

# Anesthesia with propofol and sevoflurane on postoperative cognitive function of elderly patients undergoing general thoracic surgery

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**Abstract:** This study is to analyze the effects and variations on cognitive function for elderly patients undergoing general thoracic surgery, who accepted the anesthesia with propofol and sevoflurane. A total of 500 elderly general thoracic surgical patients were selected randomly, all receiving the propofol anesthesia (Propofol group). Meanwhile, another totality of 500 patients in the same condition and period were selected and accepted the sevoflurane anesthesia (Sevoflurane group). Mini-mental state examination (MMSE) and recovery quality after anesthesia were compared among the patients in both groups respectively at the time of pre-operation and 1 h, 6 h and 12 h after surgery. There was no statistic difference in preoperative MMES of patients in both two groups ( $P < 0.05$ ); while the results of postoperative MMSE showed that both Propofol group and Sevoflurane group had a certain statistical difference, and that in Propofol group was larger compared that in Sevoflurane group. Moreover,  $P < 0.05$  was obtained on comparing the MMSE at the time of 1h, 6h and 12h after surgery and that at pre-operation, revealing statistical significance. Either propofol or sevoflurane, to certain extent, can affect patients' cognitive function when they are applied in the general thoracic surgery for elderly patients. However, the influence of propofol on cognitive function is relatively smaller, which presents a better application value.

**Keywords:** Propofol, sevoflurane, general thoracic surgery for the elderly, cognitive function.

## INTRODUCTION

Clinical researches have been proved that cognitive dysfunction is a common postoperative complication for elderly patients undergoing general thoracic surgery (fig. 1), with high incidence rate ranging 44% from 61% (Aldahmash *et al.*, 2016). When suffering from cognitive dysfunction, patients will generally experience some symptoms, such as mental confusion, anxiety, personality change and memory impairment, which bring great influences on the operative efficacy and postoperative life quality. In recent years, with the worse and worse issues on aging population, plenty of advanced countries have gradually become the aging society, and the number for elderly patients undergoing general thoracic surgery also presents an increasing trend (Shen *et al.*, 2011). Hence, how to control and improve the postoperative cognitive dysfunction in an effective way should be paid high attentions in clinic.

Propofol (fig. 2) intravenous anesthesia and sevoflurane inhalation general anesthesia have a rapid onset, a full effect to analgesia and muscular relaxation, the fast recovery and the small disturbance on physiological function, which are the two common anesthesia methods in thoracic surgery. At present, there are some available clinical research results revealing that the anesthetic efficacy of propofol and sevoflurane can be acted through enhancing  $\gamma$ -aminobutyric acid (GABA) receptor and inhibiting N-methyl-D aspartic acid (NMDA) receptor,

respectively, because both of them can lead to cognitive dysfunction by inhibiting the expression of long-term potentiation (LTP) of cell synapse in hippocampal CA1 area so as to affect the cognitive function like learning and memory (Dashti and Abdeshahian, 2016). Propofol is a short-effective intravenous anesthetics of alkyl phenols, not only can be distributed rapidly all over the body after the intravenous injection, but also makes the body in sleep state within 40s, embodying a fast and stable anesthetic effect. At the same time, its metabolism is taken place in liver by the combination with glucuronic acid prominently, and the metabolin is excreted in the urine within 34 to 60 min (Chen *et al.*, 2016). Furthermore, propofol has a certain inhibition on respiratory system and circulatory system, but it helps the rapid recovery for body after anesthesia (Lv *et al.*, 2015).

In order to reduce the postoperative cognitive dysfunction for elderly patients to minimum as far as possible and ensure their life quality, this study thoroughly analyzed the postoperative cognitive function profile on elderly patients undergoing thoracic surgery who accepted the anesthesia with propofol or sevoflurane. We hope those researches can become a certain reference value in clinic (Balkhair, 2016).

