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Effects of alfentanil combined with ciprofol on the recovery quality in patients undergoing painless gastrointestinal endoscopy

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Abstract: Objective To investigate the effects of alfentanil combined with ciprofol on anesthesia-related time indices, vital signs, and recovery quality in patients undergoing painless gastrointestinal endoscopy. **Methods** A total of 180 patients undergoing painless gastrointestinal endoscopy at the Second Affiliated Hospital of Nantong University from September 2024 to March 2025 were included and randomly divided into two groups using a numerical randomization method, 90 cases in each group. The study group received intravenous administration of alfentanil at 5 μg/kg followed by ciprofol at 0.5 mg/kg. The control group received intravenous fentanyl citrate at 0.5 μg/kg followed by ciprofol at 0.5 mg/kg. Anesthesia-related time indices, vital signs, recovery quality (Aldrete Scale scores), and the incidence of adverse reactions were compared between the two groups. **Results** The study group showed superior results in anesthesia onset time, recovery time, consciousness recovery time, orientation recovery time, and discharge time compared to the control group (P<0.05). Vital signs in the study group remained stable at 5 minutes after anesthesia and during endoscope withdrawal. The systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, and peripheral oxygen saturation in the study group were higher than those in the control group (P<0.05). The Aldrete Scale score in the study group was higher than that in the control group at endoscope withdrawal, 5 minutes, 15 minutes, and 30 minutes after withdrawal (P<0.05). There was no statistically significant difference in the total incidence of adverse reactions between the study group and the control group (1.11% *vs* 3.33%, χ^2=1.023, P=0.312). **Conclusion** Alfentanil combined with ciprofol anesthesia helps improve the anesthetic effect in patients undergoing painless gastrointestinal endoscopy, with high recovery quality and good safety.

Keywords: Alfentanil; Ciprofol; Painless gastrointestinal endoscopy; Vital signs; Quality of awakening; Aldrete score

Gastrointestinal endoscopy is an important means for the diagnosis, treatment, and efficacy evaluation of gastrointestinal diseases such as polyps, inflammation, and bleeding. Painless anesthesia technology not only creates favorable conditions for the smooth progress of the examination but also greatly enhances patient tolerance and improves their examination experience [1]. For the selection of anesthetic drugs, painless anesthesia must meet the standard requirements of being stable, rapid, and quick to recover [2]. Ciprofol is a novel short-acting gamma-aminobutyric acid subtype A ($GABA_A$) receptor agonist, with rapid onset and quick recovery, low incidence of injection pain, adverse events related to respiratory and circulatory system, postoperative nausea and vomiting, and stable anesthesia depth [bispectral index (BIS)], making it advantageous for daytime general anesthesia [3]. However, high-dose monotherapy can easily cause respiratory and circulatory depression, as well as cardiovascular system damage such as bradycardia and hypotension, and increased lipid burden. Moreover, the function of ciprofol is mainly reflected in anesthesia and sedation, with unsatisfactory analgesic effect, so it is often combined with other drugs [4]. Alfentanil combines multiple advantages including rapid onset, short action, and definite analgesic effect, making it particularly suitable for short-duration anesthesia and analgesia, such as in gastrointestinal endoscopy, laryngoscopy, and short outpatient surgeries [5]. During painless endoscopy, the combination of ciprofol and alfentanil can provide good analgesic and pain-relieving effects, help maintain stable patient vital signs, allow rapid awakening after the examination, significantly reduce the dosage of ciprofol, and effectively prevent adverse reactions [6]. This article explores the application value of alfentanil combined with ciprofol in painless gastrointestinal endoscopy.

1 Data and Methods

1.1 General Data

This study was approved by the Ethics Committee of the Second Affiliated Hospital of Nantong University (Ethics Approval Number: 2024-YJ-007-01). A total of 180 patients who underwent painless gastrointestinal endoscopy at the Second Affiliated Hospital of Nantong University from September 2024 to March 2025 were selected as the study subjects.

Inclusion criteria:

(1) meeting the indications for painless gastrointestinal endoscopy;

(2) no serious lesions in vital organs such as the heart, liver, and kidneys;

(3) no use of opioids within the past 3 months;

(4) voluntary participation.

