.82 ±2.84	19.64 ±3.25*	13.25 ±2.28*	9.06 ±2.24*
	Group B	5.78 ±2.52	11.56 ±3.38*	8.16 ±2.91*	6.42 ±2.34*
Cor [nmol/l]	Group A	205.56 ±21.23	288.39 ±27.62*	255.46 ±28.13*	224.49 ±14.42*
	Group B	207.52 ±23.25	231.35 ±30.86*	212.35 ±23.16	208.03 ±13.27
Ang-II [pg/ml]	Group A	41.75 ±7.62	59.62 ±4.43*	53.96±4.31*	49.58±4.21*
	Group B	41.82 ±7.63	51.56 ±5.62*	46.26±5.27*	43.21±4.45
ACTH	*t*	0.058	9.594	7.666	4.537
	P-value	0.953	< 0.001	< 0.001	< 0.001
Cor	*t*	0.346	7.668	6.587	4.676
	P-value	0.730	< 0.001	< 0.001	< 0.001
Ang-II	*t*	0.036	6.271	6.297	5.789
	P-value	0.971	< 0.001	< 0.001	< 0.001

ACTH – adrenocorticotropic hormone, Ang-II – angiotensin II, Cor – cortisol.

shorter than that in Group A ((2.05 ±0.68) days) (t = 9.610, $p < 0.001$) (Table III).

Stress response indicators

Compared with those before anesthesia induction, the levels of ACTH, Cor and Ang-II were improved in both groups after anesthesia induction, at extubation, and 1 h after extubation. The levels of ACTH, Cor and Ang-II had no statistically significant differences between the two groups before anesthesia induction ($p > 0.05$), but they were lower in Group B (ACTH: (11.56 ±3.38)/(8.16 ±2.91)/(6.42 ±2.34) pmol/l, Cor: (231.35 ±30.86)/(212.35 ±23.16)/(208.03 ±13.27) nmol/l, and Ang-II: (51.56 ±5.62)/(46.26 ±5.27)/(43.21 ±4.45) pg/ml) than those in Group A after anesthesia induction, at extubation, and 1 h after extubation ($p < 0.05$) (Table IV).

Incidence rate of adverse reactions

The incidence rates of adverse reactions during anesthesia recovery and after the operation in Group B (9.68% and 6.45%) were lower than those in Group A (12.90% and 9.68%) (χ^2 = 0.161 and 0.217, p = 0.688 and 0.640) (Table V).

VAS and PSQI scores

The resting and active VAS scores and PSQI scores were lower in Group B ((0.68 ±0.23)/(0.41 ±0.38)/0/0 points, (2.38 ±0.56)/(2.13 ±0.37)/(1.59 ±0.46)/(0.67 ±0.28) points, and (14.62±1.37)/(12.87±0.84)/(6.26±0.57)/(4.58±0.21) points) than those in Group A at 6 h, 1 day, 2 days and 3 days after the operation ($p < 0.05$) (Table VI).

Laboratory indicators

The two groups had no statistically significant differences in the levels of $CD4^+$, $CD8^+$ and free Cor, $CD4^+/CD8^+$ ratio and NK cell level before anesthesia ($p > 0.05$), but at 24 h after the operation, the level of $CD4^+$, $CD4^+/CD8^+$ ratio and NK cell level were higher in Group B ((45.67 ±6.14)%, (1.57 ±0.24), and (20.38 ±4.21)%) than those in Group A ($p < 0.05$),

Table V. Incidence rate of adverse reactions [*n* (%)]

Group	*n*	During anesthesia recovery				After operation			
		Tachycardia	Bucking	Restlessness	Incidence rate	Bradycardia	Hypotension	Hypoxemia	Incidence rate
Group B	31	1 (3.23)	1 (3.23)	1 (3.23)	3 (9.68)	1 (3.23)	1 (3.23)	0 (0.00)	2 (6.45)
Group A	31	1 (3.23)	2 (6.45)	1 (3.23)	4 (12.90)	1 (3.23)	1 (3.23)	1 (3.23)	3 (9.68)
χ^2	–	–	–	–	0.161	–	–	–	0.217
P-value	–	–	–	–	0.688	–	–	–	0.640

