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Retrospective Study

Different positive end expiratory pressure and tidal volume controls on lung protection and inflammatory factors during surgical anesthesia

Abstract

BACKGROUND

Mechanical ventilation can lead to the severe impairment of the metabolic pathway of alveolar surfactants, inactivating alveolar surfactants and significantly reducing lung-chest compliance. The cardiopulmonary function of elderly patients usually reduced to a certain extent, and there are lung complications after surgical anesthesia, just like lung barotrauma caused by mechanical ventilation, atelectasis and postoperative hypoxemia.

AIM

To investigate the effects of different positive end expiratory pressures (PEEPs) and tidal volumes (VTs) on respiratory function, the degree of the inflammatory response and hemodynamic indexes in patients undergoing surgery under general anesthesia.

METHODS

A total of 120 patients undergoing surgery for gastric or colon cancer under general anesthesia in Xinghua People's Hospital from January 2017 to January 2021 were randomly divided into Group A and Group B, with 60 cases in each group. The ventilation mode in Group A was VT (6.0 mL/kg) + PEEP (5.0 cmH₂O), while that in Group B was VT (6.0 mL/kg) + PEEP (8.0 cmH₂O). Blood gas parameters, respiratory mechanical parameters, inflammatory response indicators, hemodynamic indicators and related complications were compared between the two groups.

RESULTS

There were no significant differences in PaCO₂, PaO₂, oxygen or the examined indexes at T0 between group A and group B ($P > 0.05$). The measured PaO₂ value of patients in group A at T3 was higher than that in group B, and the difference was significant ($P < 0.05$). There were no significant differences in peak airway pressure (P_{peak}), mean airway pressure or dynamic pulmonary compliance (C_{dyn}) at T0 between group A and group B ($P > 0.05$). The measured P_{peak} value of patients in group A at T1 was higher than that in group B, and the difference was significant ($P < 0.05$). The measured C_{dyn} value at T1 and T2 was greater than that in group B ($P < 0.05$). Before surgery, there were no significant differences in tumor necrosis factor- α (TNF- α), interleukin (IL)-6 or IL-10 between group A and group B ($P > 0.05$). After 4 h, the measured values of TNF- α and IL-6 in group A were lower than those in group B, and the differences were significant ($P < 0.05$). The IL-10 Level in group A was higher than that in group B ($P < 0.05$). At T0, there were no significant differences in cardiac output, cardiac index (CI), stroke volume index (SVI) or mean arterial pressure between group A and group B ($P > 0.05$). The measured values of CI and SVI at T2 in patients in group A were higher than those in group B, and the differences were significant ($P < 0.05$).

CONCLUSION

For patients undergoing surgery for gastric or colon cancer under general anesthesia, the VT (6.0 mL/kg) + PEEP (5.0 cmH₂O) regimen was more effective than the VT (6.0 mL/kg) + PEEP (8.0 cmH₂O) regimen in protecting the lung function and ventilatory function of patients, and it had better effects on maintaining hemodynamic stability and reducing inflammatory reactions.

INTRODUCTION

Elderly patients often present more complications because they exhibit a variety of pathologies during the perioperative period, such as decreased respiratory function and increased heterogeneity of lung tissue^[1]. They are also prone to the development of lung injury, including barotrauma, atelectasis, postoperative hypoxemia and other complications during general anesthesia^[2,3]. In addition, pulmonary complications are one of the main complications in elderly patients after general anesthesia^[4]. Mechanical ventilation, as an important measure for respiratory support treatment and general anesthesia for surgery, has been used for a long time in clinical practice^[5,6]. Some studies have proposed the use of low volume tidal (VT) (6–8 mL/kg) combined with a certain level of positive end expiratory pressure (PEEP) and allowing PaCO₂ to rise to a certain extent as a lung protection strategy, which can improve lung compliance and oxygenation function^[7,8]. For example, applying VT supplemented with appropriate PEEP for mechanical ventilation during esophageal cancer surgery can reduce the systemic inflammatory response, improve lung function and shorten the time to extubation, indicating a certain improvement in the prognosis of patients^[9]. A large number of studies confirmed that during mechanical ventilation, the alveolar epithelium was stimulated by mechanical traction and released a variety of inflammatory cytokines, such as tumor necrosis factor- α (TNF- α), interleukin-6 (IL-6) and IL-10, which promoted the activation of macrophages and neutrophils. These cells not only produced a large amount of collagenase and elastase but also release a large amount of active oxygen. These substances can directly or indirectly destroy alveolar epithelial cells or even vascular endothelial cells, leading to lung tissue damage^[7,10,11].