Exclusion criteria:

(1) contraindications to the study drugs;

(2) gastrointestinal stricture or obstruction;

(3) psychiatric disorders;

(4) special conditions such as pregnancy, extremely poor physical condition, or mandibular movement disorders.

A study coordinator was appointed to divide the patients into a study group and a control group using a random number table method, with 90 patients in each group. The coordinator prepared the study drugs according to the randomization results. The study intervention was administered by an anesthesiologist blinded to the group allocation. The coordinator did not participate in the administration of surgical anesthesia, postoperative follow-up, or data collation. There were no statistically significant differences in general information between the two groups (P>0.05). See **Table 1**.

Tab.1 Comparison general data between two groups (n=90, $\bar{x} \pm s$)

Indicators	Gender [case(%)]		ASA grading [case(%)]		Age (years)	BMI (kg/m²)
	Male	Female	I	II		
Study group	49 (54.44)	41 (45.56)	63 (70.00)	27 (30.00)	40.16± 2.35	21.73± 2.02
Control group	46 (51.11)	44 (48.89)	60 (66.67)	30 (33.33)	40.24± 2.17	21.58± 2.15
χ^2/t value	0.201		0.231		0.237	0.482
P value	0.654		0.631		0.831	0.630

1.2 Administration Method

The study group received intravenous push of alfentanil (Yichang Humanwell Pharmaceutical, National Drug Approval Number H20203054, 2 mL∶1 mg) 5 μg/kg, followed by push of ciprofol (Shenyang Haisco Pharmaceutical, National Drug Approval Number H20200013, 20 mL∶50 mg) 0.5 mg/kg. The control group received intravenous injection of fentanyl citrate (Jiangsu Nhwa Pharmaceutical, National Drug Approval Number H20113508, 2 mL∶0.1 mg) 0.5 μg/kg, followed by push of ciprofol 0.5 mg/kg.

1.3 Observation Indicators

1.3.1 Anesthesia-related time indicators

Time to anesthesia onset, awakening, consciousness recovery, orientation recovery, and discharge from the recovery room.

1.3.2 Vital signs and saturation of peripheral oxygen (SpO2)

Vital signs were monitored by a multifunctional vital sign monitor. Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), respiratory rate (RR), and SpO_2 were recorded before anesthesia, 5 minutes after anesthesia, and at the time of endoscope withdrawal.

1.3.3 Awakening quality

Assessed by the Aldrete scale, with positive scoring.

1.3.4 Adverse events

The occurrence of hypoxemia, hypotension, and nausea and vomiting were recorded.

1.4 Statistical Methods

SPSS 24.0 was used for data analyze. Measurement data conforming to normal distribution were expressed as $\bar{x} \pm s$; intergroup comparisons were performed using independent sample t-tests. Comparisons at multiple time points were performed using repeated measures ANOVA, and pairwise comparisons were performed using the LSD-t test. Categorical data were expressed as case (%), and intergroup comparisons were performed using the chi-square test. P<0.05 was considered statistically significant.

2 Results

2.1 Comparison of anesthesia-related time indicators between the two groups

The anesthesia-related time indicators in the study group were shorter than those in the control group (P<0.05). See **Table 2**.

2.2 Comparison of vital signs and SpO_2 between the two groups

Before anesthesia, there was no statistically significant difference in vital signs between the two groups (P > 0.05). At 5 minutes after anesthesia induction and at the time of scope withdrawal, the study group had higher SBP, DBP, HR, RR, and SpO_2 than the control group (P<0.05). See **Table 3** and **Table 4**.

2.3 Comparison of recovery quality at different time points between the two groups

At the time of scope withdrawal and at 5 min, 15 min, and 30 min after withdrawal, the study group had higher Aldrete scores than the control group (P<0.05). See **Table 5**.

2.4 Comparison of the incidence of adverse reactions between the two groups

The study group had only 1 case of nausea and vomiting, while the control group had 1 case each of hypoxemia, hypotension, and nausea and vomiting. The difference in the total incidence of adverse reactions between the study group and the control group was not statistically significant (1.11% *vs* 3.33%, χ^2=1.023, P=0.312).

