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Original Article

Comparison of anesthetic efficacy and safety between ciprofol and propofol in elderly patients undergoing painless gastrointestinal endoscopy

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Abstract: Objective: To compare the anesthetic effects of ciprofol and propofol in painless gastrointestinal endoscopy (PGE) for elderly patients. Methods: A retrospective analysis was carried out In 200 elderly patients who underwent PGE at the Quzhou Affiliated Hospital of Wenzhou Medical University between September 2023 and August 2024. Based on anesthetics they received, patients were divided into a propofol group (n=109) and a ciprofol group (n=91), with further stratification by American Society of Anesthesiologists (ASA) classification (I/II). Outcome measures, including the anesthesia-related indices, blood pressure at different time points [upon entering the procedure room (T0), after anesthesia induction (T1), 2 minutes after scope insertion (T2), and upon leaving the procedure room (T3)], the incidence of adverse reactions, and patient satisfaction were compared between the two groups. Results: The two groups showed comparable anesthesia induction time, gastrointestinal endoscopy duration, time to recovery of orientation, and recovery time from anesthesia (all $P > 0.05$). However, the ciprofol group showed significantly lower visual analog scale (VAS) scores ($P < 0.05$) and higher anesthesia satisfaction (91.21% vs. 71.56%, $P < 0.05$) compared with the propofol group. Both groups exhibited gradual decreases in diastolic and systolic blood pressure from T0 to T3, with differential patterns of change observed between groups (all $P < 0.05$). The ciprofol group also showed significantly lower rates of injection pain and respiratory depression than the propofol group (both $P < 0.05$). Conclusion: For PGE in elderly patients, ciprofol demonstrates significant advantages over propofol in reducing adverse reactions, alleviating pain, and improving patient satisfaction.

Keywords: Ciprofol, propofol, painless gastrointestinal endoscopy, elderly patients, anesthetic effects, adverse reactions, satisfaction

Introduction

As China gradually enters an aging society, an increasing number of elderly patients are undergoing painless gastrointestinal endoscopy (PGE) [1]. PGE, an essential modality for diagnosing and treating digestive tract diseases, substantially improves patient comfort and procedural compliance [2]. However, compared with younger patients, elderly patients exhibit diminished physiological reserve and a higher prevalence of underlying diseases, thus suffering a higher incidence and severity of complications under anesthesia [3, 4]. Accordingly, the selection of anesthetic drugs is particularly crucial.

Propofol is currently one of the most widely used intravenous anesthetics for PGE, owing to its favorable properties such as rapid onset and quick recovery [5]. However, propofol exerts inhibitory effects on the cardiovascular system, leading to reductions in arterial pressure and respiratory depression, thereby posing increased risks, especially in elderly patients [6]. In recent years, with the advancements in medical research and technology, ciprofol, a novel γ-aminobutyric acid (GABA) receptor agonist independently developed in China, has begun to be applied in anesthesia induction and maintenance for PGE and painless fiberoptic bronchoscopy, providing a promising alternative for anesthesia in elderly patients [7]. Ciprofol

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shares structural similarities with propofol, as both are direct agonists of the GABA type A (GABA_A) receptor. However, ciprofol demonstrates higher receptor binding affinity and is clinically applicable for both anesthesia induction and maintenance [8]. A Phase III multicenter trial has confirmed that ciprofol is non-inferior to propofol in general anesthesia induction, with a significantly lower incidence of injection pain [9]. These pharmacological advantages underscore the potential value of ciprofol in geriatric anesthesia applications. Nevertheless, current research on the application of ciprofol in PGE for elderly patients remains limited and is in the exploratory stage [10]. Therefore, a systematic comparison between ciprofol and propofol regarding anesthetic efficacy, safety profile, and recovery quality in PGE among elderly patients holds significant clinical importance.

This study comprehensively evaluated the anesthetic effectiveness and safety of ciprofol versus propofol in elderly patients undergoing PGE, with the ultimate goal of providing evidence-based recommendations for optimized anesthetic selection in geriatric populations. To our knowledge, this represents one of the first comprehensive comparisons between ciprofol and propofol specifically in an elderly population undergoing PGE.