## MATERIALS AND METHODS

### General data

A total of 1000 patients (637 males and 363 females; mean age:  $[68.5 \pm 6.5]$  [range: 62-78] years; mean weight:  $[68.5 \pm 6.5]$  [range: 42-76] kg) who received the treatment

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of general thoracic surgery between March 2014 and March 2016 were recruited. Among them, lung cancer patients and esophagus cancer patients were 734 and 266, respectively. Besides, the classification of American Society of Anesthesiologists was in level I or level II. According to different anesthetic methods, patients were divided in two groups. No statistical differences was shown in the basic data ( $P > 0.05$ ), proving the incredibility on comparison results.

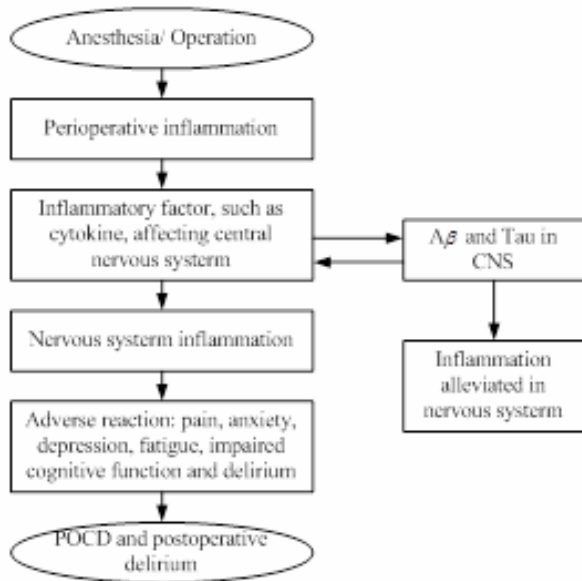


Fig. 1: Reasons of postoperative cognitive dysfunction.

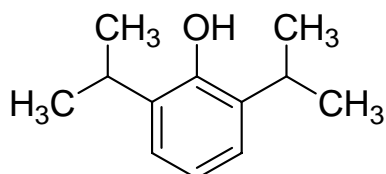


Fig. 2: Drug structure of propofol.

Inclusion and Exclusion Criteria were: 1) more than 60 years; 2) having clear logical thought and verbal expression ability as well as the normal thinking before surgery; 3) exclusion of cardiovascular and cerebrovascular diseases, incomplete renal function injury, central nervous system disease and mental disease; 4) not receiving any drug therapy influencing nervous system, such as surgical sedative drugs, antidepressant drugs and anti-anxiety drugs. All enrolled patients had a clear learning on the objective and significance of this study, were willing to participate this study and had signed the informed content. Their complete clinical data manifested the reference value.

#### Anesthetic Methods

All patients should not take medications before surgery and lie on their back in 5 mins. after lying in the operating room. Then, open their venous channel, infuse appropriate

10 mm/kg Lactated Ringer's Solution and 6% Hydroxyethyl starch, and conduct the monitor-for-routine monitoring of blood pressure, heart rate, oxyhemoglobin saturation and electrocardiogram. At induction, patients in both groups were intravenously injected with 0.1 mg/kg vecuronium bromide and 4mcg/kg fentanyl. After that, 2 mg/kg propofol was infused for patients in Propofol group and 2%-4% sevoflurane was inhaled for patients in Sevoflurane group. Afterwards, endotracheal intubation was conducted and anesthesia machine was performed for mechanical ventilation, with tidal volume kept at 8 ml/kg, respiratory rate at 12 times/min, respiratory ratio at 1:2 and partial pressure of end-tidal carbon dioxide at 30-35 mmHg. Fentanyl and vecuronium bromide were infused to maintain the anesthesia among patients in the two groups during the operation. For the meantime, the speed of pumping propofol and the concentration of inhaling sevoflurane were adjusted at any moment in accordance with blood pressure, heart rate and the progress to operation, maintaining the anesthesia depth of bispectral index (BIS) at 45-55. Stop infusing vecuronium bromide at 30 min before finishing the operation and stop inhaling sevoflurane and injecting propofol at the time of suturing skin. Antagonistic residual muscle relaxant of 0.02 mg/kg neostigmine and 0.01 mg/kg atropine was intravenously injected in patients. Extubation was conducted until patients had recovered spontaneous breath and were sober (Xie *et al.*, 2015).