Tab.2 Comparison of anesthesia-related time indicators between two groups (n=90, $\bar{x} \pm$s)

Indicators	Study group	Control group	t value	P value
Anesthesia onset time (s)	52.46±4.24	65.87±4.19	21.342	<0.001
Recovery time (min)	1.98±0.57	2.63±0.35	9.219	<0.001
Consciousness recovery time (min)	4.15±0.22	4.76±0.17	20.814	<0.001
Orientation recovery time (min)	4.95±0.19	5.23±0.34	6.820	<0.001
Discharge time (min)	9.55±1.61	11.59±1.58	8.579	<0.001

Tab.3 Comparison of vital signs between two groups (n=90, $\bar{x} \pm s$)

Time-point	SBP(mmHg)		DBP (mmHg)		HR (beats/min)		RR(times/min)	
	Study group	Control group	Study group	Control group	Study group	Control group	Study group	Control group
Before anesthesia	128.25±7.65	127.59±6.41	81.59±6.20	81.95±5.75	86.25±4.75	86.62±3.89	11.72±1.75	11.65±1.67
5 minutes after anesthesia	125.88±6.87^{ab}	103.72±5.34	77.69±4.61^{ab}	67.83±4.26	75.66±4.57^{ab}	68.85±3.24	10.39±0.25^{ab}	9.55±0.31
Endoscope withdrawal	127.21±6.43^{abc}	118.22±6.39	79.75±5.56^{abc}	71.72±6.20	79.96±3.65^{abc}	74.81±3.40	11.60±0.36^{abc}	9.61±0.39
$F/P_{\text{between-group}}$ value	6.379/0.012		4.991/0.027		5.118/0.025		6.277/0.013	
F/P_{time} value	16.931/<0.001		14.821/<0.001		57.382/<0.001		41.553/<0.001	
$F/P_{\text{interaction}}$ value	4.999/0.007		7.788/<0.001		6.644/0.002		8.740/<0.001	

Note: Compared with control group at same time-point, ^{a}P<0.05; Compared with same group before anesthesia, ^{b}P<0.05; Compared with same group 5 minutes after anesthesia, ^{c}P<0.05.

Tab.4 Comparison of SpO_2 between two groups (n=90, $\bar{x} \pm s$)

Time-point	Study group	Control group
Before anesthesia	98.63±0.21	98.59±0.23
5 minutes after anesthesia	96.67±0.46^{ab}	94.84±0.56
Endoscope withdrawal	97.48±0.18^{abc}	96.92±0.21
$F/P_{\text{between-group}}$ value	4.992/0.027	
F/P_{time} value	90.822/<0.001	
$F/P_{\text{interaction}}$ value	16.069/<0.001	

Note: Compared with control group at same time-point, ^{a}P<0.05; Compared with same group before anesthesia, ^{b}P<0.05; Compared with same group 5 minutes after anesthesia, ^{c}P<0.05.

Tab.5 Comparison of Aldrete scale scores between two groups (n=90, $\bar{x} \pm s$)

Time-point	Study group	Control group
Endoscope withdrawal	6.95±0.84^{a}	5.76±0.23
5 minutes after withdrawal	8.13±0.91^{ab}	6.24±0.33
15 minutes after withdrawal	9.25±0.62^{abc}	7.43±0.47
30 minutes after withdrawal	9.78±0.32^{abcd}	8.94±0.61
$F/P_{\text{between-group}}$ value	4.041/<0.046	
F/P_{time} value	446.819/<0.001	
$F/P_{\text{interaction}}$ value	9.213/<0.001	

Note: Compared with control group at same time-point, ^{a}P<0.05; Compared with same group endoscope withdrawal, ^{b}P<0.05; Compared with same group 5 minutes after withdrawal, ^{c}P<0.05; Compared with same group 15 minutes after withdrawal, ^{d}P<0.05.

