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Effects of Total Intravenous Anesthesia and Static Aspiration Combined General Anesthesia on Postoperative Cognitive Function and Psychological State of Elderly Patients with Esophageal Cancer

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Abstract

Objective: To compare the effects of total intravenous anesthesia and static aspiration combined general anesthesia on postoperative cognitive function and psychological state of elderly esophageal cancer patients. **Methods:** From July 2020 to April 2021, 180 elderly patients who underwent radical esophageal cancer surgery in our hospital were randomly divided into 90 cases in the control group and 90 in the observation group. The control group used static aspiration compound general anesthesia, and the patients in the observation group used intravenous anesthesia to compare the cognitive function and psychological state of the two groups of patients. **Results:** There was no statistical difference in the cognitive function score of patients in the observation group 30 minutes before anesthesia, 1 h and 24 hours after anesthesia compared with that in the control group, $P > 0.05$; there was no statistical difference between the Hamilton Anxiety Scale (HAMA) scores 30 minutes before and 24 hours after anesthesia in the observation group compared with the control group, $P > 0.05$; the cognitive function score of patients in the observation group of 4 h after surgery and 12 h after operation was significantly higher than that of the control group; the HAMA scores of patients in the observation group of 1 h, 4 h and 12 h after surgery were significantly lower than that of the control group, $P < 0.05$. **Conclusion:** The application of total intravenous anesthesia in elderly patients with esophageal cancer surgery can reduce the impact of anesthesia on their cognitive function and psychological state, which is worth popularizing and applying in clinical practice.

Keywords

Total Intravenous Anesthesia, Static Aspiration Combined General Anesthesia, Esophageal Cancer, Elderly, Surgery, Postoperative Cognitive Function, Psychological State

1. Introduction

Postoperative cognitive impairment (POCD) is a complication of the central nervous system. Weak cognitive ability, poor memory and social integration ability are the main clinical manifestations. POCD has a complex mechanism. Factors such as old age, anesthesia methods and tumors all have a certain impact on early POCD. POCD will promote the incidence of complications and mortality of patients, prolong the length of hospital stay and increase medical expenses [1]. Esophageal cancer is one of the malignant tumors with the highest morbidity and mortality in China [2] currently with surgical resection being the treatment of choice. However, the long duration of one-lung ventilation with tracheal intubation during surgery may cause disturbance of ventilation hemodynamics and pulmonary ischemia-reperfusion [3], and some elderly patients, with esophageal cancer, are prone to postoperative anxiety, irritability and cognitive dysfunction due to decreased body function and increased sensitivity to anesthetic drugs. It leads to low patient compliance with postoperative pulmonary rehabilitation exercises such as effective coughing and sputum excretion, which affects postoperative their recovery and the quality of life. This study aims to explore the effects of total intravenous anesthesia and static aspiration combined general anesthesia on postoperative cognitive function and psychological state of elderly patients with esophageal cancer for investigating a more reasonable anesthetic plan for future clinical surgical anesthesia.

2. Materials and Methods

2.1. General Information

With the consent of patients and their families and the approval of the ethics committee of our hospital, the ethics number is b2019-103-01. This study selected 180 elderly patients who underwent radical esophagectomy in a grade III cancer hospital in Guangdong Province from July 2020 to April 2021, including 106 males and 74 females, with a mean age of 65 ± 3.9 years and weight of 62.5 ± 6.3 kg, who underwent the resection of esophageal carcinoma in our hospital between July 2020 and April 2021, were selected, and their pulmonary function tests were normal. They were randomly divided into a control group and an observation group of 90 patients each. All patients signed informed consent form. The relative ratios of the data between the two groups ($P > 0.05$) were comparable.

Inclusion criteria: 1) All patients who met the surgical indications of esopha-

geal cancer were treated for the first time; 2) Cognitive function was normal before surgery; 3) Patients aged ≥ 60 years old; 4) Liver and renal function tests as well as coagulation profile were normal.

Exclusion criteria: 1) Severe complications such as intraoperative complicated with hemorrhage; 2) Allergy to anesthetic phase and drugs; 3) History of alcohol abuse or psychoactive drug dependence; 4) History of cerebrovascular disease; 5) Combined with psychiatric disorders.

2.2. Quantity Calculation of Samples

In this study, MMSE mini mental state examination scale was used as an effect index to evaluate cognitive function. According to the study design, the pre experiment shows that after the intervention of intravenous anesthesia, the effect value of cognitive function in elderly patients undergoing radical esophagectomy is 24.5. This study needs to test the efficacy α It is 0.05, which is brought into the sample calculation software Gower 3 1.9.2 considering that 20% of the samples are missing or invalid, a total of 114 samples are required.

