# Comparison of Effects of Propofol or Sevoflurane Combined with Remifentanil on Stress Response, Inflammatory Factors and Cerebral Oxygen Metabolism in Patients Undergoing Radical Esophagectomy

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## Abstract

**Objectives:** Clinical studies have shown that reducing the stress response and catabolism during the perioperative period and strengthening nutritional support during the perioperative period can improve the surgical effect and promote postoperative recovery. However, there are few studies on the effects of general anesthesia maintenance drugs on the catabolism and nutritional status of surgical patients. Based on the above background, the purpose of this article is to compare the effects of propofol or sevoflurane combined with remifentanil on the stress response, inflammatory factors and cerebral oxygen metabolism in patients undergoing radical resection of esophageal cancer.

**Methods:** 120 patients who underwent radical esophageal cancer surgery in our hospital from February 2018 to August 2019 were randomly divided into group A and group B, with 60 patients in each group. Patients in group A were anesthetized with propofol combined with remifentanil, group B were anesthetized with sevoflurane combined with remifentanil. Before and after induction of anesthesia (T0), at the beginning of surgery (T1), and 12 hours after surgery (T2), the differences in peripheral blood stress response indexes, inflammatory factors, and cerebral oxygen metabolism index were measured.

**Results:** (1) Compared with T0 stage, the stress response indicators of patients in T1 and T2 stages-cortisol (COR) and norepinephrine (NE) were significantly up-regulated, and the inflammatory factors IL-8, IL-6, TNF-  $\alpha$  was also significantly up-regulated (P<0.05), while the cerebral oxygen metabolism index arterial partial pressure of carbon dioxide (PaCO2), internal jugular venous partial pressure of carbon dioxide (PjvCO2), internal jugular venous blood oxygen partial pressure (PjvO2), internal cervical Venous oxygen saturation (SjvO2) was significantly reduced. (2) After comparing group, A and group B patients using different anesthesia methods, comparing the stress response index, inflammatory factor index and cerebral oxygen metabolism index, it was found that the stress response index and inflammatory factor index of group A were higher than those of group B. Patients in group B (P<0.05), while the cerebral oxygen metabolism index of patients in group A was significantly lower than that of patients in group B (P<0.05).

**Conclusions:** Compared with sevoflurane combined with remifentanil anesthesia, propofol combined with remifentanil anesthesia is more beneficial to the stress response, reduction of inflammatory factors and improvement of cerebral oxygen metabolism in patients with radical esophageal cancer.

**Keywords:** Stress response; Inflammatory factors; Cerebral oxygen metabolism; Radical resection of esophageal cancer

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#### Backgrounds

Esophageal cancer (Esophagus Cancer) is a common malignant tumor of the digestive system in my country. Surgical removal of tumor tissue is currently the main surgical method for the treatment of esophageal cancer. The commonly used surgical method is radical esophageal cancer. However, due to the perioperative stress in patients with esophageal cancer Hyperresponsiveness, surgical treatment is very traumatic to the patient, and has a great impact on the patient's cardiopulmonary function. Choose the appropriate anesthesia method to minimize the impact on hemodynamics and stress response, which is conducive to the successful completion of the operation [1,2].

Radical esophageal cancer surgery mainly involves incisions in the abdomen, chest and neck. It is traumatized and can release a large amount of inflammatory factors such as tumor necrosis factor- $\alpha$  and interleukin-6 to stimulate the body's inflammatory response, reduce the body's immune function, and disrupt the body's balance., Increase the incidence of complications such as lung infection and ventilatory disorders. Therefore, it is of great significance to improve the effect of perioperative analgesia. Epidural block combined with general anesthesia, as a common anesthesia method in previous radical esophageal cancer surgery, can effectively inhibit nerve impulse conduction, block the entry of noxious stimuli, reduce the body's catecholamine levels, and relieve stress. However, thoracic epidural puncture is difficult It is larger, and it has a direct inhibitory effect on the cardiac sympathetic nerves, which can increase the incidence of adverse events such as perioperative hypotension and bradycardia [3-5].