3 Discussion

Gastrointestinal endoscopy, as an important means for the diagnosis and treatment of digestive tract diseases, has its clinical value widely recognized [1]. However, the pain and discomfort that may occur during the examination often lead to physiological and psychological stress responses in patients, thereby affecting the smooth implementation of the examination. Therefore, in clinical practice, it is necessary to assess the applicability of painless anesthesia technology based on individual patient conditions and select an appropriate anesthesia regimen to optimize analgesic effects and ensure the safety and comfort of the examination process [7-8]. Painless gastrointestinal endoscopy, due to its advantages of being easily accepted by patients, non-invasive, and highly accurate, has become a common method for clinical diagnosis and treatment of gastrointestinal diseases [1].

As a fentanyl tetrazole derivative, alfentanil can exert good analgesic and pain-relieving effects and a strong ability to enhance local anesthetic activity. The drug onset time is approximately 45 seconds, the time to reach peak concentration in the effect compartment is 92-120 seconds after administration, the duration of action is approximately 10 minutes, and its distribution, redistribution, elimination, and continuous infusion half-lives are 0.5-3.0 min, 4.7-21.5 min, 65-128 min, and 47 min, respectively [9-11]. At the same time, this drug has a high plasma protein binding rate, reaching 90% after intravenous push, has a relatively small volume of distribution, has higher solubility than fentanyl, conforms to a three-compartment model, can be metabolized by the liver, and is excreted in the urine after inactivation [5]. Furthermore, the onset, peak effect, and consciousness recovery speed of this drug are faster than those of sufentanil and fentanyl, and its distribution and elimination half-lives are shorter. Therefore, it has a more pronounced and definitive anesthetic and analgesic effect in surgical procedures of shorter duration, does not increase the risk of adverse reactions, and has good clinical safety and efficacy [11]. The analgesic mechanism of this drug is that after opioid receptors on spinal dorsal horn neurons bind to the drug, the ability of neurons to transmit nociceptive information is weakened and reduced, thereby producing an analgesic effect; after the drug acts in the periaqueductal gray matter and other brain regions, it opens a pain modulation pathway through the rostral ventromedial medulla, which can improve the analgesic effect by forming and releasing endogenous opioid peptides and inhibitory neurotransmitters, and inhibiting the activity of spinal dorsal horn neurons [12-15]. Its cellular transduction mechanism is that after binding to μ-opioid receptors, it stimulates the activation of G proteins coupled to them, and G proteins can block N-type voltage-gated calcium channels and indirectly activate and open potassium channels, thus increasing intracellular potassium levels, making it difficult for neuronal action potentials to form and pain signals to be transmitted, ultimately resulting in reduced pain sensitivity and increased tolerance [16-19].

The results of this study showed that the anesthesia-related times in the study group were shorter, vital signs were more stable, awakening quality was higher, and there was no statistically significant difference in the incidence of adverse reactions between the two groups, indicating that alfentanil has a better anesthetic effect for painless gastrointestinal endoscopy. The analgesic potency of alfentanil is approximately 15 times that of morphine, the

onset time of action is approximately 1/4 that of fentanyl, and the duration of action is approximately 1/3 that of fentanyl [20-22]. Due to its good plasma protein binding rate, alfentanil can effectively improve its stability in the blood, positively affecting the balance and stability between the central nervous system and plasma concentrations. Being metabolized by the liver and excreted in urine, it can effectively accelerate the speed of awakening, consciousness recovery, and discharge from the recovery room, with ideal awakening quality [23-24]. Therefore, alfentanil is an opioid drug with fewer adverse reactions and higher safety. Also, alfentanil can exert significant synergistic pharmacological effects when combined with ciprofol.

In conclusion, the use of alfentanil combined with ciprofol for painless gastrointestinal endoscopy anesthesia can effectively maintain stable vital signs in patients, reduce the risk of adverse reactions, achieve rapid and high-quality postoperative awakening, and has good clinical application value.

