Journal of Clinical and Nursing Research, 2025, Volume 9, Issue 6
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Effectiveness of Remazolam Combined with Alfentanil for Fiberoptic Bronchoscopy in Elderly Debilitated Patients

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Abstract: *Objective*: To analyze the application value of remazolam compound alfentanil anesthesia regimen in fiberoptic bronchoscopy in elderly debilitated patients. *Methods*: Seventy-two cases of elderly debilitated patients who underwent fiberoptic bronchoscopy in the Department of Respiratory Medicine of a hospital from August 2023 to July 2024 were selected, and were divided into the control group and the observation group using the mean score method, with 36 cases in each group. In both groups, 7–10 μg/kg alfentanil was injected intravenously after oxygen denitrification, and 1 min later propofol 1.5 mg/kg was given intravenously in the control group and remazolam 0.3 mg/kg was given intravenously in the observation group. Subsequently, mivacurium chloride 0.1mg/kg IV was given to both groups. Propofol 5mg/(kg-h) was given in the control group and remazolam 0.5mg/(kg-h) was given intravenously pumped in the observation group during anesthesia maintenance. Changes in vital signs such as HR, MAP and SpO_2 and the occurrence of adverse reactions were recorded in the two groups before anesthesia administration (T_1), at the moment of placing fiberoptic bronchoscope (T_2), at the moment of placing the tracheal tube (T_3), and at 1 min after placing the tracheal tube (T_4). *Results*: Compared with T_1, patients in the observation group had lower MAP at T_2, T_3, T_4 and lower SpO_2 at T_3, T_4 ($P < 0.05$); in the control group, HR slowed down at T_2, T_3, T_4 and MAP and SpO_2 decreased at T_2, T_3, T_4 ($P < 0.05$). SpO_2 at T_3 and T_4 was lower in both groups compared with that at T_2 ($P < 0.05$). SpO_2 at T_4 was lower in the control group compared with that at T_3 ($P < 0.05$). Compared with the control group, patients in the observation group suffered from increased HR and elevated MAP at T_2, T_3, and T_4, and increased SpO_2 at T_3 and T_4 ($P < 0.05$). The incidence of intraoperative hypotension and bradycardia in the observation group was lower than that in the control group, and the difference was statistically significant ($P < 0.05$). The incidence of intraoperative choking and coughing, postoperative hypoxemia, nausea and vomiting, and dizziness were found in the patients of both groups, drowsiness and other adverse reactions incidence rate comparison, the difference are not statistically significant ($P > 0.05$). *Conclusion*: Remazolam and alfentanil are used in fiberoptic bronchoscopy for elderly debilitated patients with remarkable effect, which can effectively improve the vital signs of patients, reduce the risk of intraoperative hypotension, bradycardia, and other adverse reactions, and have high anesthetic effectiveness and safety.

Keywords: Debility; Elderly; Alfentanil; Remazolam; Fiberoptic bronchoscopy

Online publication: July 2, 2025

1. Introduction

Fiberoptic bronchoscopy is an important means for the diagnosis and treatment of respiratory diseases. However, as a highly irritating and invasive operation, it can cause strong airway reactions and dramatic fluctuations in hemodynamics, often triggering adverse reactions such as choking, nausea, bradycardia, etc. in patients [1]. Due to the poor tolerance of elderly debilitated patients, the risk of associated complications is higher. Therefore, it is important to find a safe and effective sedation and analgesia regimen suitable for elderly debilitated patients. Although traditional propofol sedative drugs can provide some sedative effect, there are adverse effects such as respiratory depression and circulatory fluctuations, and the metabolism of elderly patients slows down, which makes them prone to drug accumulation and increases the risk [2]. In recent years, remazolam, as a new type of benzodiazepine, has the advantages of fast onset of action, rapid metabolism, easy to regulate the depth of sedation, and less impact on the respiratory circulation, and has been gradually applied to the field of clinical anesthesia and sedation [3]. As an ultra-short-acting opioid, alfentanil has a strong analgesic effect, rapid onset of action, and short duration of action, which can synergistically enhance the effect of sedation and analgesia, reduce the respective dosage, and decrease the incidence of adverse reactions when combined with remazolam [4]. Currently, there are few studies on the use of remazolam combined with alfentanil for fiberoptic bronchoscopy in elderly debilitated patients, and this study aims to investigate the effectiveness and safety of this regimen and provide a reference basis for the clinic.