However, the stress response caused by anesthesia during surgery cannot be ignored. Choosing an appropriate anesthetic is beneficial to reduce the body's stress response and maintain hemodynamic stability. Propofol and sevoflurane are commonly used anesthetics in recent years. Due to their different anesthesia methods, the effects of the two drugs have been controversial [6]. This study explored the effects of propofol or sevoflurane on stress response inflammatory factors and cerebral oxygen metabolism index in patients undergoing radical esophageal cancer surgery under one-lung ventilation, in order to provide a theoretical basis for the clinical rational selection of anesthetics and methods.

### Methods and materials 1. General information and patient inclusion

#### criteria

The 120 patients who underwent radical esophageal cancer surgery in our hospital from February 2018 to August 2019 were randomly divided into group A and group B, with 60 patients in each group. The average age was 52.9±10.3 years, of which 89 were males and 31 were females. None of the patients included in this study had diabetes, hypertension, hematology, or other metabolic disorders, and no serious infectious diseases. There were no abnormalities in cardiovascular, liver, kidney, and lung functions in preoperative examinations, and neutrophil counts in routine blood tests And the classification values are all within the normal range, there is no history of long-term use of glucocorticoids, tricyclic antidepressants, antibiotics and vitamins, no antitumor treatment such as radiotherapy or chemotherapy before surgery, and no hemorrhage (requiring intraoperative blood transfusion Products), and the estimated operation time is within 4h. There was no statistical difference in age and gender between the two groups of patients (P>0.05), and they were comparable.

#### 2. Anesthesia methods

Patients in group A were anesthetized with propofol combined with remifentanil, group B were anesthetized with sevoflurane combined with remifentanil. First, routinely fasting water for 8 hours before surgery, all patients are not given any drugs before surgery, routinely monitor ECG and BP, etc., open the right upper limb venous access, and place the right radial artery under local anesthesia (for blood sampling and monitoring) Invasive blood pressure), and use an anesthesia depth monitor to monitor the patient's anesthesia depth. Then, sufentanil 0.1-1.0ug/kg was injected intravenously for induction of anesthesia, the right double-lumen bronchial catheter was inserted through the mouth, and the bronchoscope was used for positioning. After the tracheal intubation was completed, mechanical ventilation was performed. The inhaled oxygen concentration was 100%. Flow rate 1.0-1.5L/min, VT6-8mL/kg, RR10-14 times/min, inspiratory-expiration ratio 1:2, ventilation parameters are basically unchanged at OLV, adjust the ventilation frequency RR to 12-16 times/min, Maintain PET CO235-40mmHg. The propofol group received intravenous infusion of propofol 4-8 mg/kg·min, and the sevoflurane group inhaled 1%-3% of sevoflurane. Both groups were combined with intravenous infusion of remifentanil and maintained remifentanil. The intravenous

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infusion rate is constant at 0.2ug/kg·min, and the dosage of propofol or sevoflurane is adjusted according to the depth of anesthesia, and the Narcotrend index of the depth of anesthesia is maintained at 40-50, and the heart rate and mean arterial pressure are within ±20% of the baseline value. Fluctuations within the range, propofol, sevoflurane and remifentanil were stopped 5 minutes before the end of the operation.

## 3. Detection method

Before and after induction of anesthesia (T0), at the beginning of surgery (T1), and 12 hours after surgery (T2), the differences in peripheral blood stress response indexes, inflammatory factors, and cerebral oxygen metabolism index were measured. 2 ml of internal jugular venous blood and radial artery blood were drawn at 3-time intervals, and blood gas analysis was performed using i-STAT portable hand-held blood analyzer (Abbott, USA). Compare the partial pressure of arterial carbon dioxide (PaCO2), internal jugular venous carbon dioxide partial pressure (PjvCO2), internal jugular venous blood oxygen partial pressure (PjvO2), and internal jugular venous blood oxygen saturation (SjvO2). In addition, the differences of stress response indicators and inflammatory factors in peripheral blood were observed before and after induction of anesthesia (T0), at the beginning of surgery (T1), and 12 hours after surgery (T2).

## 4. Statistical methods

Statistical analysis was performed on the data using SPSS 19.0 software. Measurement data were expressed as (x±s), using t test; counting data were expressed as rate (%), using X2 test, P<0.05 was considered statistically significant.