Conflict of Interest None

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·临床麻醉专题·论著·

阿芬太尼复合环泊酚对行无痛胃肠镜患者苏醒质量的影响

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摘要：目的 探讨阿芬太尼复合环泊酚对行无痛胃肠镜患者麻醉相关时间指标、生命体征、苏醒质量的影响。**方法** 共纳入2024年9月至2025年3月南通大学第二附属医院180例行无痛胃肠镜检查患者，按照随机数字法分为两组，各90例。研究组予以先静脉推注阿芬太尼5 μg/kg，再推注环泊酚0.5 mg/kg。对照组予以先静脉注射枸橼酸芬太尼0.5 μg/kg，再推注环泊酚0.5 mg/kg。对比两组麻醉相关时间指标、生命体征、苏醒质量（Aldrete量表评分）和不良反应发生率。**结果** 研究组麻醉起效时间、苏醒时间、意识恢复时间、定向力恢复时间和离室时间均短于对照组（P<0.05）。研究组在麻醉后5 min和退镜时生命体征稳定，收缩压、舒张压、心率、呼吸频率及外周血氧饱和度均高于对照组（P<0.05）。研究组在退镜时和退镜后5、15、30 min的Aldrete评分均高于对照组（P<0.05）。研究组和对照组的不良反应总发生率差异无统计学意义（1.11% *vs* 3.33%，χ^2=1.023，P=0.312）。**结论** 阿芬太尼复合环泊酚麻醉有助于改善无痛胃肠镜患者麻醉效果，苏醒质量高，且安全性好。

关键词： 阿芬太尼；环泊酚；无痛胃肠镜；生命体征；苏醒质量；Aldrete评分

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Effects of alfentanil combined with ciprofol on the recovery quality in patients undergoing painless gastrointestinal endoscopy

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Abstract: Objective To investigate the effects of alfentanil combined with ciprofol on anesthesia-related time indices, vital signs, and recovery quality in patients undergoing painless gastrointestinal endoscopy. **Methods** A total of 180 patients undergoing painless gastrointestinal endoscopy at the Second Affiliated Hospital of Nantong University from September 2024 to March 2025 were included and randomly divided into two groups using a numerical randomization method, 90 cases in each group. The study group received intravenous administration of alfentanil at 5 μg/kg followed by ciprofol at 0.5 mg/kg. The control group received intravenous fentanyl citrate at 0.5 μg/kg followed by ciprofol at 0.5 mg/kg. Anesthesia-related time indices, vital signs, recovery quality (Aldrete Scale scores), and the incidence of adverse reactions were compared between the two groups. **Results** The study group showed superior results in anesthesia onset time, recovery time, consciousness recovery time, orientation recovery time, and discharge time compared to the control group (P<0.05). Vital signs in the study group remained stable at 5 minutes after anesthesia and during endoscope withdrawal. The systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, and peripheral oxygen saturation in the study group were higher than those in the control group (P<0.05). The Aldrete Scale score in the study group was higher than that in the control group at endoscope withdrawal, 5 minutes, 15 minutes, and

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30 minutes after withdrawal (P<0.05). There was no statistically significant difference in the total incidence of adverse reactions between the study group and the control group (1.11% *vs* 3.33%, χ^2=1.023, P=0.312). **Conclusion** Alfentanil combined with ciprofol anesthesia helps improve the anesthetic effect in patients undergoing painless gastrointestinal endoscopy, with high recovery quality and good safety.