Reducing lung complications after surgery for gastric cancer or colon cancer under general anesthesia is an urgent problem to be solved. Research has shown^[12] that PEEP can improve the oxygenation function of the lung to a certain extent and improve the ventilation effect. PEEP has been widely used in the treatment of acute lung injury and has achieved good clinical effects^[3,13]. In this study, elderly patients (aged 60–81) undergoing abdominal tumor surgery under general anesthesia were taken as the research subjects, and the clinical effects of different ventilation modes were explored

from a new perspective through comparisons among different groups to provide a theoretical and experimental basis for the safe implementation of mechanical ventilation in elderly patients.

MATERIALS AND METHODS

Material

A total of 120 patients undergoing surgery for gastric cancer or colon cancer under general anesthesia in our Hospital from January 2017 to January 2021 were selected and randomly divided into Group A and Group B, with 60 cases in each group according to random numbers. Inclusion criteria: (1) The patient had surgical treatment for gastric cancer or colon cancer under general anesthesia; (2) American Association of Anesthesiologists^[14] classification: grades I-III; (3) The age of the patient was 60–81 years old; and (4) Presurgical lung function and heart function were tested, and the patient could tolerate the surgery. The exclusion criteria were as follows: (1) concomitant bronchial asthma; (2) pulmonary infection, tuberculosis and pulmonary fibrosis; (3) a history of congenital heart disease, severe arrhythmia and myocardial infarction; (4) a history of cerebrovascular disease in the past six months; (5) allergic history; and (6) other serious complications or complications.

Patients and their families received appropriate communication, and an informed consent form was signed by each patient before enrollment in this study. This study was implemented based on the protocols of the Medical Ethics Committee of our hospital.

Pharmaceutical instrument

Anesthetic drugs were given as follows: Midazolam: 10 mg/2 mL, Jiangsu Enhua Pharmaceutical Co., Ltd.; Propofol injection: 20 mL 200 mg, AstraZeneca Pharmaceutical Co., Ltd.; Intravenous neostigmine: 1 mL: 0.5 mg × 10 PCs, Henan Runhong Pharmaceutical Co., Ltd.; Etomidate fat emulsion 20 mg/10 mL, Jiangsu Enhua Pharmaceutical Co., Ltd.; Sevoflurane 250 mL/bottle, Maronite Pharmaceutical

Co., Ltd.; Vecuronium bromide powder batch number: 1104012, 4 mg, manufacturer: Hainan Starr Pharmaceutical Co., Ltd.; and Fentanyl: 50 µg/1 mL, Yichang Renfu Pharmaceutical Co., Ltd.

Instrument reagent

ELISA kits were purchased from Beijing Dakota Biotechnology Co., Ltd.; a microplate reader was used (model ELX-800) manufacturer: Burt Co., Ltd., USA; OMEDA 7100 (Shanghai Lixin Industry Co., Ltd.), an anesthesia machine was used, and Philips ECG Monitor (Philips Medical Instruments, the Netherlands) was used.

Anesthesia and ventilation methods

Surgical anesthesiologists were all doctors in the same group. Food and water was withheld from patients for more than 8 h before the operation. The venous channel was opened after entering the room, and ECG monitoring was conducted. An intravenous injection of 0.02 mg/kg midazolam was performed, and a right femoral artery puncture was performed under local anesthesia. Anesthesia was performed with an induced oxygen flow of 5 L/min, midazolam 0.01–0.03 mg/kg, propofol 2 mg/kg, and vecuronium 0.15 mg/kg. Intubation was performed successfully and the rats were mounted on the anesthesia machine. The ventilation mode in group A was VT (6.0 mL/kg) + PEEP (5.0 cmH₂O), while that in group B was VT (6.0 mL/kg) + PEEP (8.0 cmH₂O). End-expiratory carbon dioxide was maintained at 35–45 mmHg (1 mmHg = 0.133 kPa) during the operation, with a maximum airway pressure peak of no more than 25 cmH₂O. Before the operation, intravenous fentanyl at 2 µg/kg and propofol at 3 mg/ (kg h) were administered to maintain anesthesia, remifentanyl was administered at 0.05–1.00 µg/ (kg min), and intermittent vecuronium bromide injections and inhaled sevoflurane at a 0.5–1.2 minimum alveolar concentration were given. Inhalation anesthesia was stopped 20 min before the end of the operation, with an oxygen flow rate of 5 L/min and intravenous fentanyl at 0.5–1.0 µg/kg. Spontaneous breathing resumed after surgery.