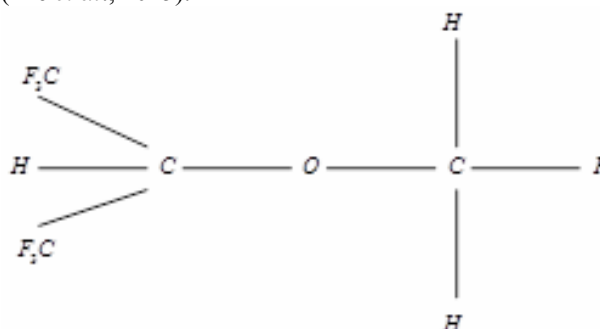


Fig. 3: Structure of Sevoflurane.

#### Clinical observation indexes

Assessment on cognitive function: mini-mental state examination (MMES) was adopted to assess patients' cognitive function level at the time of pre-operation and 1h, 6h and 12h after surgery, respectively.

Recovery quality: The duration of spontaneous breathing recovery, open eye time and extubation time were recorded and postoperative complications, such as nausea, vomit and restlessness, were observed.

#### STATISTICAL ANALYSIS

SPSS19.0 statistical software was adopted for data analysis; (n, %) was applied for presenting enumeration data, which was tested by Chi-square; ( $\bar{x} \pm s$ ) was

**Table 1:** Comparison of MMSE score of patients in the two groups before and after operative anesthesia.

Groups	Pre-operation	Postoperative 1h	Postoperative 6h	Postoperative 12h
Propofol group	29.6±0.8	26.1±0.7	27.3±0.6	28.9±0.5
Sevoflurane group	29.8±0.6	23.2±0.5	25.1±0.7	26.1±0.4
t	4.472	75.381	53.358	97.780
P	0.000	0.000	0.000	0.000

**Table 2:** Comparison of S100β protein contents between two groups before and after operation (pg/ml).

Group	Pre-operation	Post-operation	t	P
Sevoflurane group	58.3±15.8	152.4±43.4	45.557	0.000
Propofol group	58.7±17.4	96.3±25.7	27.089	0.000
t	0.380	24.870		
P	0.703	0.000		

employed for revealing measurement data, which was tested by t-test. Values of  $P < 0.05$  was considered statistically significant.

## RESULTS

Results of MMSE score showed that the cognitive function scores before operation were similar for patients in the two groups, without statistical difference; but within 1-12h after operative anesthesia, distinct variety was found in the cognitive function score for patients in both two groups, so comparisons of that before and after operation presented  $P < 0.05$ , showing statistical difference. Moreover, postoperative MMSE score for patients in Propofol group was larger than that in Sevoflurane group, difference showing  $P < 0.05$ , showing statistically significant (table 1).

Comparing the serum S100β protein content in patients of both groups before and after surgery, it displayed that postoperative serum S100β protein content was significantly raised for patients in the two groups. That was (58.3±15.8) pg/ml and (152.4±43.4) pg/ml respectively in Sevoflurane group before and after surgery; while that was (58.7±17.4) pg/ml and (96.3±25.7) pg/ml respectively in Sevoflurane group before and after surgery, which was obvious that change amplitude of serum S100β protein content in Propofol group was less than that of Sevoflurane group, revealing  $P < 0.05$  in the inter-group differences, a significantly statistical difference.

The postoperative anesthesia recovery quality in Propofol group had a distinct superiority to that in Sevoflurane group. The durations of postoperative spontaneous breathing recovery, postoperative eye open and postoperative extubation were (8.86±1.03) min, (12.53±2.24) min and (14.35±4.37) min, respectively for patients in Propofol group, while those were (12.21±1.84) min, (16.32±1.54) min and (20.13±4.32) min, respectively for patients in Sevoflurane group. Statistical analysis

discovered that  $P < 0.05$  was obtained for the inter-group difference comparisons, showing significantly statistical difference.