## Results

## 1. Comparison of the general conditions of the two groups of patients

There was no significant statistical difference between the two groups of patients in general indicators, anesthesia time, operation time and one-lung ventilation time (P>0.05), see Table 1 for details.

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	Exhale forcefully for one second (actual	Forced vital capacity (actual	Anesthesia	Operation
Group	measurement/predicted volume, %)	measurement/predicted volume, %)	time (min)	time (min)
A group	92±11	87±12	180±13	155±19
B group	98±13	86±11	183±15	157±18
P value	0.059	0.21	0.35	0.56

### Table 2. Changes in the stress response of patients in groups A and B in T0, T1, and T2

Group	Project	Т0	T1	Т2
A group	COR (pg/L)	31±2	36±3*#	39±5*#
	NA (pg/L)	50±3	59±4*#	65±8*#
B group	COR (pg/L)	32±2	35±2*	37±3*
	NA (pg/L)	50±3	56±3*	61±7*

Note: \*: compared with T0 stage,  $P \le 0.05$ ; #, group A compared with group B,  $P \le 0.05$ .

#### Table 3. Changes of inflammatory factors in the T0, T1, and T2 stages of patients in group A and B

Group	Project	Т0	T1	Т2
A group	IL-8 (ug/L)	44±4	55±5*#	69±8*#
	IL-6 (ug/L)	125±15	151±17*#	161±18*#
	TNF- $\alpha$ (ug/L)	89±12	101±12*#	118±16*#
B group	IL-8 (ug/L)	45±4	52±5*	65±7*
	IL-6 (ug/L)	125±15	145±18*	156±19*
	TNF- $\alpha$ (ug/L)	89±12	97±13*	105±16*

Note: \*: compared with T0 stage,  $P \le 0.05$ ; #, group A compared with group B,  $P \le 0.05$ .

2. Comparison of differences in stress response, inflammatory factors, and cerebral oxygen metabolism index between the two groups of patients in different periods

Compared with TO stage, the stress response

indexes of patients in T1 and T2 stages-cortisol (COR) and norepinephrine (NA) were significantly up-regulated, and the inflammatory factors IL-8, IL-6, and TNF- $\alpha$  were also significantly increased Up-regulation (P<0.05), and cerebral oxygen

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metabolism index arterial partial pressure of carbon dioxide (PaCO2), internal jugular venous partial pressure of carbon dioxide (PjvCO2), internal

jugular venous blood oxygen partial pressure (PjvO2), internal jugular venous blood oxygen the saturation (SjvO2) is significantly reduced, as shown in Table 2-4.

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Group	Project	то	T1	T2
A group	PaCO2	124.56±20.11	110.3±20.00* #	101.23±18.96*#
	PjvCO2	136.65±30.20	124.35±25.65*#	112.36±21.36*#
	PjvO2	89.32±15.69	81.23±14.65*#	71.23±11.25*#
	SjvO2	0.71±0.05	0.65±0.06*#	0.63±19*#
B group	PaCO2	124.54±20.14	115.30±20.05*	109.28±18.54*
	PjvCO2	135.65±31.20	129.38±26.62*	119.36±22.36*
	PjvO2	89.38±15.64	84.28±14.68*	75.29±12.29*
	SjvO2	0.70±0.04	0.67±0.06*	0.66±19*

 Table 4. Changes of Cerebral Oxygen Metabolism Index of Patients in Group A and Group B in T0, T1, and T2

 T0

 T1

 T2

Note: \*: compared with T0 stage, P < 0.05; #, group A compared with group B, P < 0.05.

## **3.** Differences in various indicators between the two groups

After comparing group, A and group B patients using different anesthesia methods, comparing the stress response index, inflammatory factor index and cerebral oxygen metabolism index, it was found that the stress response index and inflammatory factor index of group A were higher than those of group B (P<0.05), while the cerebral oxygen metabolism index of group A patients was significantly lower than that of group B patients (P <0.05). The results are shown in Table 2-4.