Observation index

The blood gas parameters, respiratory mechanical parameters, inflammatory response indicators, hemodynamic indicators and related complications of the two groups at different times [before anesthesia induction (T0), 10 min mechanical ventilation (T1), 60 min mechanical ventilation (T2), and after catheter removal (T3)] were compared.

The blood gas parameters mainly included arterial partial pressure of carbon dioxide (PaCO_2), arterial partial pressure of oxygen (PaO_2), oxygen and index. The respiratory mechanical parameters mainly included peak airway pressure (P_{peak}), mean airway pressure (P_{mean}), and dynamic pulmonary compliance (C_{dyn}).

Inflammatory response indicators included serum TNF- α , IL-6, and IL-10.

Hemodynamic indicators mainly included the patient's cardiac output (CO), cardiac index (CI), stroke volume index (SVI), and mean arterial pressure (MAP).

At different times during the operation, 3 mL of venous blood was collected and centrifuged at 3000 r/min for 15 min. Serum was separated, and the levels of TNF- α , IL-6 and IL-10 were detected by ELISA.

During the operation, a multifunctional monitor was used to record the P_{peak} , C_{dyn} , P_{mean} , MAP, CO, SVI, and CI. Arterial blood was drawn for blood gas analysis, PaO_2 and PaCO_2 were recorded, and the oxygenation index (OI) was calculated, where $\text{OI} = \text{PaO}_2 / \text{FiO}_2$.

Statistical analysis

In this study, the measurement values of P_{peak} , P_{mean} and C_{dyn} were all in line with the approximate normal distribution or normal distribution through the normal distribution test, expressed as mean \pm SD, and the measurement data were analyzed by the t test and an analysis of variance in SPSS software. The χ^2 test was used to analyze adverse reactions. The significance level was set at $\alpha = 0.05$.

RESULTS

Comparison of general data between two groups

There were no significant differences in baseline data, such as age, height, weight, and sex composition, between group A and group B ($P > 0.05$, Table 1).

Comparison of operation indexes between two groups

There were no significant differences in operation time, anesthesia time, total fluid replacement or urine volume between group A and group B ($P > 0.05$, Table 2).

Comparison of blood gas index between two groups

There were no significant differences in PaCO₂, PaO₂, oxygen or index at T0 ¹ between group A and group B ($P > 0.05$). The measured PaO₂ value ⁷ of patients in group A at T3 was higher than that in group B, and the difference was significant ($P < 0.05$, Table 3).

Comparison of airway compliance between two groups

Compared with group A and group B at T0, there was no significant difference ($P > 0.05$). The measured value of P_{peak} in group A ¹ was higher than that in group B at T1 ($P < 0.05$), and the measured value of Cdyn at T1 and T2 was higher than that in group B ($P < 0.05$) (Table 4).

Comparison of serum inflammatory factor levels before and after the operation between the two groups

Before surgery, there were no significant differences in TNF- α , IL-6 or IL-10 ² between group A and group B ($P > 0.05$). After 4 h, the measured values of TNF- α and IL-6 in group A ² were lower than those in group B, and the differences were significant ($P < 0.05$). The IL-10 Level in group A was higher than that in group B ($P < 0.05$) (Table 5).

Comparison of hemodynamic indexes before and after operation between the two groups

At T0, there were no significant differences in CO, CI, SVI or MAP between group A and group B ($P > 0.05$). The measured values of CI and SVI at T2 in group A were higher than those in group B, and the differences were significant ($P < 0.05$) (Table 6).

Comparison of complication rate between two groups

The incidence of surgical complications in group A and group B was statistically analyzed, and there were no significant differences between the two groups ($P > 0.05$, Table 7).

DISCUSSION

In elderly patients, the alveoli are more likely to collapse during general anesthesia, causing atelectasis and leading to lung injury and hypoxemia. Small tidal volume combined with PEEP has been widely used in the clinical treatment of acute lung injury and has achieved good clinical results. However, with the increase in PEEP, the venous return flow may be decreased, and the arterial vascular resistance will be increased, which may affect cardiac output and increase the risk of lung injury, especially for elderly patients under general anesthesia^[15-17].

