

Original Article

Effect of remifentanil combined with sevoflurane inhalation anesthesia on coagulation function and postoperative recovery of patients undergoing endoscopic selective varices devascularization

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Abstract: Objective: To investigate the effect of remifentanil combined with sevoflurane inhalation anesthesia on coagulation function and postoperative recovery of patients undergoing endoscopic selective varices devascularization (ESVD). Methods: Altogether 116 patients undergoing ESVD in our hospital were randomly divided into two groups. The control group received propofol combined with remifentanil anesthesia, while the observation group received remifentanil combined with sevoflurane inhalation anesthesia. Results: There was no statistical difference in coagulation function indexes between the control group and the observation group ($P > 0.05$), and the clinical anesthesia effect of the observation group was better ($P < 0.001$). Five minutes after intubation, compared with the control group, the clinical stress response index was better (all $P < 0.001$), the quality of anesthesia recovery was higher (all $P < 0.001$), the heart rate was better after anesthesia ($P < 0.001$), and the incidence of adverse reactions was higher ($P < 0.01$) in the observation group. Conclusion: Compared with remifentanil combined with propofol anesthesia, remifentanil combined with sevoflurane inhalation anesthesia for ESVD can effectively improve the clinical anesthesia effect, improve the quality of anesthesia recovery, and reduce stress reactions, but the incidence of adverse reactions is increased. Therefore the clinical application still needs to be strengthened.

Keywords: Remifentanil, propofol, sevoflurane, endoscopic selective varices devascularization, anesthetic effect, coagulation function, postoperative recovery

Introduction

Endoscopic selective varices devascularization (ESVD) is a common minimally invasive surgical treatment. Compared with other general anesthesia operations, it has the advantages of having a small wound, less bleeding and a quick recovery [1]. ESVD can continuously alleviate damage to other organs caused by an open surgery and it promotes the postoperative rehabilitation of patients [2]. The key to relieve pain and improve prognosis is to select reasonable and appropriate anesthesia methods [3]. At present, remifentanil combined with sevoflurane or propofol is widely used for general anesthesia in the clinic. Although both of the modes have the advantages of a quick onset, easy measurement of anesthesia degree, simi-

lar anesthesia effects and safety, remifentanil combined with sevoflurane can promote patients' rapid awakening and obviously relieve patients' pain [4, 5]. However, the effects of the two drugs on the anesthesia for ESVD and their influence on coagulation function and safety have not been reported. In this research, the effects of remifentanil combined with sevoflurane inhalation anesthesia on coagulation function and postoperative recovery of patients undergoing ESVD were studied.

Materials and methods

General information

From January 2017 to May 2018, altogether 116 patients undergoing ESVD in our hospital were selected. Inclusion criteria: (1) Patients

Clinical effect of remifentanil combined with sevoflurane inhalation anesthesia

who had not received ESVD within 1 month; (2) Patients with complete clinical data; (3) Informed consent forms was obtained from the patients [6]. Exclusion criteria: (1) Those with other serious important organ diseases; (2) Those with severe consciousness disorders; (3) Those with diseases of the blood and immune systems; (4) Those were allergic to narcotic drugs in this research [7].

Research participants were randomly divided into two groups by a random number table method. The control group (58 cases, 28 males and 30 females) was given propofol combined with remifentanil anesthesia, aged 45 to 69 years, with an average of (57.0 ± 1.5) years. According to Child-Pugh classification, there were 20 cases of Grade A, 27 cases of Grade B and 11 cases of Grade C. According to vein's classification, there were 48 cases of GOV1, 7 cases of GOV2 and 3 cases of GOV3. The observation group (58 cases, 29 males and 29 females) was given remifentanil combined with sevoflurane inhalation anesthesia, aged 46 to 69 years, with an average of (57.5 ± 1.4) years. According to Child-Pugh classification, there were 18 cases of Grade A, 29 cases of Grade B and 11 cases of Grade C. According to vein's classification, there were 46 cases of GOV1, 9 cases of GOV2 and 3 cases of GOV3. There was no significant difference in general data between the two groups, and they were comparable ($P > 0.05$). This research has been approved by Ethics Committee of our hospital.

Methods

Patients in both groups were intubated under general anesthesia.

Control group: All patients received target-controlled infusion anesthesia of propofol combined with remifentanil, in which the induced concentration of propofol (AstraZeneca Pharmaceutical Co., Ltd.) was 1 mg/kg, the plasma concentration of propofol was 1.5-2.5 $\mu\text{g/mL}$ during operation, and remifentanil (Yichang Humanwell Pharmaceutical Co., Ltd., 1 mg; 0.4 $\mu\text{g/kg}$) was induced to 6 ng/mL, and the plasma concentration was maintained to 2-8 ng/mL during operation. Target-controlled infusion was used for anesthesia. After the target-controlled infusion device was connected, age, body weight and target concentration were input, and the drug was administered under com-

puter control. Propofol was stopped 5 min before the operation, and remifentanil was stopped at the end of the operation.

