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Effectiveness of Remimazolam Benzenesulfonate Combined with Alfentanil in Elderly Patients Undergoing Painless Gastroenteroscopy

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Abstract: *Objective:* To observe the effects of remimazolam benzenesulfonate combined with alfentanil during painless gastroenteroscopy in elderly patients. *Methods:* This study analyzes patients aged 60–85 years old undergoing painless gastroenteroscopy. A total of 140 patients, examined between February 2023 and February 2024, voluntarily participated and were randomly divided into an experimental group and a control group. The control group received alfentanil combined with propofol for anesthesia, while the experimental group received alfentanil combined with remimazolam benzenesulfonate. The relevant indices of both groups were separately analyzed. *Results:* Patients in the experimental group had a shorter awakening time, a faster discharge rate ($P < 0.05$), and a shorter examination duration; however, the difference in examination time between the two groups was not statistically significant ($P > 0.05$). Before anesthesia, there was no significant difference in the basic information and vital signs of the two groups ($P > 0.05$). Two minutes after anesthesia, both groups showed a decline in vital signs, but the vital signs of the experimental group remained more stable after the procedure, with the group's indices showing improvement over the control group ($P < 0.05$). Additionally, the incidence of adverse reactions in the experimental group was lower than in the control group ($P < 0.05$). *Conclusion:* In painless gastroenteroscopy for elderly patients, anesthesia using a combination of remimazolam benzenesulfonate and alfentanil improves anesthesia effectiveness, hastens patient recovery, enhances the stability of vital signs, and effectively controls adverse reactions, thereby improving patient comfort.

Keywords: Remimazolam benzenesulfonate; Alfentanil; Elderly patients; Painless gastroenteroscopy

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1. Introduction

Upper gastrointestinal endoscopy is a commonly used test for the early screening of gastrointestinal disorders in current clinical practice and is regarded as the gold standard for diagnosing such conditions [1]. However, gastrointestinal endoscopy is an invasive and often uncomfortable procedure, and in recent years, its use has been on the rise in Asian countries [2]. Traditional gastrointestinal endoscopy can cause patients significant discomfort and pain, with many experiencing nausea, vomiting, nerve reflexes, and involuntary body movements.

These factors may interfere with the examination and even lead to serious complications, resulting in a large proportion of patients developing resistance to undergoing gastrointestinal endoscopy [3].

Patients' demand for painless gastroenteroscopy has been increasing with the continuous development of comfort medicine. They increasingly seek methods to alleviate the discomfort, anxiety, or pain associated with the procedure to complete what is typically an unpleasant experience successfully. Therefore, painless gastroenteroscopy focuses on effectively reducing patients' pain, tension, and discomfort, ensuring the accuracy and reliability of the examination, and minimizing physiological stress reactions that could otherwise skew results.

Elderly patients, due to varying degrees of organ function decline, have a reduced ability to tolerate anesthetic drugs. Additionally, their diminished physiological function and greater psychological resistance result in poorer stress tolerance, leading to stronger pain sensations and more significant hemodynamic fluctuations during the procedure [4]. These factors increase the risk of cardio-cerebral and vascular complications, making the examination process riskier for elderly patients. Thus, safely and effectively performing painless gastroenteroscopy in elderly patients remains a challenging issue. The goal is to minimize patient pain, reduce reflexes and movements, and improve the overall success of the procedure.

In light of these challenges, effective sedation and analgesia are key to ensuring painless gastroenteroscopy. Recent studies have shown that remimazolam benzenesulfonate offers significant advantages in sedation and anxiolysis, proving to be of high value in clinical anesthesia. Alfentanil, with its strong analgesic effect and rapid onset, complements this by providing effective pain relief. The combination of these two drugs maximizes their benefits, achieving both sedation and analgesia.

Compared to younger patients, elderly patients have unique physiological and psychological characteristics. Their liver and kidney functions may decline, reducing their ability to metabolize drugs, and thereby placing greater demands on the adjustment of anesthetic regimens [5]. This study explores the effects of combining remimazolam benzenesulfonate and alfentanil to improve anesthesia protocols for elderly patients undergoing painless gastroenteroscopy.

