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Original Research Article

Effect of alfentanil plus propofol on painless gastrointestinal endoscopy in elderly patients

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Abstract

Purpose: *To determine the effect of alfentanil in combination with propofol in painless gastrointestinal endoscopy (PGE) in elderly patients.*
Methods: *This was a retrospective analysis of data from 200 elderly patients who underwent PGE at The Quzhou Affiliated Hospital of Wenzhou Medical University, Quzhou, China from June 2021 to December 2022. The patients were divided into study (n = 108) and control groups (n = 92). The study group received anesthesia with alfentanil (10 μg/kg) and propofol (1 - 2 mg/kg), while the control group was anesthetized with sufentanil (0.1 μg/kg) combined with propofol (1 - 2 mg/kg).*
Results: *Study group consumed significantly less propofol compared to control group ($p < 0.05$). There were no significant differences in baseline values of mean arterial pressure (MAP), blood oxygen saturation (BOS), and heart rate (HR) between the two groups ($p > 0.05$). However, during the examination, the control group showed significantly lower mean values of MAP, BOS, and HR compared to study group ($p < 0.05$). Additionally, study group experienced significantly shorter recovery time from anesthesia, time to recovery of consciousness, and time to orientation recovery compared to control group ($p < 0.05$). The incidence of patients rated with excellent or good anesthetic effects was significantly higher in study group compared to control group ($p < 0.05$).*
Conclusion: *Alfentanil in combination with propofol offers stable vital signs and superior anesthetic effect in elderly patients undergoing PGE, with fewer adverse reactions compared to sufentanil and propofol combination. Applicability of these findings requires further validation with more data.*

Keywords: *Alfentanil, Propofol, Elderly patients, Painless gastrointestinal endoscopy*

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INTRODUCTION

Gastrointestinal endoscopy is a commonly performed invasive examination, often conducted under topical anesthesia of the throat or anal area. This method frequently results in patient discomfort, including pain, nausea, and vomiting during the procedure [1]. As medical technology advances, painless gastrointestinal endoscopy (PGE), a non-invasive and accurate technique, is becoming increasingly prevalent in clinical settings [2]. PGE offers enhanced safety and comfort compared to traditional methods. However, elderly patients often have decreased tolerance to anesthetic drugs due to a decline in physiological functions, particularly within the

central nervous system, predisposing patients to complications such as arrhythmias and respiratory depression during anesthesia [3]. Therefore, PGE is frequently performed in elderly patients using carefully chosen anesthetic regimens [4].

Propofol, known for its rapid onset, short duration of action, and relatively few adverse reactions, is commonly used as a sedative in gastrointestinal endoscopy [5]. However, excessive doses may lead to adverse effects such as dyspnea, respiratory depression, and hypotension [6]. To mitigate these risks, propofol is often combined with other analgesics to reduce the required dosage and, consequently, the likelihood of adverse reactions [7].

Alfentanil, a short-acting opioid analgesic, is favourable for its rapid onset, short duration, and mild respiratory inhibition [8]. Currently, studies on the combined use of alfentanil and propofol in PGE for elderly patients are limited. Therefore, this study aimed to investigate the anesthetic efficacy and safety of a combination regimen of alfentanil and propofol for PGE in elderly patients, providing a reliable reference for future application.

METHODS

Subjects

This study was a retrospective analysis of data from 280 elderly patients who underwent painless PGE at The Quzhou Affiliated Hospital of Wenzhou Medical University, Quzhou People's Hospital, Quzhou, China from June 2021 to December 2022. From the initial pool of 280 patients screened, 200 were found eligible for the study. These patients were then divided into study (108 patients administered alfentanil in combination with propofol for anesthesia), and control group (92 patients who received a combination of sufentanil and propofol). The study was performed with permission from the Medical Ethics Committee of The Quzhou Affiliated Hospital of Wenzhou Medical University (approval no. K001399YM), and met the criteria in the Declaration of Helsinki [9].

Inclusion criteria

Patients between 65 - 75 years old, had mini-mental state examination scores of 26 or higher before enrolment [10], patients classified as I - III according to the American Society of Anaesthesiologists (ASA) [11], not allergic to drugs adopted in this study, had not taken sedative and analgesic drugs recently, and with complete records.