Observation group: All patients received remifentanil combined with sevoflurane (Hebei Yipin Pharmaceutical Co., Ltd., China) inhalation anesthesia. The application method of remifentanil anesthetic was the same as that of the control group. Sevoflurane was inhaled at a concentration of 1.5%-4.5%, and the dosage was adjusted according to the anesthesia depth and hemodynamic changes.

After operation, 2.0 mg of neostigmine (Zhejiang Xianju Pharmaceutical Co., Ltd., China) and 1.0 mg of atropine (Zhejiang Ruixin Pharmaceutical Co., Ltd., China) were given intravenously. To reduce the awareness rate during operation, 0.01 mg/kg of midazolam was added intravenously every 1 h when the operation time was longer than 2 h, and stopped 30 min before the end of operation. The tidal volume of two groups of patients during operation was 6-8 mL/kg, and the respiratory frequency was 12 times/min-14 times/min.

Outcome measures

Main outcome measures: Clinical anesthesia effect, coagulation function and anesthesia recovery quality. Secondary outcome measures: clinical stress reaction, hemodynamic indexes and adverse reactions.

Operation conditions: The operation time, blood loss, anesthesia time and remifentanil dosage were compared between the two groups.

Blood coagulation function: Venous blood from the elbow of patients was collected before operation and 1 h after operation, and thrombin time, activated thrombin time, fibrinogen, prothrombin time and other indexes were detected by CoaguChek XS whole coagulation tester, made in Switzerland [8, 9].

Clinical stress response: The clinical stress response refers to stress response indicators at 5 minutes before anesthesia induction and 5 minutes after intubation, including diastolic blood pressure, systolic blood pressure, adrenaline, cortisol and other indicators. Among them, diastolic blood pressure and systolic blood

Clinical effect of remifentanil combined with sevoflurane inhalation anesthesia

Table 1. Comparison of baseline data ($\bar{x} \pm sd$)

Index	Observation group (n=58)	Control group (n=58)	t/ χ^2	P
Operation time (min)	175.31±15.54	172.57±14.66	0.977	0.331
Intraoperative blood loss (mL)	317.09±32.85	321.24±30.97	0.700	0.485
Postoperative drainage fluid volume (mL)	479.17±42.96	466.81±45.92	1.497	0.132
Anesthesia time (min)	256.14±22.85	247.36±31.08	1.733	0.086
Remifentanil dosage (μ g)	2127.55±297.84	2382.97±288.14	4.694	0.000

Table 2. Indexes of coagulation function ($\bar{x} \pm sd$)

Group	Thrombin time (s)	Activated partial thromboplastin time (s)	Fibrinogen (g/L)	Prothrombin time (s)
Control group (n=58)	20.21±1.02	36.45±2.39	3.54±0.25	12.87±2.01
Observation group (n=58)	19.94±1.15	35.81±2.02	3.37±0.98	12.52±1.97
t	1.536	1.558	1.280	0.941
P	0.127	0.122	0.203	0.346

pressure in the body were detected by ambulatory blood pressure monitoring, usually once every 15-30 minutes, and the final result was the average of the values at the two time points. Three milliliters of elbow venous blood were collected at the two time points, and adrenaline, cortisol and other hormones were detected by high performance liquid chromatography, with Agilent.

Anesthesia recovery quality: The recovery of clinical indicators of patients was recorded in detail, which mainly included spontaneous breathing recovery time, complete instruction action time, speech response time and extubation time.

Hemodynamic index: The change of blood oxygen saturation of patients was detected by using blood oxygen saturation detector, and the change of HR (heart rate) was observed.

Adverse reactions: The adverse reactions included nausea, vomiting, respiratory depression and other adverse reactions.

Statistical methods

SPSS 20.0 was used to analyze the data, and the measurement data were expressed by mean \pm standard deviation ($\bar{x} \pm sd$). Two independent samples t test was used to compare the mean between the two groups, and paired t test was used to compare the mean before and after intervention in the same group. The count-

ing data were expressed by rate and tested by χ^2 test, and the difference was statistically significant with $P < 0.05$.

Results

Operation conditions

There were no significant differences in operation time, intraoperative blood loss, postoperative plasma drainage and anesthesia time between the two groups (all $P > 0.05$). The dosage of remifentanil in the observation group was significantly less than that in the control group ($P < 0.001$; **Table 1**).