2. Information and methods

2.1. General information

Seventy-two cases of elderly debilitated patients who underwent fiberoptic bronchoscopy in the Department of Respiratory Medicine of a hospital in August 2023–July 2024 are selected and divided into a control group and an observation group, 36 cases each, using the mean score method. In the control group, there are 20 males and 16 females, aged 65–83 (72.3 ± 5.8) years, BMI (22.1 ± 2.3) kg/m², ASA classification: 23 cases of grade II and 13 cases of grade III. The proportion of combined hypertension was 58.3%, the proportion of combined diabetes mellitus was 36.1%, the proportion of combined COPD was 41.7%, and the preoperative pulmonary function test showed FEV1/FVC ratio (0.62 ± 0.08) and oxygenation index PaO_2/FiO_2 (285 ± 35) mmHg. In the observation group, there were 22 males and 14 females, with an age of 67–85 (73.1 ± 6.2) years old, BMI (21.8 ± 2.5) kg/m², 21 cases of ASA class II, and 15 cases of class III. The proportion of combined hypertension was 61.1%, combined diabetes was 33.3%, and combined COPD was 44.4%. Preoperative pulmonary function tests showed FEV1/FVC ratio (0.60 ± 0.09) and oxygenation index PaO_2/FiO_2 (278 ± 40) mmHg. Comparison of the general data of the patients in the two groups did not show any statistically significant difference ($p > 0.05$). The study protocol is approved by the Medical Ethics Committee of our hospital, and all patients voluntarily signed a written informed consent.

The inclusion criteria are: (1) Age ≥ 65 years and meeting Fried's criteria for the debilitating phenotype (including ≥ 3 features such as weight loss, decreased grip strength, and slowed gait speed); (2) American Society of Anesthesiologists (ASA) classification II-III [5]; and (3) Diagnostic or therapeutic fiberoptic bronchoscopy was required. Meanwhile, the exclusion criteria include: (1) those with combined severe hepatic and renal insufficiency (Child-Pugh class C or eGFR<30ml/min); (2) those with a history of drug allergy; (3) those with recent use of sedative and analgesic medications; (4) those with cognitive dysfunction who were unable to cooperate with the assessment.

2.2. Methodology

All patients are fasted for 8 h and 4 h before surgery, and heart rate (HR), mean arterial pressure (MAP), and blood oxygen saturation (SpO_2) are monitored after admission to the room, peripheral venous access is established, and crystalloid is infused with 10 mL/kg $^{-1}$/h^{-1}. A reinforced tracheal tube (inner diameter: 6.5–7.0 mm for men and 6.0–6.5 mm for women) and fiberoptic bronchoscope are externally coated with sterile liquid paraffin for backup. No preoperative medication is administered before induction of anesthesia, and after oxygen denitrification treatment, all patients were slowly injected intravenously with 7–10 μg/kg alfentanil (Yichang Renfu Pharmaceutical Co., Ltd., batch no. 33S070111, specification 2 mL: 1 mg) within 30 s. After 1 min, propofol 1.5 mg/kg is given intravenously in the control group, and remazolam (Yichang Renfu Pharmaceutical Co., Ltd.) is given in the observation group. 0.3 mg/kg intravenously.

Subsequently, 0.1mg/kg mivacurium chloride (GSK, Germany) is given intravenously in both groups. When the BIS value reached 40–60, and the respiratory line is connected for mechanical ventilation to maintain $PETCO_2$ at 35–45 mmHg. During the anesthesia maintenance period, the observation group is continuously pumped with remazolam (0.5 mg/kg/h), and the control group is pumped with propofol (5 mg/kg/h) to maintain the BIS value of 40–60. At the end of the examination, the remazolam or propofol drug pumping is stopped and the patient is transferred to the anesthesia recovery room (PACU). When the patient was awake, $PETCO_2 < 45$ mmHg, and $SpO_2 > 90\%$, he or she is pulled for mask oxygenation (6–8L/min) and transferred to the ward accompanied by family members. In case of bradycardia (heart rate < 50 beats/min), intravenous atropine (0.3–0.5mg) is administered. In case of hypotension (systolic blood pressure decreased more than 30% of the basal value or < 90mmHg), norepinephrine (8–16μg) is administered.