Keywords: Alfentanil; Ciprofol; Painless gastrointestinal endoscopy; Vital signs; Quality of awakening; Aldrete score
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胃肠镜检查是息肉、炎症、出血等胃肠疾病诊治和疗效评估的重要手段，无痛麻醉技术为检查顺利推进创造有利条件的同时，还在很大程度上增强患者耐受性、改善其检查体验[1]。无痛麻醉在麻醉药物的选择方面需满足平稳、迅速且恢复快的标准要求[2]。环泊酚是新型短效γ-氨基丁酸A型(gamma-aminobutyric acid subtype A, $GABA_A$)受体激动剂，起效快，恢复迅速，注射痛和呼吸及循环系统相关不良事件发生率低，术后恶心呕吐的发生率低，麻醉深度[脑电双频指数(bispectral index, BIS)]较稳定，用于日间全身麻醉具有优势[3]。但大剂量单一用药易造成呼吸循环抑制，以及心率减缓、血压降低等心血管系统损伤和脂质负荷加重，且环泊酚的功能主要体现在麻醉和镇静，镇痛效果不甚理想，故常与其他药物联用[4]。阿芬太尼集起效迅速、短效、镇痛效果确切等多项优势于一身，尤其适合短时间内的麻醉镇痛，如胃肠镜检查、喉镜检查、时间较短的门诊手术等[5]。无痛内镜诊疗期间，环泊酚联合阿芬太尼可以起到良好的镇痛止痛作用，有利于患者生命体征保持稳定，检查后可快速苏醒的同时，还可显著减少环泊酚用量，并有效防范不良反应[6]。基于此，本文探讨阿芬太尼复合环泊酚在无痛胃肠镜中的应用价值。报道如下。

1　资料与方法

1.1　一般资料　本研究经过南通大学第二附属医院伦理委员会批准(伦理审批号：2024-YJ-007-01)。选择2024年9月至2025年3月于南通大学第二附属医院行无痛胃肠镜检查的180例患者为研究对象。纳入标准：(1) 符合无痛胃肠镜检查指征；(2) 心肝肾等重要器官无严重病变；(3) 近3个月内未使用过阿片类药物；(4) 自愿参与。排除标准：(1) 对研究药物存在禁忌；(2) 胃肠道狭窄或梗阻；(3) 有精神疾病；(4) 孕妇、体质极差、下颌活动障碍等特殊情况。

指定一名研究协调员，将患者按随机数字表法分成研究组和对照组，每组各90例，协调员根据随机化结果准备研究药物，研究干预将由不知晓分组情况的麻醉医师实施。协调员不参与手术麻醉实施、术后随访及数据整理。两组一般资料比较差异无统计学意义(P>0.05)。见表1。

1.2　给药方法　研究组给予静脉推注阿芬太尼(宜昌人福药业，国药准字H20203054，2 mL∶1 mg) 5 μg/kg，再推注环泊酚(沈阳海恩科制药，国药准字H20200013，20 mL∶50 mg)0.5 mg/kg。对照组给予静脉注射枸橼酸芬太尼(江苏恩华药业，国药准字H20113508，2 mL∶0.1 mg)0.5 μg/kg，再推注环泊酚0.5 mg/kg。

1.3　观察指标

1.3.1　麻醉相关时间指标　麻醉起效、苏醒、意识恢复、定向力恢复和离室时间。

1.3.2　生命体征和外周血氧饱和度(saturation of peripheral oxygen, SpO_2)　用多功能生命体征监测仪监测，于麻醉前、麻醉后5 min和退镜时分别记录收缩压、舒张压、心率、呼吸频率(respiratory rate, RR)和SpO_2。

1.3.3　苏醒质量　用Aldrete量表评估，正向计分。

1.3.4　不良反应　记录低氧血症、低血压和恶心呕吐的发生情况。

1.4　统计学方法　利用SPSS 24.0软件分析数据。符合正态分布的计量资料以$\bar{x}\pm s$表示，组间比较采用独立样本t检验；多时点比较采用重复测量资料方差分析，两两比较采用LSD-t检验。计量资料以例(%)表示，组间比较采用χ^2检验。P<0.05为差异有统计学意义。

2　结　果

2.1　两组麻醉相关时间指标比较　研究组麻醉相关时间指标短于对照组，差异均有统计学意义(P<0.05)。见表2。

表1　两组一般资料比较　(n=90, $\bar{x}\pm s$)
Tab.1　Comparison of general data between two groups (n=90, $\bar{x}\pm s$)

组别	性别(例)		ASA分级(例)		年龄(岁)	身体质量指数(kg/m²)
	男	女	Ⅰ级	Ⅱ级		
研究组	49	41	63	27	40.16±2.35	21.73±2.02
对照组	46	44	60	30	40.24±2.17	21.58±2.15
χ^2/t值	0.201		0.231		0.237	0.482
P值	0.654		0.631		0.831	0.630