Exclusion criteria

Patients with coronary heart disease, severe liver or kidney function diseases, asthma, glaucoma, or severe coagulation dysfunction, history of allergies to anesthetics and their excipients, severe bradycardia, sleep apnoea syndrome, history of epilepsy or convulsions, hypoproteinaemia (due to malnutrition or low weight) or anemia (hemoglobin < 70 g/L), presence of severe hyperthyroidism or other related complications.

Treatment

Prior to the procedure, each patient in both groups was required to fast for at least 6 h and abstain from water intake for a minimum of 2 hours. For patients with gastric retention or functional delayed gastric emptying, fasting and water deprivation periods were appropriately extended. Key patient data including gender, age, height, weight, ASA classification, and relevant medical history were recorded. A nasal oxygen tube was placed before anesthesia administration with an oxygen flow rate set at 5 L/min.

Control group was anesthetized using sufentanil (Yichang Humanwell Pharmaceutical Co. Ltd, SFDA approval no. H20054171) at 0.1 μg/kg, injected slowly and intravenously in combination with propofol (Guangdong Jiabo Pharmaceutical Co., Ltd., SFDA approval no. H20084457) administered intravenously after 2 min at 1-2 mg/kg until consciousness and eyelash reflex were lost. The study group received anesthesia with alfentanil (Yichang Humanwell Pharmaceutical Co. Ltd, SFDA approval no. 20203054) injected slowly and intravenously at 10 μg/kg in combination with propofol administered intravenously after 2 min at 1 - 2 mg/kg until the consciousness and eyelash reflex disappeared.

Careful attention was paid to the speed of anesthetic injection, which was gradually decreased. Once the patient no longer responds to verbal stimuli and loses both the instructional reflex and eyelash reflex, the gastrointestinal endoscopy procedure is initiated immediately. Propofol dosage was adjusted according to patient's response during examination. If the patient exhibits body movements or coughing, an additional dose of 0.5 mg/kg propofol was administered. If peripheral oxygen saturation falls below 90 %, or if tongue retropulsion occurs,

mask-assisted ventilation or a mandibular lift is provided. If mean arterial pressure (MAP) drops below 50 mmHg, 5 - 10 mg ephedrine (Sinopharm Group Xinjiang Pharmaceutical Co. Ltd, SFDA approval no. H65020272) was administered. For HR below 45 bpm, 0.5 mg atropine was given. After the procedure, patients were transferred to the post-anesthesia care unit for close monitoring and recovery.

Evaluation of parameters/indices

Physiological parameters

Basic physiological parameters such as blood pressure, heart rate (HR), and blood oxygen saturation (BOS) were documented at baseline and during examination. Blood pressure was monitored using an automated non-invasive blood pressure monitor, HR was continuously measured by electrocardiography, and BOS was assessed using a pulse oximeter attached to the patient's finger in both study and control groups and compared.

Recovery time

Recovery time from anesthesia, time to regain consciousness and time for orientation recovery were evaluated and compared between study and control groups.

Anesthetic effect

The anesthetic effect was assessed based on the examiner's satisfaction with anesthesia depth, ease of endoscope placement, and resistance encountered during the procedure in both study and control groups. Anesthetic effect was classified as excellent (high satisfaction with anesthesia depth, smooth endoscope placement, and no resistance), good (adequate anesthesia depth, generally smooth endoscope placement, and mild resistance), and poor (criteria for excellent or good not met [12]. Total propofol consumption was recorded and also compared in both study and control groups.

Incidence of adverse effects

Incidence of adverse reactions such as cough, intestinal colic, nausea, and vomiting during anesthesia were also compared between the two groups.

Statistical analysis

The data were processed using Statistical Packages for Social Sciences (SPSS, IBM Corp, Armonk, NY, USA) software version 20.0, and graphical visualizations were created with GraphPad Prism (GraphPad Software, San Diego, USA) version 8. Measurement variables were presented as mean ± standard deviation (SD). Comparisons between and within groups were conducted using the independent-sample t-test and paired-sample t-test, respectively. Categorical variables were summarized as frequencies (percentages) and analyzed using the chi-square test (χ^2). $P < 0.05$ was considered statistically significant.

RESULTS

Baseline data

There was no significant difference in baseline data (age, gender, ASA physical status classification, body mass index, family medical history, type of gastrointestinal endoscopy performed, or place of residence) between control and study groups ($p > 0.05$; Table 1).

Total propofol consumption

Total propofol consumption was significantly lower in study group compared to control group ($p < 0.001$; Figure 1).