Coagulation function

There were no significant differences in thrombin time, activated thromboplastin time, prothrombin time and fibrinogen between the observation group and the control group (all $P > 0.05$), as shown in **Table 2**.

Clinical stress response

Five minutes before anesthesia induction, there were no significant differences in the clinical stress response indexes between the two groups (all $P > 0.05$), and five minutes after intubation, the clinical stress response indexes of the observation group were significantly better than those of the control group (all $P < 0.001$), as shown in **Table 3** and **Figure 1**.

Clinical effect of remifentanyl combined with sevoflurane inhalation anesthesia

Table 3. Clinical stress response indicators (score, $\bar{x} \pm sd$)

Group	Diastolic pressure (mmHg)	Systolic blood pressure (mmHg)	Adrenaline (ng/L)	Cortisol ($\mu\text{g/L}$)
Control group (n=58)				
5 minutes before induction of anesthesia	125.21 \pm 9.82	78.67 \pm 4.91	70.56 \pm 12.04	94.94 \pm 2.35
5 minutes after intubation	130.24 \pm 11.02 ^{***}	86.45 \pm 3.54 ^{***}	78.65 \pm 6.87 ^{***}	108.64 \pm 10.65 ^{***}
Observation group (n=58)				
5 minutes before induction of anesthesia	124.91 \pm 7.81	78.58 \pm 4.01	69.88 \pm 17.47	94.85 \pm 2.07
5 minutes after intubation	126.82 \pm 5.23 ^{***,###}	79.62 \pm 6.47 ^{***,###}	67.48 \pm 8.54 ^{***,###}	91.24 \pm 6.90 ^{***,###}

Note: Compared with before treatment, ^{***}P<0.001; compared with control group, ^{###}P<0.001.

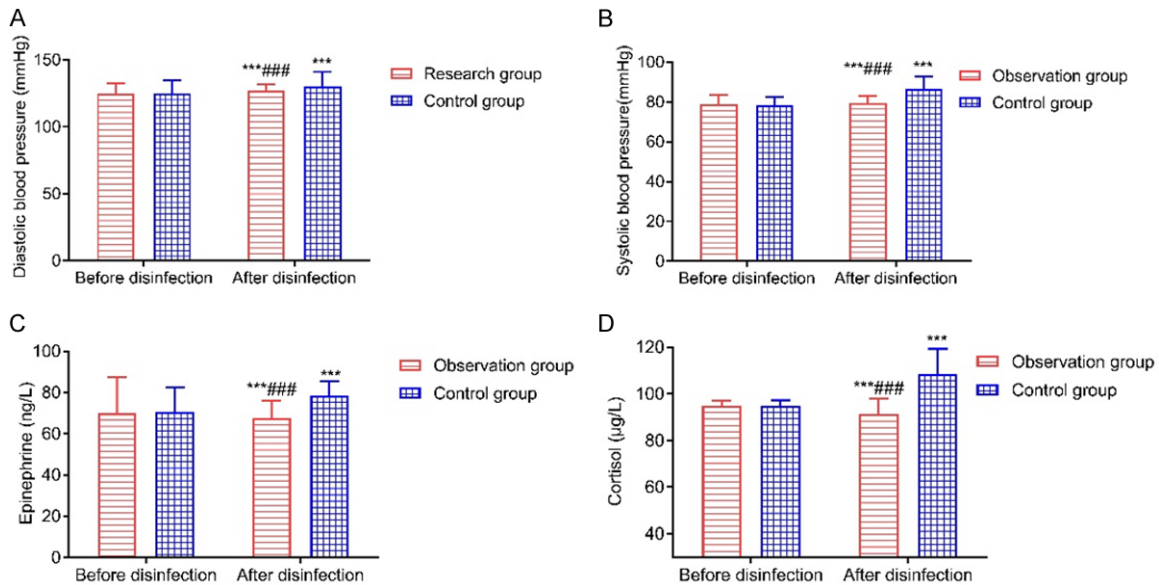


Figure 1. Comparison of clinical stress response indicators. A: diastolic pressure; B: systolic blood pressure; C: adrenaline; D: cortisol. Compared with before disinfection, ^{***}P<0.001; compared with the control group, ^{###}P<0.001.

Table 4. Anesthesia recovery quality (min, $\bar{x} \pm sd$)

Group	Spontaneous breathing recovery time	Complete command action time	Speech response time	Extubation time
Control group (n=58)	5.57 \pm 1.05	7.88 \pm 1.17	11.54 \pm 1.85	15.38 \pm 1.22
Observation group (n=58)	4.36 \pm 1.17	6.05 \pm 1.26	7.86 \pm 1.07	11.98 \pm 1.04
t	5.862	8.105	13.113	16.152
P	0.000	0.000	0.000	0.000

Anesthesia recovery quality

Compared with the control group, the quality of anesthesia recovery in the observation group was significantly higher (all P<0.001), as shown in **Table 4**.