In this study, patients undergoing gastric or colon cancer surgery under general anesthesia were given different kinds of ventilation. The ventilation mode in group A was VT (6.0 mL/kg) + PEEP (5.0 cmH₂O), and that in group B was VT (6.0 mL/kg) + PEEP (8.0 cmH₂O). The results of this study showed that there were no significant differences in PaCO₂, PaO₂, oxygen or index at T0 between group A and group B ($P > 0.05$). The measured PaO₂ value of patients in group A at T3 was higher than that in group B, and the difference was significant. This study found that a small tidal volume of 6 mL/kg combined with PEEP 5 cmH₂O and 8 cmH₂O could improve alveolar oxygenation function. To a certain extent, PaO₂ increased with increasing PEEP, improving the oxygenation and ventilation function of the lung. The unventilated alveolar dead spaces would reopen, and the number would increase, leading to the corresponding enhancement of alveolar oxygenation function. PEEP is conducive to the

exchange of external gas and alveolar gas, as well as the release of carbon dioxide and the entry of oxygen into the alveolar space, thus improving the oxygenation and ventilation function of the lung in elderly patients.

P_{peak} , P_{mean} and C_{dyn} are three commonly used respiratory mechanical indicators that can reflect lung compliance, airway resistance and alveolar pressure^[18,19]. The results of this study showed that there were no significant differences in P_{peak} , P_{mean} and C_{dyn} at T0 between the patients in group A and group B ($P > 0.05$). The P_{peak} measured value of patients in group A at T1 was higher than that in group B, and the difference was significant ($P < 0.05$). The C_{dyn} measured value at T1 and T2 was greater than that in group B. In Group B, the 6 mL/kg tidal volume in combination with PEEP at 5 cmH₂O mode had a lower change in airway pressure and a lower P_{peak} and thus had less adverse effect on lung compliance, suggesting an improved lung protection and more advantages especially in patients with low lung compliance. In this study, it was also found that the measured C_{dyn} value at T1 and T2 was greater than that in group B, which might be due to the decrease in lung compliance caused by the increase in long-term airway pressure in patients during the operation mode. The mode in group B was conducive to the protection of the lung, and it could avoid lung injury caused by high tidal volume. The lung functions of different patients are different, and the PEEP that causes the reopening of collapsed alveoli is also different. When setting the PEEP, we need to evaluate its clinical effect and the impact of adverse consequences on patients and then make the corresponding parameter settings to achieve the best effect and minimize adverse reactions. When the PEEP exceeds a certain range, the probability of lung injury will increase. However, further research is needed.

The results of this study showed that the CI and SVI measured values of patients in group A at T2 were higher than those in group B, and the differences were significant. A tidal volume of 6 mL/kg combined with a PEEP of 5 cmH₂O improved intrathoracic and right atrial pressure, reduced left ventricular transmural systolic blood pressure and pressure gradient, reduced intrathoracic blood volume and extravascular lung water, and improved hemodynamics. Setting appropriate PEEP could improve

cardiac function and alleviate pulmonary edema. In this study, a tidal volume of 6 mL/kg combined with a PEEP of 5 cmH₂O ventilation mode was more conducive to the stability of body hemodynamics.

With the clinical benefits of low tidal volume combined with an appropriate level of PEEP-based lung protective ventilation strategy in patients undergoing mechanical ventilation during major surgery, anesthesiologists began to explore and find lung protective ventilation strategies that could be applied during mechanical ventilation during general anesthesia. Studies have shown that a small tidal volume combined with an appropriate level of PEEP ventilation can inhibit the release of inflammatory cytokines. There are few reports regarding the effects of different mechanical ventilation modes on inflammatory cytokines in elderly patients undergoing gastric or colon cancer surgery under general anesthesia. Once inflammatory factors are out of balance, they will lead to serious adverse consequences. IL-10 is an anti-inflammatory and immunosuppressive factor that inhibits the release of proinflammatory mediators such as IL-6 and TNF- α ^[20]. The results of this study showed that at 4 h after surgery, the measured values of TNF- α and IL-6 in group A were lower than those in group B, and the differences were significant ($P < 0.05$). The IL-10 Level in group A was higher than that in group B ($P < 0.05$). The results of blood gas indicators showed that the use of a tidal volume of 6 mL/kg combined with the PEEP 5 cmH₂O mode of mechanical ventilation in elderly patients with gastric or colon cancer under general anesthesia had less impact on inflammatory factors and blood gas indicators in elderly patients, and the incidence of postoperative lung injury was also low.