2.3. Anesthetic Methods

The intravenous accesses (IV) were established for routine rehydration after the patients in both groups entered the operating room, and the changes of vital signs and SPO_2 of the patients were intimately monitored. The patients were given Oxygen masks, taking midazolam 0.04 mg/kg, propofol 1 - 2 mg/kg, fentanyl 2 ug/kg as well as vecuronium bromide 0.1 mg/kg by intravenous drip. Ventilator ventilation via tracheal cannula was given after obtaining satisfactory muscle relaxation effect.

In the control group, patients were administered the propofol by intravenous drip, administered sevoflurane 2% - 3%, by intravenous drip and inhalation, at a flow rate of 1 L/min continuously; In the observation group, total intravenous anesthesia was administered with propofol 5 - 12 mg/kg·h.

2.4. Observational Index

1) The changes in cognitive function in the two groups were observed and analyzed by the Mini-Mental State Examination Scale (MMSE) [3] with a total score of 30 at 30 minutes before anesthesia and at 1 h, 4 h, 12 h, and 24 h after surgery, and higher scores indicate better cognitive function.

2) Changes in psychological state were recorded and analyzed in the two groups, which were assessed by the Hamilton Anxiety Scale (HAMA) at 30 minutes before anesthesia and 1 h, 4 h, 12 h, and 24 h after surgery [4]. The full score of HAMA full was 60, with < 7 been classified as normal, 7 - 16 as mild depression, 17 - 24 as moderate depression, and >24 as major depression, and higher scores indicate more severe anxiety in the patients.

2.5. Statistical Methods

Data statistical analysis was performed by SPSS 22.0, with quantitative data be-

ing expressed as means (±S). Comparisons between two groups were performed by t-test, and differences were considered statistical significance if P is < 0.05.

3. Results

A total of 90 elderly patients with esophageal cancer in the control group and the observation group were included in this study. There was no significant difference in gender, age, height, weight, operation time and anesthesia time between the two groups (P > 0.05).

3.1. Comparison of MMSE Scores between the Two Groups

The MMSE scores obtained at 30 minutes before anesthesia and 1 h and 24 h after surgery did not show any statistical significance between the two groups (P > 0.05);

The MMSE scores of the observation group were significantly better than those of the control group at 4 h and 12 h after surgery, which showed statistical significance (P < 0.05). Details are shown in Table 1.

3.2. Comparison of Psychological State Scores between the Two Groups (x ± S)

The psychological state of the two groups at 30 minutes before anesthesia and 24 h after surgery was consistent, and there was no statistical significance in the HAMA scores (P > 0.05); The psychological state of the observation group was better than that of the control group at 1 h, 4 h, and 12 h after surgery, and the HAMA scores of the observation group were lower than that of the control group, P < 0.05. Details are shown in Table 2.

Table 1. Comparison of MMSE scores between the two groups (±S).

Group	Number of cases	30 minutes before anesthesia	1 h after surgery	4 h after surgery	12 h after surgery	24 h after surgery
Control Group	90	28.92 ± 0.98	21.13 ± 0.65	23.17 ± 1.23	25.59 ± 1.16	27.98 ± 1.03
Observation Group	90	28.86 ± 1.01	20.97 ± 0.54	26.33 ± 1.27	27.68 ± 1.04	28.45 ± 0.98
t		0.238	2.35	3.11	2.89	2.63
P		0.572	0.273	0.004	0.046	0.61

Table 2. Comparison of psychological state scores between the two groups (±S).

Group	Number of cases	30 minutes before anesthesia	1 h after surgery	4 h after surgery	12 h after surgery	24 h after surgery
Control Group	90	16.18 ± 1.33	14.53 ± 1.15	12.42 ± 1.08	10.39 ± 1.31	7.06 ± 1.53
Observation Group	90	15.79 ± 1.36	11.62 ± 1.38	9.17 ± 1.26	7.11 ± 1.35	6.79 ± 1.60
t		0.073	5.18	7.34	7.14	4.88
P		0.69	0.03	0.038	0.04	0.69

4. Discussion

Patients had to undergo one-lung ventilation with antegrade bronchial intubation when they underwent the resection of esophageal carcinoma to better expose the surgical field to facilitate resection of the lesion by the surgeon. The one-lung ventilation of causes hemodynamic changes and changes in the ventilatory blood flow ratio, and as a result, there are studies showing that postoperative patients with esophageal cancer have a higher chance of developing cognitive dysfunction than patients undergoing other oncologic surgeries. Moreover, elderly patients suffer from weak autoimmune, degeneration of the central nervous system, and increased sensitivity of the body to anesthetic drugs, If a slower metabolizing anesthetic is used during anesthesia, the patient is prone to long-lasting depression of neurologic function, postoperative cognitive dysfunction, and negative mood [4] [5] [6].