## DISCUSSION

From the research results of this study, it showed that the MMSE scores at the time of postoperative 1h, 6h and 12h for patients in Sevoflurane group were smaller than those in Propofol group. At the time of postoperative 12 h for patients in Propofol group, the cognitive function level almost reached the same with that before surgery, which was not presented for patients in Sevoflurane group. Therefore, propofol had a smaller influence on the recovery of cognitive function for elderly patients. Meanwhile, S100β protein was closely related to patients' memory and learning capacity, a specific protein reflecting the brain injury of patients (Phanse *et al.*, 2016). Its content changing has a close relevance to the nervous system injury. Moreover, the higher of the content, the more nerve cell and brain cell will suffer injuries, and it may induce brain cell apoptosis and necrosis if severe (Yu *et al.*, 2012). Hence, it is necessary to control the S100β protein in elderly patients. In this study, although there was an increase on the postoperative S100β protein content for patients in Propofol group, it was significantly smaller than that in Sevoflurane group ( $P < 0.05$ ), which showing a relative small injury of propofol on patients' nerve function. Clinical researches demonstrated that sevoflurane (fig. 3) may have a certain influence on patients' nervous system function because patients' brain wave appears obvious change during anesthesia. Furthermore, there are more contraindications in using sevoflurane and it will cause adverse influence during the treatment if it is not careful.

## CONCLUSION

It was concluded that anesthesia with propofol or sevoflurane had a certain influence on cognitive function when applied on elderly patients undergoing

general thoracic surgery, but compared with sevoflurane, the influence was smaller and the recovery quality was better for patients using propofol. Therefore, in the similar clinical treatment, individual condition must be analyzed in detail and propofol should be regarded the first choice as anesthetic drug.

## REFERENCES

- Aldahmash BA, DM El-Nagar and KE Ibrahim (2016). Attenuation of hepatotoxicity and oxidative stress in diabetes STZ-induced type 1 by biotin in Swiss albino mice. *Saudi J. Biol. Sci.*, **23**: 311-317.
- Balkhair KS (2016). Microbial contamination of vegetable crop and soil profile in arid regions under controlled application of domestic wastewater. *Saudi J. Biol. Sci.*, **23**: S83-92.
- Chen ZX, ZF Zhang and WS Aqma (2016). Mechanical characteristics of antibacterial epoxy resin adhesive wood biocomposites against skin disease. *Saudi J. Biol. Sci.*, **23**: S126-136.
- Dashti MG and Abdeshahian P (2016). Batch culture and repeated-batch culture of Cunninghamella bairdii 2A1 for lipid production as a comparative study. *Saudi J. Biol. Sci.*, **23**: 172-180.
- Lv WY, XH Jiang, WQ Xu, JY Wang and SB Zhang (2015). Effect of propofol or sevoflurane combined with dexmedetomidine on postoperative cognitive function, erythrocyte sedimentation rate and oxidative stress in patients with bone tumor. *Chin. J. Biochem. Pharm.*, **8**: 128-130, 133.
- Phanse MA, Patil MJ and Abbulu K (2016). Synthesis, characterization and evaluation of the suppression of insulin resistance in Type-II diabetes mellitus animals by treatment with metal complex. *Saudi J. Biol. Sci.*, **23**: 420-425.
- Shen YF, QX Wu and MY Xu (2011). Effects of anesthesia with propofol and sevoflurane on postoperative cognitive function of elderly patients undergoing thoracic surgery. *J. Shanghai Jiaotong Univ. (Med. Sci.)*, **31**: 322-325.
- Xie ZR, Meng XH and Liu XL (2015). Influence of total intravenous anesthesia with propofol and fentanyl on operative cognitive function in elderly patients undergoing thoracic surgery. *Chin. J. Geront.*, **17**: 3669-3671.
- Yu XC, YG Wang and LB Gao (2012). Influence of anesthesia with sevoflurane or propofol on postoperative cognitive function in elderly patients of lung cancer. *J. Tianjin Med. Univ.*, **18**: 102-105.