2.2　两组生命体征和SpO_2比较　麻醉前两组生命体征差异无统计学意义（P>0.05）。麻醉后5 min和退镜时研究组收缩压、舒张压、心率、RR及SpO_2均高于对照组（P<0.05）。见表3、表4。

表2　两组麻醉相关时间指标比较　（n=90，$\bar{x}\pm s$）

Tab.2　Comparison of anesthesia-related time indicators between two groups　（n=90，$\bar{x}\pm s$）

项目	研究组	对照组	t值	P值
麻醉起效时间(s)	52.46±4.24	65.87±4.19	21.342	<0.001
苏醒时间(min)	1.98±0.57	2.63±0.35	9.219	<0.001
意识恢复时间(min)	4.15±0.22	4.76±0.17	20.814	<0.001
定向力恢复时间(min)	4.95±0.19	5.23±0.34	6.820	<0.001
离室时间(min)	9.55±1.61	11.59±1.58	8.579	<0.001

2.3　两组不同时点苏醒质量比较　退镜时及退镜后5 min、15 min和30 min，研究组Aldrete量表的分值均高于对照组（P<0.05）。见表5。

2.4　两组不良反应发生率比较　研究组仅发生恶心呕吐1例，对照组发生低氧血症、低血压和恶心呕吐各1例。研究组和对照组不良反应总发生率差异无统计学意义（1.11% *vs* 3.33%，χ^2=1.023，P=0.312）。

表3　两组生命体征比较　（n=90，$\bar{x}\pm s$）

Tab.3　Comparison of vital signs between two groups　（n=90，$\bar{x}\pm s$）

时点	收缩压(mmHg)		舒张压(mmHg)		心率(次/min)		RR(次/min)	
	研究组	对照组	研究组	对照组	研究组	对照组	研究组	对照组
麻醉前	128.25±7.65	127.59±6.41	81.59±6.20	81.95±5.75	86.25±4.75	86.62±3.89	11.72±1.75	11.65±1.67
麻醉后5 min	125.88±6.87^{ab}	103.72±5.34	77.69±4.61^{ab}	67.83±4.26	75.66±4.57^{ab}	68.85±3.24	10.39±0.25^{ab}	9.55±0.31
退镜时	127.21±6.43^{abc}	118.22±6.39	79.75±5.56^{abc}	71.72±6.20	79.96±3.65^{abc}	74.81±3.40	11.60±0.36^{abc}	9.61±0.39
$F_{组间}/P_{组间}$值	6.379/0.012		4.991/0.027		5.118/0.025		6.277/0.013	
$F_{时间}/P_{时间}$值	16.931/<0.001		14.821/<0.001		57.382<0.001		41.553/<0.001	
$F_{交互}/P_{交互}$值	4.999/0.007		7.788/<0.001		6.644/0.002		8.740/<0.001	

注：与同时点对照组比较，^aP<0.05；与同组麻醉前比较，^bP<0.05；与同组麻醉后5 min比较，^cP<0.05。

表4　两组SpO_2比较　（n=90，$\bar{x}\pm s$）

Tab.4　Comparison of SpO_2 between two groups　（n=90，$\bar{x}\pm s$）

时点	研究组	对照组
麻醉前	98.63±0.21	98.59±0.23
麻醉后5 min	96.67±0.46^{ab}	94.84±0.56
退镜时	97.48±0.18^{abc}	96.92±0.21
$F_{组间}/P_{组间}$值	4.992/0.027	
$F_{时间}/P_{时间}$值	90.822/<0.001	
$F_{交互}/P_{交互}$值	16.069/<0.001	

注：与同时点对照组比较，^aP<0.05；与同组麻醉前比较，^bP<0.05；与同组麻醉后5 min比较，^cP<0.05。

表5　两组Aldrete量表评分比较　（n=90，$\bar{x}\pm s$）

Tab.5　Comparison of Aldrete scale scores between two groups　（n=90，$\bar{x}\pm s$）