2.3. Observation indicators

Observation Records Patients Record the changes of vital signs such as HR, MAP and SpO_2in the two groups before anesthesia administration (T_1), immediately after placement of fiberoptic bronchoscope (T_2), immediately after placement of tracheal tube (T_3) and 1min after placement of tracheal tube (T_4). The changes of hypotension, bradycardia, choking, postoperative hypoxemia, nausea and vomiting, and dizziness during the induction period of anesthesia, dizziness, drowsiness, and other adverse reactions during the induction period of anesthesia are recorded.

2.4. Statistical methods

SPSS23.0 software is applied for statistical analysis, and the measurement information is expressed as mean ± standard deviation ($\bar{x} \pm s$), and t-test is used for comparison, and the count information is expressed as rate (%), and x^2 test is used for comparison, and $P < 0.05$ is taken as statistically significant difference.

3. Results

3.1. Changes in vital signs in both groups

Compared with T_1, patients in the observation group had lower MAP at T_2, T_3, T_4, and lower SpO_2 at T_3, T_4 ($P < 0.05$); and patients in the control group had slower HR at T_2, T_3, T_4, and lower MAP and SpO_2 at T_2, T_3, T_4 ($P < 0.05$). $SpO_{(2)}$at $T_3$and $T_4$was lower in both groups compared with that at T_2 ($P < 0.05$). SpO_2 at $T_4$was lower in the control group compared with that at T_3 ($P < 0.05$). Compared with the control group, patients in the observation group

suffered from increased HR and elevated MAP at T_2, T_3, and T_4, and elevated SpO_2 at $T_3$and T_4 ($P < 0.05$). **Table 1** shows the results in detail.

Table 1. Changes in vital signs at different anesthesia time nodes in both groups ($\bar{x} \pm s$)

Groups	Timing	HR (times/minute)	MAP (mmHg)	SpO_2 (%)
Control group (n=36)	T_1	81.42 ± 12.47	79.45 ± 8.39	98.66 ± 0.61
	T_2	73.16 ± 11.55 [a]	70.34 ± 6.21 [a]	97.70 ± 0.63[a]
	T_3	72.36 ± 11.85 [a]	69.84 ± 7.12[a]	96.14 ± 1.23 [ab]
	T_4	71.69 ± 12.34 [a]	68.43 ± 5.44[a]	93.25 ± 2.91 [abc]
Observation group (n=36)	T_1	81.49 ± 12.52	78.57 ± 8.58	98.57 ± 0.72
	T_2	79.56 ± 11.78 [d]	74.53 ± 6.41 [ad]	98.20 ± 1.09
	T_3	78.85 ± 12.23 [d]	74.091 ± 7.13 [ad]	97.23 ± 0.85 [abd]
	T_4	78.19 ± 12.06 [d]	72.46 ± 6.53 [ad]	97.01 ± 0.91 [abd]

Note: Compared with T_1, [a]$P < 0.05$; compared with T_2, [b]$P < 0.05$; compared with T_3, [c]$P < 0.05$; compared with control group, [d]$P < 0.05$.

3.2. Comparison of the occurrence of adverse reactions between the two groups of patients

The incidence of intraoperative hypotension and bradycardia in patients of the observation group was lower than that in the control group, and the difference was statistically significant ($P < 0.05$); the two Comparison of the incidence of adverse reactions such as intraoperative choking, postoperative hypoxemia, nausea and vomiting, dizziness and drowsiness in patients of the group, the differences were not statistically significant ($P > 0.05$), see **Table 2**.