Table VI. VAS and PSQI scores ($\bar{x} \pm s$, point)

Group	*N*	6 h after operation	1 day after operation	2 days after operation	3 days after operation
Resting VAS score:					
Group B	31	0.68 ±0.23	0.41 ±0.38	0	0
Group A	31	1.56 ±0.37	1.24 ±0.49	0.82 ±0.53	0.48 ±0.16
t	–	11.246	7.452	8.614	16.703
P-value	–	< 0.001	< 0.001	< 0.001	< 0.001
Active VAS score:					
Group B	31	2.38 ±0.56	2.13 ±0.37	1.59 ±0.46	0.67 ±0.28
Group A	31	2.96 ±0.74	2.67 ±0.42	2.03 ±0.59	1.38 ±0.49
t	–	3.479	5.371	3.274	7.004
P-value	–	< 0.001	< 0.001	< 0.001	< 0.001
PSQI score:					
Group B	31	14.62 ±1.37	12.87 ±0.84	6.26 ±0.57	4.58 ±0.21
Group A	31	16.37 ±1.25	14.49 ±0.97	10.89 ±0.85	7.32 ±0.46
t	–	2.251	2.690	3.427	8.147
P-value	–	0.028	0.009	0.001	< 0.001

PSQI – Pittsburgh Sleep Quality Index, VAS – Visual Analogue Scale.

and the levels of $CD8^+$ and free Cor were lower in Group B ((28.26 ±1.21)% and (456.56 ±91.16) nmol/l) than those in Group A ($p < 0.05$) (Table VII).

Blood oxygen metabolism indicators

Group B had higher PaO_2 ((45.52 ±11.14) mm Hg) and pH value (7.42 ±0.06) ($p < 0.05$) and a lower $PaCO_2$ ((4.05 ±0.32) mm Hg) than Group A ($p < 0.05$) (Table VIII).

Discussion

TAPB is defined as ultrasound-guided injection of ropivacaine into the plane between the internal oblique fascia and the transversus abdominis fascia to block the nerves on the plane. Ultrasonically, the patient's anatomical structure, the entry of the puncture needle and the diffusion of anesthetic drugs can be directly observed, and the dosage of anesthetic drugs can be adjusted based on the actual situation of the patient, so that a better analgesic effect can be obtained, which not only lays a foundation for the smooth implementation of surgery, but also reduces the postoperative pain and helps shorten the recovery time of patients. Moreover, TAPB combined with low-dose dexmedetomidine can better prevent postoperative delirium [21]. In this study, the incidence rate of postoperative

Table VII. Laboratory indicators ($\bar{x}$ ± s)

Indicator	Time	Group B (*n* = 31)	Group A (*n* = 31)	*t*	*P*-value
$CD4^+$ (%)	Before anesthesia	44.15 ±5.23	43.82 ±5.46	0.243	0.808
	24 h after operation	45.67 ±6.14	38.14 ±5.27	5.181	< 0.001
$CD8^+$ (%)	Before anesthesia	26.32 ±1.52	26.41 ±1.56	0.230	0.818
	24 h after operation	28.26 ±1.21	31.69 ±1.33	10.621	< 0.001
$CD4^+/CD8^+$	Before anesthesia	1.58 ±0.27	1.56 ±0.25	0.302	0.763
	24 h after operation	1.57 ±0.24	1.42 ±0.15	2.950	0.004
Free Cor [nmol/l]	Before anesthesia	284.15 ±45.23	293.85 ±52.48	0.779	0.438
	24 h after operation	456.56 ±91.16	632.14 ±95.31	7.412	< 0.001
NK cell level (%)	Before anesthesia	26.45 ±4.52	25.95 ±4.48	0.437	0.663
	24 h after operation	20.38 ±4.21	17.62 ±3.74	2.728	0.008

$CD4^+$ – cluster of differentiation, Cor – cortisol.