时点	研究组	对照组
退镜时	6.95±0.84^a	5.76±0.23
退镜后5 min	8.13±0.91^{ab}	6.24±0.33
退镜后15 min	9.25±0.62^{abc}	7.43±0.47
退镜后30 min	9.78±0.32^{abcd}	8.94±0.61
$F_{组间}/P_{组间}$值	4.041/<0.046	
$F_{时间}/P_{时间}$值	446.819/<0.001	
$F_{交互}/P_{交互}$值	9.213/<0.001	

注：与同时点对照组比较，^aP<0.05；与同组退镜时比较，^bP<0.05；与同组退镜后5 min比较，^cP<0.05；与同组退镜后30 min比较，^dP<0.05。

3　讨　论

胃肠镜检查作为消化道疾病诊断和治疗的重要手段，其临床价值已得到广泛认可[1]。然而，检查过程中可能引发的疼痛和不适常导致患者出现生理及心理应激反应，进而影响检查的顺利实施。因此，在临床实践中需根据患者个体情况评估无痛麻醉技术的适用性，并选择适宜的麻醉方案，以优化镇痛效果并确保检查过程的安全性和舒适性[7-8]。无痛胃肠镜检查因其易于被患者接受、无创、准确性高等应用优势，已成为目前临床诊治胃肠道疾病常用方式[1]。

作为芬太尼四唑衍生物，阿芬太尼可以发挥良好的镇痛止痛作用和强劲的局部麻醉活性提升作用，药物起效时间约45 s，效应室峰值到达时间为用药后的92~120 s，维持时间长约10 min，且其分布、再分布、消除和持续输注半衰期分别为0.5~3.0 min、4.7~21.5 min、65~128 min、47 min[9-11]。同时，该药物的血浆蛋白结合率较高，静脉推注后可达90%，在分布容积方面偏小，在溶解度方面高于芬太尼，且符合三室模型，可通过肝脏代谢，并于失活后随尿液排出体外[5]。此外，该药物的起效、峰效和意识恢复速度较之舒芬太尼和芬太尼均更快，分布和消除半衰期则更短，故在耗时较短的手术操作中有着更加明显、确切的麻醉镇痛作用，且不会导致不良反应风险的提高，临床应用安全性和有效性均较佳[11]。该药物的镇痛作用原理为脊髓背角神经元上的阿片受体与该药物结合后，可以对神经元的伤害性信息传递能力

予以削弱、降低，进而产生镇痛作用；该药物在中脑导水管周围灰质和其他脑部区域发挥作用后，会开通一条经延脑头端腹内侧区的疼痛调节路径，此路径可以通过内源性阿片肽和抑制性神经递质的形成释放、抑制脊髓背角神经元活动，故而改善镇痛效果[12-15]。该药物的细胞传导机制为与μ阿片受体结合后，对与其偶联G蛋白产生激活刺激影响，而G蛋白可以对由N型电压调控的钙通道进行封闭处理，对钾通道产生间接性的激活开启作用，故细胞内钾水平增高，以致神经元的动作电位难以形成，疼痛信号难以传递，最终引起疼痛敏感性降低、耐受度提升的效果[16-19]。

本研究结果显示，研究组麻醉相关时间均较短，生命体征较为稳定，苏醒质量较高，且两组不良反应发生率差异无统计学意义，提示阿芬太尼有着更优的无痛胃肠镜麻醉效果。阿芬太尼的镇痛效力约为吗啡的15倍，药效起效时间约为芬太尼的1/4，维持时间约为芬太尼的1/3[20-22]。阿芬太尼因其良好的血浆蛋白结合率，可以很好地提高其在血液中的稳定性，对平衡稳定中枢神经系统和血浆间浓度具有积极影响，经肝脏代谢、尿液排出，可以有效加快苏醒、意识恢复和离室的速度，苏醒质量较为理想[23-24]。因此，阿芬太尼是一种不良反应少、安全性高的阿片类药物，且联用环泊酚时可发挥显著的药效协同作用。

综上所述，阿芬太尼复合环泊酚用于无痛胃肠镜麻醉可有效维持患者生命体征稳定，降低不良反应风险，术后苏醒快且质量高，具有较好的临床应用价值。

利益冲突　无

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