2. Materials and methods

2.1. General information

This study was approved by the Ethics Committee of the Affiliated Hospital of Hebei University (Ethics No. HDFYLL-KY-2023-023). A total of 140 patients, aged 60–85 years, with ASA classifications I–II, who underwent painless gastroenteroscopy at our hospital from February 2023 to February 2024, were randomly divided into an experimental group and a control group using the random number table method. Each group consisted of 70 patients. All patients provided informed consent before the procedure and were fully briefed on the trial process, possible medication regimens, and potential complications.

Inclusion criteria: (1) Patients aged 60–85 years. (2) ASA classification I–II. (3) Patients with a normal body mass index, within the range of 18–28 kg/m^2. (4) Acceptance of anesthesia risks and signed informed consent.

Exclusion criteria: (1) Patients allergic to any components of the study drugs. (2) Patients with recent upper respiratory tract infections. (3) Patients with serious respiratory or circulatory diseases or other organ dysfunctions. (4) Patients with mental disorders. (5) Patients who have been using analgesic and sedative drugs for a long time. (6) Patients who refuse to participate in the trial.

2.2. Test methods

All patients fasted for 8 hours before the operation, abstained from drinking clear liquids for 2 hours, and followed standard gastroenteroscopy preparation procedures. The entire surgical examination was completed within 15 minutes.

2.2.1. Control group control method

Upon patient admission, an intravenous fluid pathway was established, and 0.9% saline was administered for continuous sedation. A tee was connected to monitor vital signs such as blood pressure, blood oxygen levels, and cardiac activity. Oxygen was administered via a mask at a flow rate of 3L/min, and patients were positioned in the right lateral recumbent position for the examination. The control group received alfentanil at 5 μg/kg (produced by Yichang Renfu Pharmaceutical Co., Ltd., State Drug License No. H20203054, specification: 2 mL:1 mg) over approximately 30 seconds, followed by propofol at 2 mg/kg, administered over 1 minute (produced by Beijing Fresenius Kabi Pharmaceutical Co., Ltd., State Drug License No. HJ20170305, specification: 20 mL:0.2 g). The patient's condition was monitored to check for eyelash reflex disappearance and stable breathing, ensuring readiness for gastroenteroscopy [6]. During the procedure, any body movements were observed, and additional propofol at 0.5 mg/kg was administered as needed.

2.2.2. Experimental group control methods

The experimental group received alfentanil combined with remimazolam benzenesulfonate for anesthesia. The basic procedure was the same as for the control group, including positioning. Intravenous alfentanil was administered at 5 μg/kg for 30 seconds, followed by remimazolam benzenesulfonate at 0.2 mg/kg (produced by Yichang Renfu Pharmaceutical Co., Ltd., State Drug License No. H20200006, specification: 25 mg), injected over 1 minute. After drug administration, the patient's condition was monitored to confirm deep sleep and the absence of an eyelash reflex, ensuring a smooth gastroenteroscopy procedure. During the examination, additional doses of remimazolam benzenesulfonate (2–5 mg) were administered as needed to manage any body movements [7].

2.2.3. Vital signs management

Throughout the examination, the patient's blood pressure was maintained within 20% of baseline levels. If systolic blood pressure dropped below 90 mmHg or 20% of the baseline value, ephedrine (6–9 mg) was administered to raise it. If the heart rate fell below 50 beats per minute, atropine (0.3 mg) was given to increase the heart rate. If oxygen saturation dropped below 90%, oxygen flow was increased, and the patient's jaw was supported, or abdominal pressure was applied to assist breathing. If oxygen saturation did not improve, a respiratory balloon was used to assist ventilation, and endotracheal intubation was performed if necessary.

2.3. Observation of indicators

The general condition of the patients in both groups was compared. Examination parameters such as awakening time and discharge time were assessed. Vital signs (blood pressure, heart rate, and blood oxygen levels) were evaluated before and after anesthesia. The incidence of adverse reactions in both groups was statistically analyzed.