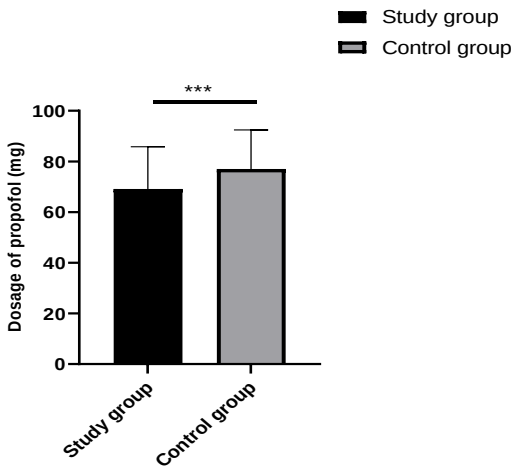

Figure 1: Comparison of Total consumption of propofol in the two groups. ***$P < 0.001$ vs control group

Physiological parameters

There was no significant difference in baseline values of MAP (Figure 2 A), BOS (Figure 2 B), and HR (Figure 2 C) between study and control groups ($p > 0.05$). However, mean values of these parameters measured during examination were significantly lower in control group compared to study group ($p < 0.05$; Figure 2).

Table 1: Comparison of baseline data (N, %)

Factor		Study group (n = 108)	Control Group (n = 92)	χ2	*P*-value
Age	≥70 years old	40(37.0)	35(38.0)	0.022	0.884
	<70 years old	68(63.0)	57(62.0)		
Gender	Male	49(45.4)	51(55.4)	2.013	0.156
	Female	59(54.6)	41(44.6)		
BMI	≥23kg/m^2	45(41.7)	49(53.3)	2.681	0.102
	<23kg/m^2	63(58.3)	43(46.7)		
ASA classification	Class I	32(29.6)	22(23,9)	0.844	0.656
	Class II	48(44.4)	45(48.9)		
	Class III	28(25.9)	25(27.2)		
Family medical history	Yes	31(28.7)	25(27.2)	0.058	0.810
	No	77(71.3)	67(72.8)		
Type of gastrointestinal endoscopy	Gastroscopy	52(48.1)	40(43.5)	0.4362	0.509
	Enteroscopy	56(51.9)	52(56.5)		
Place of residence	Urban areas	35(32.4)	28(30.4)	0.090	0.765
	Rural areas	73(67.6)	64(69.6)		