Table VIII. Blood oxygen metabolism indicators ($\bar{x}$ ± s)

Group	*N*	PaO_2 [mm Hg]	$PaCO_2$ [mm Hg]	pH
Group B	31	45.52 ±11.14	4.05 ±0.32	7.42 ±0.06
Group A	31	38.62 ±10.46	5.58 ±1.05	7.31 ±0.04
t	–	2.514	7.760	8.493
P-value	–	0.014	< 0.001	< 0.001

$PaCO_2$ – partial pressure of carbon dioxide, PaO_2 – partial pressure of oxygen.

delirium in Group B (3.23%) was lower than that in Group A (22.58%) ($\chi^2 = 5.166$, $p = 0.023$), and the duration of delirium in Group B ((0.76 ±0.31) days) was shorter than that in Group A ((2.05 ±0.68) days) ($t = 9.610$, $p < 0.001$), suggesting that TAPB combined with low-dose dexmedetomidine has higher safety in elderly patients undergoing laparoscopic colectomy. The reason is that dexmedetomidine can effectively improve the blood perfusion in the cerebral ischemic region, reduce the number of apoptotic neurons, and stimulate the secretion of growth factors to inhibit NO production, thereby protecting the nervous system and avoiding postoperative delirium.

The antitumor effect is achieved through the immune system, and the metastasis and recurrence rates of tumors increase in the case of immune system damage. Surgery and anesthesia are both potent stressors for elderly patients undergoing laparoscopic colectomy, which weaken the immunity to some extent [22, 23]. In elderly patients undergoing laparoscopic colectomy, cellular immunity is dominant postoperatively. T lymphocytes are the major immune effector cells, and $CD4^+$ and $CD8^+$ are jointly involved in the immune response. Decreases in $CD4^+$ and $CD4^+/CD8^+$ and an increase in $CD8^+$ suggest immunosuppression [24]. In this study, it was found that TAPB combined with low-dose dexmedetomidine caused less damage to the immune system of elderly patients undergoing laparoscopic colectomy. TAPB can effectively restrain the spinal nerve impulse transmission caused by surgical stimulation and reduce sympathetic activity, without decreasing the sensitivity of the immune system. Meanwhile, the overall dosage of anesthetic drugs is reduced, so that the secretion of stress-responsive hormones (plasma Cor, catecholamines, etc.) is suppressed and the adverse impact of oxidative stress on the immune system is relieved, thus ameliorating immunosuppression [25].

In this study, Group B had higher PaO_2 ((45.52 ±11.14) mm Hg) and pH (7.42 ±0.06) ($p < 0.05$) and lower $PaCO_2$ ((4.05 ±0.32) mm Hg) than Group A ($p < 0.05$), demonstrating that TAPB combined with low-dose dexmedetomidine can reduce surgical injury in elderly patients undergoing laparoscopic colectomy. Since surgery is bound to induce tissue damage and metabolic disorders, these outcomes can be reflected in the results of blood gas analysis, which in turn can help determine the surgical safety and recovery of patients. In detail, blood gas analysis can be used to assess the following changes. 1) pH: After surgery, the acid concentration of tissue metabolites increases, which may lead to acid-base imbalance and decrease pH. This reflects the metabolism and degree of tissue damage [26]. 2) $PaCO_2$: After surgery, the breathing depth and rate may change, causing $PaCO_2$ to rise or fall. An increase in $PaCO_2$ may reflect abnormal lung function and poor ventilation, whereas a decrease in $PaCO_2$ may indicate accelerated tissue metabolism and respiratory compensation [27]. 3) PaO_2: After surgery, tissue oxygen consumption may change, leading to the reduction in PaO_2. The decrease of PaO_2 may reflect poor ventilation, abnormal lung function, insufficient blood flow, etc. [28]. Although general anesthesia inhibits brain functions to a certain extent, it is difficult to inhibit the activation of the sympathetic nervous system and pituitary system by surgery [29]. In contrast, through ultrasound-guided block of the transversus abdominis plane, TAPB can reduce sympathetic excitability and diaphragmatic excitability without inhibiting the respiratory system, and relieve blood acidification, thereby improving the safety of surgery.

Conclusions

TAPB combined with low-dose dexmedetomidine can achieve better anesthetic, analgesic and sedative effects, ameliorate stress responses, and enhance immunity with higher safety in elderly patients undergoing laparoscopic colectomy. Nevertheless, this study has a limitation. The PSQI score was determined only during 3 days instead of a 1-month period. Further in-depth studies are ongoing in our group.

Conflict of interest

The authors declare no conflict of interest.

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