Materials and methods

Study population

A retrospective analysis was carried out on the medical records of 234 elderly individuals who underwent PGE at the Quzhou Affiliated Hospital of Wenzhou Medical University from September 2023 to August 2024. After applying the following inclusion and exclusion criteria, a total of 200 individuals undergoing PGE were enrolled in the study. This study was approved by the Ethics Committee of the Quzhou People's Hospital.

Inclusion criteria: (1) age ≥ 60 years; (2) American Society of Anesthesiologists (ASA) physical status classification of I or II; and (3) complete clinical data available.

Exclusion criteria: (1) contraindications to study medications; (2) contraindications to general anesthesia/deep sedation; (3) a history of anesthesia/sedation-related adverse events; (4) a history of chronic pain or substance abuse; and (5) significant organ dysfunction.

Among the 200 enrolled patients, 109 who received propofol lipid emulsion were assigned to the propofol group, while 91 who received ciprofol injection were assigned to the ciprofol group. These patients were further divided into four groups based on anesthetic type and ASA classification: ASA I + ciprofol (n=50), ASA I + propofol (n=58), ASA II + ciprofol (n=41), and ASA II + propofol (n=51). The detailed screening and grouping process is illustrated in **Figure 1**.

Procedure protocol

Patients were instructed to fast for at least 8 hours before examination. Twenty minutes before entering the procedure room, simethicone emulsion [Menarini group (China)] was administered. Upon entering, the individuals were positioned in a left lateral decubitus position with continuous monitoring of peripheral capillary oxygen saturation (SpO_2), electrocardiogram (ECG), and non-invasive blood pressure. An intravenous line was established with nasal oxygen supplementation (3 L/min), followed by administration of 15-20 mg ketorolac tromethamine injection (Shandong New Era Pharmaceutical Co., Ltd.). One minute later, individuals in the propofol group received 2 mg/kg propofol lipid emulsion (Beijing Fresenius Kabi Pharmaceutical Co., Ltd.), while those in the ciprofol group received 0.4 mg/kg ciprofol injection (Liaoning Haisco Pharmaceutical Co., Ltd.) for anesthesia induction. The drugs were administered via slow intravenous push over more than 30 seconds, with injection pain assessed using the visual analog scale (VAS) immediately upon initiation of drug administration [11, 12].

Criteria for successful anesthesia induction: Modified Observer's Assessment of Alertness/Sedation (MOAA/S) scale score was ≤1 and gastrointestinal endoscopy was initiated upon successful induction [13]. Consistent with standard clinical practice for procedural sedation in our institution, the depth of anesthesia was managed by the attending anesthesiologist, guided by the patient's continuous physiological parameters and clinical responses. This titrated dosing strategy, aimed at maintaining a MOAA/S score of ≤1, represents the estab-