BMI: Body mass index; ASA: American Society of Anaesthesiologists

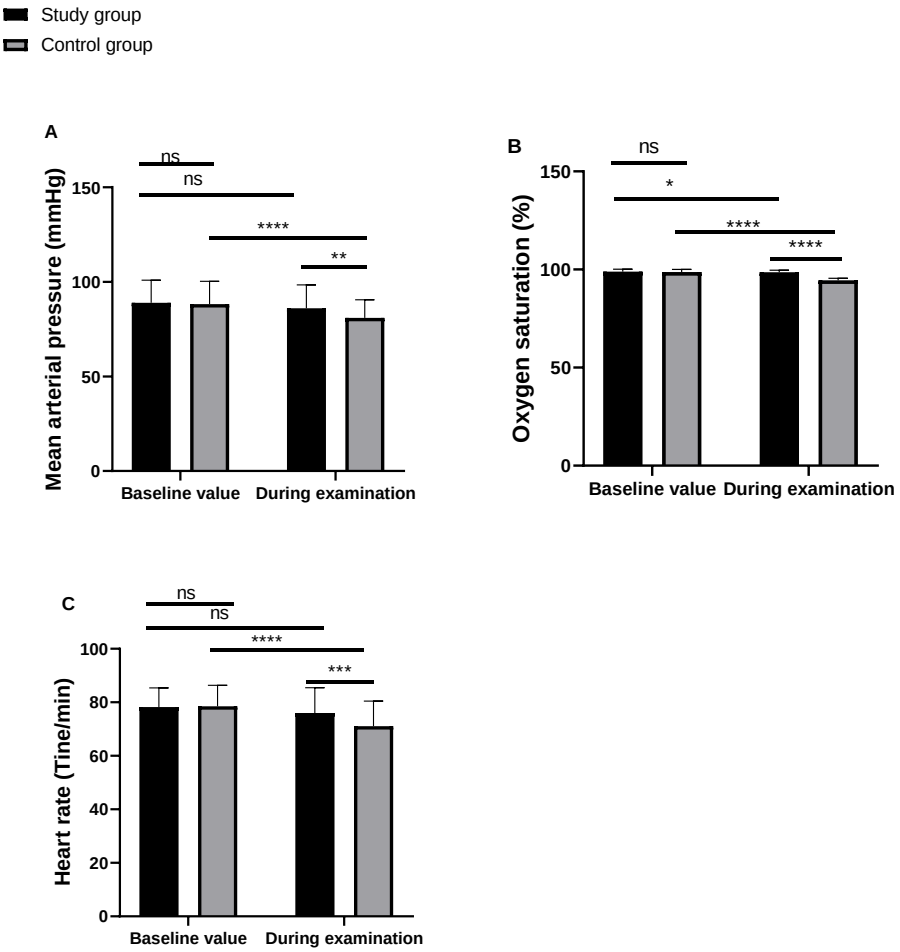

Figure 2: Physiological parameters between the two groups. A: Mean arterial pressure (MAP) at baseline and during examination. B: Blood oxygen saturation at baseline and during examination. C: Heart rate (HR) at baseline and during examination. ***Note***: ns: not significant, $p > 0.05$ vs control group; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$ vs control group

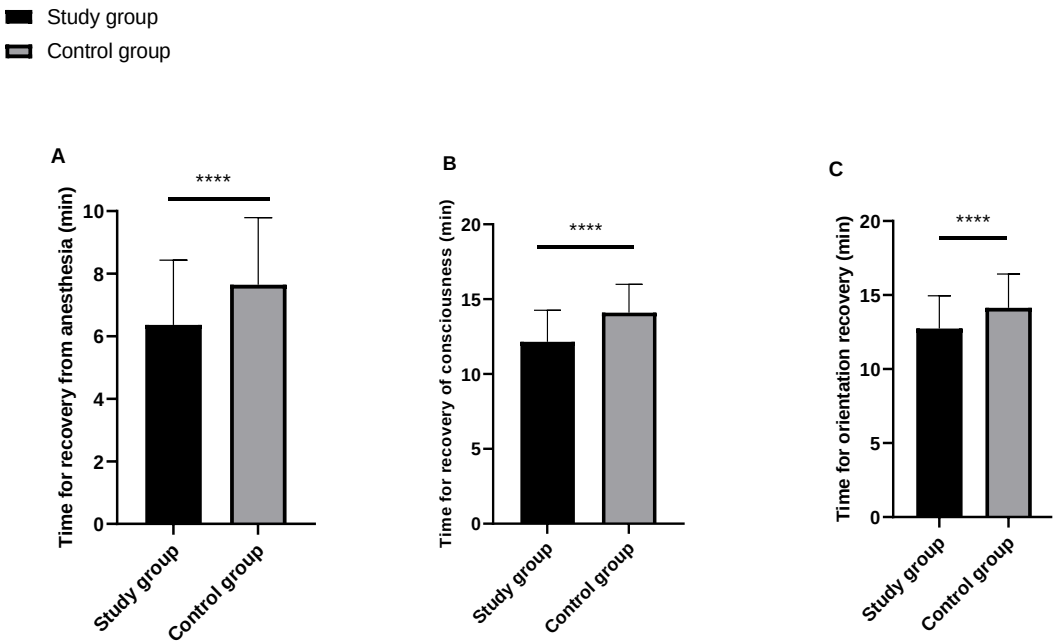

Figure 3: Anesthesia recovery between the two groups. A: Time for recovery from anesthesia. B: Time for recovery of consciousness. C: Time for orientation recovery. ****P < 0.0001 vs control group

Table 2: Anesthetic effect between the two groups (N, %)

Group	Excellent	Good	Poor
Study (n=108)	93(86.11)	15(13.89)	0(0.00)
Control (n=92)	61(66.30)	28(30.44)	3(3.26)
$\chi 2$	10.071	6.203	3.575
P-value	0.002	0.013	0.059

Table 3: Incidence of adverse reactions (N, %)

Group	Choking	Intestinal colic	Nausea and vomiting	Total adverse reaction
Study (n=108)	2(1.85)	2(1.85)	1(0.93)	5(4.63)
Control (n=92)	3(3.26)	2(2.17)	7(7.61)	12(13.04)
$\chi 2$				4.522,
P-value				0.034

Anesthesia parameters

Study group exhibited significantly shorter recovery time (recovery from anesthesia, consciousness, and orientation) compared to the control group (P < 0.05; Figure 3).