## Conclusions

Radical esophageal cancer surgery is very traumatic, and postoperative catheter stimulation is also painful, which makes patients suffer stress during the postoperative anesthesia recovery period. Elderly patients are often accompanied by underlying diseases such as coronary heart disease and heart disease due to poor physical fitness the presence of restlessness can lead to increased heart rate and blood pressure, which significantly increases the risk of cardiovascular disease. Adding drugs to reduce agitation during the anesthesia process can effectively relieve symptoms. This kind of drugs should anesthetize the central nervous system, inhibit breathing, and have high safety. After stopping the drug, physical fitness should be restored as soon as possible to inhibit the spontaneous activity of sympathetic nerves [7,8].

Radical resection of esophageal cancer can have a significant impact on cardiopulmonary function, and requires high surgical anesthesia techniques and drugs. During general anesthesia, anesthesia should be used for stable anesthesia, highefficiency block analgesia, suitable depth of sedation, no addiction or drug resistance, and anesthetic drugs that have little effect on the respiratory system, immune function, and gastrointestinal tract to prevent delayed recovery and respiratory depression. Surgical stress occurs throughout the operation period. Preoperative tension, fear and other emotions, surgical injury and pain, or blood volume changes can all trigger the patient's surgical stress response, and surgical trauma is the most common. Under normal circumstances, the change of cerebral oxygen metabolism rate is consistent with cerebral blood flow, but when the cerebral oxygen metabolism rate increases, the cerebral blood vessels automatically expand and increase cerebral blood flow. This adjustment process is called cerebral oxygen metabolism rate/cerebral blood flow balance. The blood of the internal jugular venous bulb returns directly from the brain tissue. It can replace the cerebral venous blood to measure its SjvO2 and combine with Ca-jvDO2 and CMRO2 to reflect the blood flow and oxygen metabolism of the whole brain tissue [9-11].

This study showed that, compared with T0, the stress response indicators-cortisol (COR), norepinephrine (NE), and norepinephrine (NA) in T1 and T2 patients were significantly up-regulated, and inflammatory factor indicators IL-8, IL-6, TNF- $\alpha$  were also significantly up-regulated (P<0.05), while the cerebral oxygen metabolism index arterial partial pressure of carbon dioxide (PaCO2), internal jugular venous partial pressure of carbon dioxide (PjvCO2), internal jugular venous bulb The partial pressure of blood oxygen (PjvO2) and internal

jugular venous blood oxygen saturation (SjvO2) decreased significantly. After comparing group, A and group B patients using different anesthesia methods, comparing the stress response index, inflammatory factor index and cerebral oxygen

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metabolism index, it was found that the stress response index and inflammatory factor index of group A were higher than those of group B (P < 0.05), while the cerebral oxygen metabolism index of group A patients was significantly lower than that of group B patients (P < 0.05).

According to a study in esophageal cancer, although sevoflurane and remifentanil can synergize sedation and analgesia, there is an imbalance between the rise and fall of sevoflurane blood concentration and the maintenance of drug efficacy, and the lag is obvious. It may Produce depression. Compared respiratory with sevoflurane, propofol can exert an anesthetic effect within 30 seconds, wake up quickly, smoothly, and thoroughly. It can also remove free radicals and relieve the inflammatory response of lung tissue cells. Remifentanil combined with propofol can effectively inhibit the body's stress response. Stabilize blood flow, inhibit the expression activity of ICAM-1 and VCAM-1, prevent the body from excessively releasing inflammatory mediators and inflammatory factors, and balance the antiinflammatory response and pro-inflammatory response [12,13]. Prevent macrophages from releasing polypeptide substances and liver release CRP, prevent surgical trauma from causing a cascading inflammatory cascade effect, thereby inhibiting inflammation, reducing the damage of inflammatory response to lung tissue, and avoiding severe damage to lung function by anesthesia and surgical operations. Remifentanil and propofol can synergistically exert a sedative effect. Effective control of heart rate and blood pressure, good controllability, small damage to liver and kidney function, low incidence of vomiting and nausea, high safety, rapid, stable and comfortable recovery, satisfactory anesthesia, analgesia, and sedation.

In summary, compared with sevoflurane combined with remifentanil anesthesia, propofol combined with remifentanil anesthesia is more conducive to the stress response of patients with radical esophageal cancer, the reduction of inflammatory factors and the improvement of cerebral oxygen metabolism.

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