Clinically, it has been concluded in recent years that the ventilation mode of low VT, a certain level of PEEP and permissive hypercapnia is mainly used for the treatment of acute lung injury, acute respiratory distress syndrome and other causes leading to respiratory failure. This study focused on the effects of different mechanical ventilation modes on the prognosis of elderly patients with gastric cancer and gastric or colon cancer.

CONCLUSION

In summary, the VT (6.0 mL/kg) + PEEP (5.0 cmH₂O) scheme is more effective than the VT (6.0 mL/kg) + PEEP (8.0 cmH₂O) scheme in protecting the lung function and ventilatory function of patients undergoing surgery for gastric cancer or colon cancer under general anesthesia, and it has better effects on maintaining hemodynamic stability and reducing inflammatory reactions.

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Table 1 Comparison of general data of the two groups of patients (mean \pm SD)

Index	Group A (n = 60)	Group B (n = 60)	t/ χ^2 value	P value
Age (yr)	69.6 \pm 5.3	70.3 \pm 5.7	-0.697	0.487
Height (cm)	165.0 \pm 6.1	163.9 \pm 5.5	1.037	0.302
Body weight (kg)	125.1 \pm 9.7	126.4 \pm 7.5	-0.821	0.413
SBP (mmHg)	129.5 \pm 7.6	128.0 \pm 8.2	1.039	0.301
DBP (mmHg)	75.2 \pm 6.9	76.8 \pm 7.7	-1.199	0.233
HR (beats/min)	76.4 \pm 8.1	75.0 \pm 7.0	1.013	0.313
Sex, n (%)			0.862	0.353
Male	33 (55.00)	38 (63.33)		
Female	27 (45.00)	22 (36.67)		
hypertension, n (%)			1.269	0.260
Yes	26 (43.33)	20 (33.33)		
No	34 (56.67)	40 (66.67)		
Diabetes, n (%)			1.713	0.191
Yes	11 (18.33)	6 (10.00)		

No	49 (81.67)	54 (90.00)		
ASA stage, <i>n</i> (%)			2.874	0.238
I stage	15 (25.00)	10 (16.67)		
II stage	35 (58.33)	33 (55.00)		
III stage	10 (16.67)	17 (28.33)		

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate; ASA: American Society of Anesthesiologists.

Table 2 Comparison of surgical indicators between the two groups (mean \pm SD)

Group	Operation time (min)	Anesthesia time (min)	Total rehydration (mL)	Urine volume (mL)
Group A ($n = 60$)	216.3 \pm 20.5	233.8 \pm 19.5	2568.1 \pm 208.4	398.5 \pm 58.1
Group B ($n = 60$)	212.0 \pm 22.7	229.5 \pm 22.8	2590.4 \pm 211.7	410.3 \pm 63.5
<i>t</i> value	1.089	1.110	-0.581	-1.062
<i>P</i> value	0.278	0.269	0.562	0.290

Table 3 Comparison of surgical indicators between the two groups (mean \pm SD)

Group	Operation time (min)	Anesthesia time (min)	Total rehydration (mL)	Urine volume (mL)
Group A ($n = 60$)	216.3 \pm 20.5	233.8 \pm 19.5	2568.1 \pm 208.4	398.5 \pm 58.1
Group B ($n = 60$)	212.0 \pm 22.7	229.5 \pm 22.8	2590.4 \pm 211.7	410.3 \pm 63.5
<i>t</i> value	1.089	1.110	-0.581	-1.062
<i>P</i> value	0.278	0.269	0.562	0.290

Table 4 Comparison of airway compliance indexes between the two groups (mean \pm SD)

Group	T0	T1	T2	T3
<i>P</i> _{peak} (cmH ₂ O)				
Group A ($n = 60$)	15.36 \pm 2.44	20.06 \pm 1.98	21.58 \pm 2.74	17.41 \pm 2.80
Group B ($n = 60$)	16.11 \pm 2.70	18.62 \pm 2.70	20.67 \pm 2.68	18.15 \pm 2.76
<i>t</i> value	-1.596	3.331	1.839	-1.458
<i>P</i> value	0.113	0.001	0.068	0.148
<i>P</i> _{mean} (cmH ₂ O)				