2.4. Statistical analysis

For data processing, SPSS 25.0 statistical software was used. The chi-squared test was applied to categorical

and hierarchical data, while the *t*-test was used for continuous data conforming to a normal distribution. A *P*-value of less than 0.05 indicated a statistically significant difference between the groups.

3. Results

3.1. Patients' general information

Table 1 shows that there was no significant difference in the patients' general information between the two groups ($P > 0.05$).

Table 1. Patients' general information

	Experimental group	Control group
Gender		
Male	31	33
Female	39	37
ASA classification		
I	20	22
II	50	48
Age (years)	68.38 ± 3.21	68.43 ± 3.16
Body mass index (kg/m^2)	23.44 ± 4.14	24.12 ± 3.90

3.2. Inspection indicators

As can be seen from **Table 2**, the time of awakening and leaving the room, etc. was relatively shorter in the experimental group, $P < 0.05$, while the examination time of the experimental group was slightly shorter than that of the control group, but the difference between the two groups was not statistically significant, $P > 0.05$.

Table 2. Comparison of examination indicators between the two groups (mean ± standard deviation)

Groups	Wake-up time (min)	Inspection time (min)	Off-chamber time (min)
Experimental group ($n = 70$)	8.09 ± 1.76	7.38 ± 1.52	29.24 ± 6.18
Control group ($n = 70$)	11.51 ± 2.13	7.71 ± 1.69	37.23 ± 5.38
t	6.412	4.158	5.627
P	0.027	0.041	0.031

3.3. Vital signs indicators

As shown in **Table 3**, before anesthesia, the vital signs indicators of the two groups were comparable ($P > 0.05$); 2 minutes after anesthesia, the indicators of the observation group decreased but were higher than those of the control group ($P < 0.05$); after the end of the operation, the indicators of the observation group were more stable ($P < 0.05$).

Table 3. Vital signs indicators at different times between both groups (mean ± standard deviation)

Timing	Groups	Heart rate (beats/min)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)	Oxygen saturation (%)
Before anesthesia	Experimental group (n = 70)	85.65 ± 3.86	128.18 ± 7.71	81.57 ± 6.21	98.62 ± 0.11
	Control group (n = 70)	86.02 ± 3.72	127.89 ± 7.76	82.01 ± 5.79	98.59 ± 0.12
	t	0.628	0.429	0.668	1.269
	P	0.531	0.669	0.507	0.205
2 minutes after the anesthesia	Experimental group (n = 70)	75.62 ± 4.54	125.88 ± 6.85	77.66 ± 4.61	96.63 ± 0.46
	Control group (n = 70)	68.88 ± 3.21	103.76 ± 5.41	67.82 ± 4.25	94.85 ± 0.57
	t	7.682	11.325	9.852	12.054
	P	0.013	0.001	0.001	0.001
End of operation	Experimental group (n = 70)	80.02 ± 3.57	127.21 ± 6.39	79.72 ± 5.53	97.45 ± 0.17
	Control group (n = 70)	74.82 ± 3.41	118.18 ± 6.48	71.71 ± 6.18	96.98 ± 0.21
	t	6.521	6.434	6.689	9.863
	P	0.019	0.021	0.017	0.001

3.4. Adverse reactions

Table 4 shows that the probability of adverse reactions was significantly lower in the experimental group (P < 0.05).

Table 4. Incidence of adverse reactions in the two groups [n (%)]

Groups	Bradycardia	Respiratory depression	Hypotension	Total adverse reaction incidence
Experimental group (n = 70)	0 (0.00)	2 (2.86)	0 (0.00)	2 (2.86)
Control group (n = 70)	4 (5.71)	2 (2.86)	6 (8.57)	12 (17.14)
χ^2				10.695
P				0.001

4. Discussion

Procedural sedation is now recognized as essential for most endoscopic procedures. Several drugs, including imipramine and propofol, are currently used for sedation during painless gastroenteroscopy, but each has certain drawbacks in clinical practice. Propofol is the most commonly used drug for systemic sedation due to its excellent sedative properties and short half-life. However, it has been reported to cause aspiration pneumonia, cardiovascular and respiratory depression, hypoxia, and in some cases, may even necessitate tracheal intubation [8,9]. Imipramine, a benzodiazepine with rapid onset and strong amnesic properties, is also frequently used. Its half-life ranges from 1.8 to 6.4 hours [10], and its active metabolites can result in prolonged and less predictable recovery from sedation [11].