Anesthetic effect

Study group showed significantly higher number and proportion of patients with excellent or good anesthetic effects compared to control group (p < 0.05; Table 2).

Incidence of adverse reactions

Study group demonstrated significantly lower incidence of adverse reactions compared to control group (p < 0.05; Table 3).

DISCUSSION

Painless gastrointestinal endoscopy (PGE) allows patients to undergo gastrointestinal procedures without pain, achieved through intravenous administration of sedative and anesthetic drugs [13]. The use of PGE is increasingly prevalent among elderly population. However, elderly patients exhibit a higher incidence of postoperative anesthetic complications compared to younger adults, largely due to their distinct physiological characteristics [14]. The availability of propofol has significantly advanced painless anesthesia techniques. Nonetheless, excessive use of propofol may lead to adverse reactions, such as respiratory depression [15]. Therefore, propofol is commonly combined with opioid analgesics like fentanyl and sufentanil to mitigate these risks [16]. This study assessed the effects of a

combination of alfentanil and propofol in PGE for elderly patients. In practice, using propofol in combination with other drugs reduces the dosage required, thus decreasing patient discomfort and side effects [17,18]. Results of this study revealed that study group, which received alfentanil and propofol, consumed significantly less propofol compared to control group. This suggests that alfentanil and propofol combination effectively reduces propofol dosage necessary for achieving PGE in elderly patients.

It has also been documented that anesthesia causes changes in vital signs to some extent [19]. The mean values of vital signs acquired during examination and their corresponding baseline values in the two groups were analyzed and compared. The results revealed no significant differences in baseline values of MAP, BOS, and HR between the two groups. However, during the examination, the mean values of these indicators were significantly higher in study group compared to control group. These results suggest that combination of alfentanil and propofol better maintains stability of vital signs, leading to a more stable anesthesia state compared to the combination of sufentanil and propofol.

The anesthetic performance and effects of the two groups were also analyzed, and the results revealed that study group demonstrated significantly shorter times for recovery from anesthesia, orientation recovery, and recovery of consciousness compared to control group. Furthermore, a higher number and proportion of patients in study group exhibited excellent or good anesthetic effects compared to control group. These findings indicate that combination of alfentanil and propofol enhances anesthetic effects in elderly patients undergoing PGE.

The incidence of adverse reactions during anesthesia was compared between the two groups, and the result revealed that study group exhibited significantly lower incidence of adverse reactions compared to control group. This finding suggests that the use of alfentanil in combination with propofol helps to reduce the occurrence of adverse events associated with anesthesia. The observed reduction in propofol use may be attributed to the effects of alfentanil. The study finding is in tandem with Sultan *et al* [20], who demonstrated that combinations of remifentanil or alfentanil with propofol are safe and feasible for patient-controlled sedation during outpatient colonoscopy procedures. These results suggest that alfentanil in combination with propofol, effectively improves anesthetic management for elderly patients undergoing painless gastrointestinal endoscopy.

Limitations of this study

While this study provides valuable insights into the effects of combining alfentanil with propofol in PGE for elderly patients, it does have limitations. The relatively small sample size may have introduced some deviations in the results. Furthermore, given the variety of anesthesia schemes for PGE, the generalizability of these findings requires further validation with more data.

CONCLUSION

The combination of alfentanil and propofol minimally impacts the fluctuation of vital signs, provides superior anesthetic effects, and results in fewer adverse reactions for elderly patients undergoing PGE. Although these findings suggest that alfentanil-propofol combination may be considered for application in anesthetic management for elderly patients undergoing PGE, it did not determine the optimal dosing ratio between alfentanil and propofol, leaving room thus necessitating the need to investigate the ideal dose combination.

DECLARATIONS

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Ethical approval

The study was performed with permission from the Medical Ethics Committee of The Quzhou Affiliated Hospital of Wenzhou Medical University (approval no. K001399YM).

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Qun Cheng and Lu Song conceived and designed the study, and drafted the manuscript. Qun Cheng, Yunping Lan, Gongmin Yu, Changxing Xia and Lu Song collected, analyzed and interpreted the experimental data. Yunping Lan and Gongmin Yu revised the manuscript for important intellectual content. All authors read and approved the final draft of the manuscript for publication.

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