Group A (<i>n</i> = 60)	8.51 ± 1.84	10.33 ± 1.96	11.36 ± 2.24	10.71 ± 2.54
Group B (<i>n</i> = 60)	8.93 ± 2.00	9.81 ± 2.71	10.95 ± 2.46	10.40 ± 2.75
<i>t</i> value	-1.197	1.204	0.955	0.641
<i>P</i> value	0.234	0.231	0.342	0.522
Cdyn (cmH ₂ O)				
Group A (<i>n</i> = 60)	38.64 ± 3.11	30.52 ± 3.04	29.64 ± 3.11	33.75 ± 3.58
Group B (<i>n</i> = 60)	39.33 ± 4.05	28.64 ± 3.58	28.11 ± 2.90	32.68 ± 2.83
<i>t</i> value	-1.047	3.101	2.787	1.816
<i>P</i> value	0.297	0.002	0.006	0.072

P_{peak}: Peak airway pressure; P_{mean}: mean airway pressure; Cdyn: Dynamic pulmonary compliance.

Table 5 Comparison of serum inflammatory factor levels before and after operation between the two groups (mean ± SD)

Group	TNF-α (ng/mL)		IL-6 (pg/mL)		IL-10 (pg/mL)	
	Preoperative	4 h after operation	Preoperative	4 h after operation	Preoperative	4 h after operation
Group A (<i>n</i> = 60)	43.26 ± 6.80	76.65 ± 8.77	47.14 ± 5.50	56.94 ± 7.30	34.62 ± 5.10	29.51 ± 4.75
Group B (<i>n</i> = 60)	45.10 ± 6.55	89.28 ± 12.64	45.03 ± 6.28	69.71 ± 10.38	36.36 ± 6.15	25.83 ± 5.08
<i>t</i> value	-1.510	-6.359	1.958	-7.795	-1.687	4.099
<i>P</i> value	0.134	0.000	0.053	0.000	0.094	0.000

TNF-α: Tumor necrosis factor-α; IL: Interleukin.

Table 6 Comparison of hemodynamic indexes between two groups of patients before and after operation (mean \pm SD)

Group	T0	T1	T2	T3
CO (L/min)				
Group A (n = 60)	4.81 \pm 0.85	4.43 \pm 0.80	4.36 \pm 0.75	4.51 \pm 0.83
Group B (n = 60)	4.95 \pm 0.90	4.30 \pm 0.78	4.13 \pm 0.80	4.37 \pm 0.86
t value	-0.876	0.901	1.625	0.907
P value	0.383	0.369	0.107	0.366
CI [L/(min m ²)]				
Group A (n = 60)	4.11 \pm 0.40	3.83 \pm 0.46	3.51 \pm 0.42	3.68 \pm 0.40
Group B (n = 60)	4.26 \pm 0.44	3.90 \pm 0.50	3.30 \pm 0.39	3.53 \pm 0.44
t value	-1.954	-0.798	2.838	1.954
P value	0.053	0.426	0.005	0.053
SVI (mL/m ²)				
Group A (n = 60)	47.52 \pm 4.63	44.03 \pm 3.75	43.85 \pm 3.11	45.08 \pm 4.09
Group B (n = 60)	48.36 \pm 4.90	43.41 \pm 4.03	41.66 \pm 3.57	44.13 \pm 4.37
t value	-0.965	0.872	3.583	1.229
P value	0.336	0.385	0.000	0.221
MAP (mmHg)				
Group A (n = 60)	97.63 \pm 4.15	88.16 \pm 5.20	87.11 \pm 4.64	102.84 \pm 5.00
Group B (n = 60)	98.90 \pm 4.68	86.85 \pm 4.96	86.08 \pm 5.03	104.07 \pm 4.86
t value	-1.573	1.412	1.166	-1.366
P value	0.118	0.161	0.246	0.174

CO: Cardiac output; CI: Cardiac index; SVI: Stroke volume index; MAP: mean arterial pressure.

Table 7 Comparison of the complication rate between the two groups

Group	Lung infection	Atelectasis	Other	Complication rate (%)
Group A (<i>n</i> = 60)	2	0	1	3 (5.00)
Group B (<i>n</i> = 60)	3	1	3	7 (11.67)
χ^2 value				1.745
<i>P</i> value				0.186

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