Table 2. Comparison of the incidence of adverse reactions between the two groups of patients [n (%)]

Groups	Intraoperative hypotension	Bradycardia	Intraoperative choking	Postoperative hypoxemia
Control group (n=36)	14 (38.89)	10 (27.78)	6 (16.67)	6 (16.67)
Observation group (n=36)	4 (11.11)	3 (8.33)	3 (8.33)	4 (11.11)
x^2	7.407	4.599	0.508	0.465
p	0.007	0.032	0.476	0.496
Groups	Postoperative nausea and vomiting	Postoperative dizziness	Drowsiness	
Control group (n=36)	5 (13.89)	7 (19.44)	3 (8.33)	
Observation group (n=36)	3 (8.33)	6 (16.67)	2 (5.56)	
x^2	0.141	0.094	0.000	
p	0.708	0.760	1.000	

4. Discussion

Elderly debilitated patients' tolerance to invasive operations is significantly reduced due to multiple organ function

decline, reduced metabolic capacity and complex coexisting diseases [5]. Fiberoptic bronchoscopy, as an important means of diagnosis and treatment of respiratory diseases, may induce severe choking, hemodynamic fluctuations, and hypoxemia, further increasing the cardiopulmonary burden due to its irritation and uncertainty of operation time [6]. Existing anesthesia protocols are mostly designed based on the general patient population, whereas elderly debilitated patients have significant differences in drug sensitivity and pharmacokinetics, and routine administration of drugs may increase the risk of hypotension and bradycardia [7]. Therefore, the management of anesthesia in this population requires a balance between deep sedation and safety to avoid adverse events caused by drug accumulation or respiratory depression. Alfentanil is ideal for suppressing choking during airway maneuvers because its half-life is similar to the length of the examination and its respiratory depression is less severe than that of other opioids [8].

In contrast, although propofol is widely used for sedation, its respiratory and circulatory depressant effects are more pronounced and may increase cardiopulmonary burden, especially in elderly or debilitated patients [9]. In recent years, remazolam has been gaining attention for its favorable safety profile [10]. Studies have shown that in upper gastrointestinal endoscopy, the respiratory and circulatory depressant effects of remazolam are significantly lower than those of propofol, and the incidence of injection pain is much lower, providing a more comfortable anesthetic experience for the patient [11]. However, the potential synergistic effects of remazolam in combination with opioids need to be guarded against, which may lead to myocardial depression and a decrease in arterial pressure, with some patients requiring antihypertensive drugs to maintain hemodynamic stability.

Further studies have also confirmed that the combination of remazolam and opioids significantly decreases mean arterial pressure (MAP) and heart rate (HR), suggesting the need for increased monitoring and timely intervention in the clinic [12]. The results of this study showed that MAP decreased at T_2, T_3, T_4 and SpO_2 decreased at T_3, T_4 in patients of the observation group compared with those at T_1 ($P < 0.05$); HR slowed down at T_2, T_3, T_4 in the control group, and MAP and SpO_2 decreased at T_2, T_3, T_4 ($P < 0.05$). SpO_2 at T_3 and T_4 was lower in both groups compared with that at T_2 ($P < 0.05$). SpO_2 at T_4 was lower in the control group compared with that at T_3 ($P < 0.05$). Compared with the control group, patients in the observation group suffered from increased HR and elevated MAP at T_2, T_3, and T_4, and elevated SpO_2 at T_3 and T_4 ($P < 0.05$). The differences in the incidence of adverse reactions, such as intraoperative choking and coughing, postoperative hypoxemia, nausea and vomiting, dizziness, and somnolence, were not statistically significant when compared with the incidence of adverse reactions in the observation group ($P > 0.05$). The incidence of intraoperative hypotension and bradycardia in patients of the observation group was lower than that of the control group, and the difference was statistically significant ($P < 0.05$).

5. Conclusion

In conclusion, remazolam combined with alfentanil has less hemodynamic effects on elderly debilitated patients undergoing fiberoptic bronchoscopy, with mild respiratory depression and a lower incidence of adverse effects, making it a safer and more effective anesthetic regimen, and it is recommended to be promoted in geriatric surgical care.

Disclosure statement

The authors declare no conflict of interest.

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