4.1. Cognitive Dysfunction Was Less Common in Patients Treated with Total Intravenous Anesthesia than with Intravenous-Inhalation Combined Anesthesia

The study compared the MMSE scores of the two groups with **Table 1** showing that the MMSE scores of the two groups at 30 minutes before anesthesia and 1 h and 24 h after surgery had no statistical significance ($P > 0.05$), whereas the scores of the observation group at 4 h and 12 h after surgery were significantly higher ($P < 0.05$), indicating that the patients in the observation group were obviously less cognitively dysfunction than the patients in the control group. However, the results also showed that, as anesthesia time goes by, the MMSE scores of the two groups at 24 h after surgery could not recover to their levels before surgery, which was consistent with the study of Wang Yonghong *et al.* [7]. The total intravenous anesthesia only requires intravenous anesthetic drugs, and the adopted combination of propofol and fentanyl, belongs to short acting anesthetic drugs. The two are used together for anesthesia, which can satisfy the real-time anesthetic depth during the surgery and will not cause postoperative accumulation of anesthetic drugs. Propofol is able to scavenge free radicals thoroughly and inhibit the peroxidation of lipids leading to play a certain protective effect on brain tissue [8]. Fentanyl has a protective effect on myocardium and can easily metabolize. It can accelerate the recovery of cognitive function of patients after operation. The anesthesia effect of combined drugs is significant. At the same time, the dose is controllable, and the depth of anesthesia is more accurate. Short acting drugs make patients recover faster after operation and accelerate the recovery of MMSE level, which is consistent with the results of clinical research [8]. Sevoflurane administrated in the control group was able to inhibit central cholinergic system function and affect the release of other neurotransmitters resulting that the increased incidence of postoperative hypoxemia raised the occurrence of cognitive dysfunction. Studies have shown that sevoflurane may lead to neuronal apoptosis, easy to cause neurodegenerative changes, and lead to cognitive impairment. This study shows that there are significant differ-

ences in MMSE scores between the two groups at 4 h and 12 h after operation. It is speculated that it is related to the use of sevoflurane. It is considered that sevoflurane will affect the occurrence of postoperative cognitive impairment to a certain extent, but there is no significant difference in MMSE scores at 24 h after operation, indicating that it does not play a decisive role in cognitive impairment [8].

4.2. Patients under Total Intravenous Anesthesia Have Better Psychological State than Those under Intravenous-Inhalation Combined Anesthesia

The study compared the psychological state of patients in the two groups, and from Table 2 showing that the psychological state of patients in the two groups was consistent at 30 minutes before anesthesia and 24 h after surgery, but the patients in the observation group were better than the control group at 1 h, 4 h, and 12 h after surgery, which was consistent with the long anesthesia time for the resection of esophageal carcinoma and the sevoflurane used in the control group had more accumulation in the body, which caused elderly patients were prone to postoperative discomfort such as irritability and vomiting leading to experience anxiety and other negative emotions [9]. Propofol is able to maintain the homeostasis of the body's internal environment, inhibit the secretion of adrenocorticotropic hormone and reduce cortisol concentration to attenuate sympathetic nervous system activity. It also has a broad CNS depressant effect that can directly inhibit the vagus nerve nucleus of the chemoreceptor trigger zone (CTZ) [10]. Total intravenous anesthesia has advantages such as intraoperative maintenance of oxygenation, postoperative wakefulness, low incidence of nausea and vomiting, etc., which greatly reduces the occurrence of negative emotions such as postoperative anxiety. Studies by Gao Lijun and other scholars have also proved that total intravenous anesthesia has a faster speed of anesthetic induction, which can eliminate the fear such as patient tension and anxiety.

In summary, in elderly surgical patients with esophageal cancer, intravenous anesthesia with propofol causes less damage to patients' postoperative cognitive function with less psychological impacts on patients and is superior to the intravenous-inhalation combined anesthesia.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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