Hemodynamic conditions

Before anesthesia, there was no significant difference in blood oxygen saturation and HR between the two groups (P>0.05). After anesthesia, there was no significant difference in blood

oxygen saturation between the two groups (P>0.05), but the heart rate increased significantly (P<0.05). Compared with the control group, there were no significant changes in oxygen saturation after anesthesia in the observation group (P>0.05), and the heart rate was lower (P<0.001), as shown in **Table 5**.

Adverse reactions

Compared with the control group, the incidence of adverse reactions in the observation group

Clinical effect of remifentanil combined with sevoflurane inhalation anesthesia

Table 5. Hemodynamic indicators ($\bar{x} \pm sd$)

Group	Blood oxygen saturation (%)		HR (times/min)	
	Before anesthesia	After anesthesia	Before anesthesia	After anesthesia
Control group (n=58)	96.27±1.42	97.17±2.53	76.90±9.82	83.48±3.50*
Observation group (n=58)	96.55±1.32	97.88±2.77	76.56±8.57	80.74±2.10*
t	1.100	1.441	0.199	5.112
P	0.274	0.152	0.843	0.000

Note: Compared with before treatment, *P<0.05. HR: heart rate.

Table 6. Adverse reactions (cases, %)

Group	nausea	Vomiting	Respiratory depression	Incidence
Control group (n=58)	5	4	3	20.69%
Observation group (n=58)	12	10	6	48.28%
χ^2	3.377	2.924	0.482	10.747
P	0.066	0.087	0.488	0.001

was significantly higher (P<0.01), as shown in **Table 6**.

Discussion

ESVD is mainly applied to alleviate the bleeding of esophageal varices in the body, it can continuously reduce the risk of postoperative re-bleeding, and the effect is remarkable [10, 11]. It is still necessary to select appropriate and effective narcotic drugs for analgesia during and after operations [12, 13]. At present, remifentanil combined with sevoflurane inhalation anesthesia, as an effective and safe anesthesia scheme, and is widely used in ESVD [14, 15].

The results of this study showed that compared with the control group, the clinical anesthesia effect of the observation group was obviously improved. At the same time, 5 minutes after intubation, compared with the control group, the clinical stress response index of the observation group was significantly better, and the dosage of remifentanil in the observation group was significantly less than that in the control group. This suggested that sevoflurane combined with remifentanil for general anesthesia can effectively improve the stress response index of the body and it has ideal anesthetic effect. This may be because sevoflurane anesthesia can assist analgesia and reduce blood pressure, and remifentanil combined with sevoflurane anesthesia is more effective, which significantly reduces the dosage of remi-

fentanil, thus reducing its damage to other important organs and tissues and therefore reducing the stress response of the body [16-19].

The quality of anesthesia recovery in the observation group was significantly higher than that in the control group. After anesthesia,

compared with the control group, the heart rate of the observation group was significantly better. Compared with the control group, there was no obvious difference in coagulation function, suggesting that sevoflurane combined with remifentanil anesthesia had little influence on coagulation function and hemodynamic indexes, thus improving the quality of anesthesia recovery. The main reason is that the application of sevoflurane combined with remifentanil can effectively expand the bronchus and inhibit the autonomic reflex, at the same time reduce the blood-gas partition coefficient and the stimulation of the organism to ensure the stability of the anesthesia process and promote the rapid awakening of patients after operation [20, 21]. At the same time, combined inhalation of both groups can continuously improve the quality of clinical anesthesia, reduce the minimum effective concentration of sevoflurane in the alveoli, reduce the incidence of hypodose-dependent blood pressure reduction of remifentanil, and ensure the safety of patients [22, 23]. However, the results of this study showed that the incidence of adverse reactions in the observation group was significantly higher than that in the control group. This suggested that sevoflurane combined with remifentanil anesthesia significantly increased the incidence of nausea and vomiting, which should be closely observed in the clinical application.

There are still some shortcomings in this research, such as having only a few study sam-

ples and a lack of scientific basis. In the future, it is still necessary to collect a larger number of clinical cases as research subjects, so as to improve the rationality and scientific method [24, 25].

To sum up, compared with remifentanil combined with propofol anesthesia, remifentanil combined with sevoflurane inhalation anesthesia can improve the clinical anesthesia effect, improve the quality of anesthesia recovery, and reduce the impact of the stress response and overall hemodynamics, but the incidence of the adverse reactions is increased. Clinical application still needs to be strengthened.

Disclosure of conflict of interest

None.

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Clinical effect of remifentanil combined with sevoflurane inhalation anesthesia

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