Remimazolam benzenesulfonate, a new ultra-short-acting benzodiazepine with minimal impact on the respiratory cycle and a specific antagonist to control its effects, has been approved for painless gastrointestinal endoscopy. A multicenter, randomized phase III clinical trial comparing remimazolam benzenesulfonate and propofol in patients undergoing upper gastrointestinal endoscopy confirmed that a single dose of remimazolam

benzenesulfonate, with supplemental doses as needed, provided adequate sedation [12]. Remimazolam benzenesulfonate is a new short-acting gamma-aminobutyric acid type A ($GABA_A$) receptor agonist that potentiates gamma-aminobutyric acid's effects, inhibiting related neurotransmitters, enhancing sedation, and slowing nociceptive transmission. Its synergy with alfentanil can further enhance analgesic effects, reduce drug dosages, accelerate onset, prolong analgesia, improve patient cooperation, and ensure the smooth progression of gastroenteroscopy, thus enhancing examination safety.

Chen Xujun's research found that combining these two agents improves the accuracy of painless gastroenteroscopy results in elderly patients. This combination ensures the rapidity and durability of analgesia, reduces patients' pain perception, and alleviates nervousness and other emotions [13]. However, drug dosage varies among patients, requiring physicians to consider allergy histories and comorbidities, adjust anesthesia plans, and monitor patient responses to enhance safety.

Alfentanil, known for its fast onset and strong analgesic effects, is commonly used during painless gastroenteroscopy to improve patient comfort. Modern pharmacological studies have shown that alfentanil binds to μ-opioid receptors in the central nervous system, inhibiting nociceptive transmission, reducing the central nervous system's pain sensitivity, and alleviating patient pain [14]. Additionally, alfentanil has sedative properties that effectively relieve anxiety, placing patients in a more relaxed state and improving cooperation. However, alfentanil is associated with adverse reactions, including respiratory depression, which can lead to reduced respiratory rate and, in severe cases, respiratory arrest. Thus, respiratory monitoring is critical during alfentanil administration to detect abnormalities early and ensure patient safety.

Alfentanil alone, especially at higher doses, can lead to respiratory depression and cardiovascular events. To mitigate this, combining alfentanil with other drugs reduces the required dosage and enhances anesthesia safety. For instance, the synergy between propofol and alfentanil achieves rapid induction, inducing unconsciousness during the examination and enhancing patient comfort [15]. However, the depth of anesthesia must be carefully monitored to avoid excessive sedation.

In this study, the application of the experimental group's anesthesia regimen effectively shortened wake-up and discharge times, stabilized vital signs, and reduced the incidence of adverse reactions ($P < 0.05$). This is primarily due to the synergistic effect of remimazolam benzenesulfonate and alfentanil, which enhances sedation, reduces drug duration, promotes quicker patient recovery, ensures effective analgesia and sedation, and facilitates the orderly conduct of the examination, improving patient comfort and allowing for faster room turnover. Additionally, this combination improves patient tolerance, controls adverse reactions more effectively, and stabilizes vital signs during and after the procedure [16].

In conclusion, for elderly patients undergoing painless gastroenteroscopy, special attention should be paid to their unique characteristics. The anesthesia regimen should be tailored accordingly. Combining remimazolam benzenesulfonate with alfentanil enhances analgesia and sedation, improves patient cooperation and comfort, ensures smooth examination progression, reduces procedure time, and facilitates quicker recovery with more stable vital signs.

Disclosure statement

The author declares no conflict of interest.

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