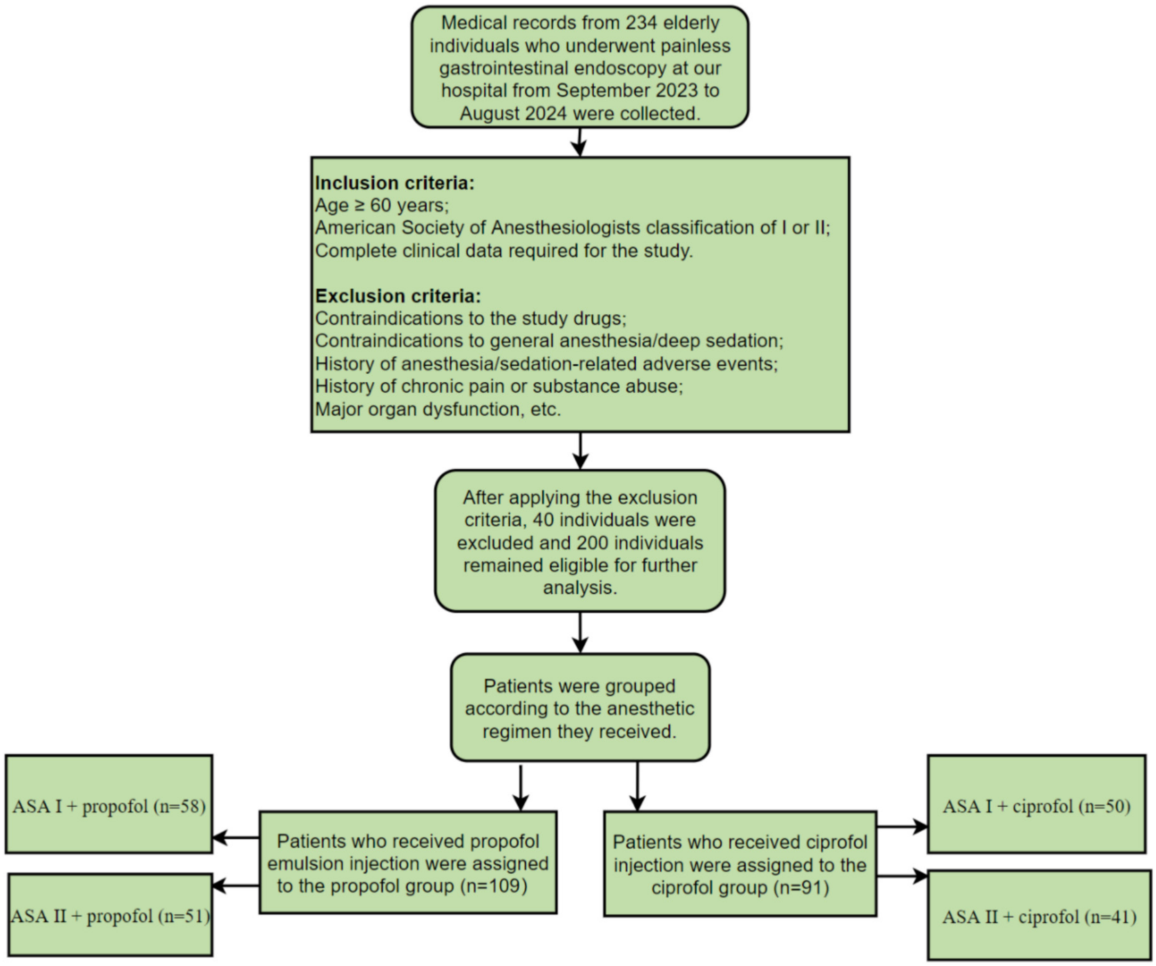

Figure 1. Flowchart of screening and grouping process.

lished standard of care for ensuring patient safety and procedural efficacy during PGE. Criteria for failed intubation: MOAA/S > 1 after 2 minutes of initial induction (rescue protocol: additional 0.5 mg/kg propofol or 0.1 mg/kg ciprofol in divided doses until adequate sedation). The total number of rescue doses administered, the total supplemental drug consumption, and the time from initial induction to successful endoscope insertion were recorded for all patients. Criteria for anesthesia failure: MOAA/S > 1 after 5 consecutive supplemental doses. For SpO_2 < 90% (persisting > 30 s), airway management and increased oxygen were provided, with ventilation if necessary. Apnea was defined as respiratory rate = 0 for > 30 s. For nausea/vomiting, 5 mg tropisetron hydrochloride (Luoxin Pharmaceuticals Group Stock Co., Ltd.) was given. For heart rate < 50 bpm (> 30 s), 0.5 mg atropine sulfate (Tianjin Pharmaceuticals Group Co., Ltd.) was administered. For persistent hypotension (> 30 s), 6 mg ephedrine hydrochloride (Northeast Pharmaceutical Group Shenyang First Pharmaceutical Co., Ltd.) was administered.

Post-procedure, all patients recovered in the post-anesthesia care unit until discharge readiness.

Data collection

Data of patients were collected, including baseline demographic characteristics (age, sex, body mass index (BMI), hypertension history, diabetes mellitus (DM) history, ASA physical status classification, and residential information), anesthesia-related parameters (induction time, gastrointestinal endoscopy duration, time to recovery of orientation, and recovery time from anesthesia), clinical evaluation metrics (VAS scores, diastolic and systolic blood pressure measurements, and anesthesia satisfaction ratings), as well as documented adverse events (respiratory depression, dizziness, hypotension, injection pain, involuntary movement responses, nausea/vomiting episodes, and bradycardia).

Outcome measures

(1) Age, sex, BMI, hypertension history, DM history, ASA classification, and residential information were recorded for all enrolled individuals.

(2) Procedure-related parameters included anesthesia induction time, total gastrointestinal endoscopy duration, time to recovery of orientation, and recovery time from anesthesia.

(3) Pain intensity was evaluated using the VAS scoring system (range: 0-10) [12], with higher scores indicating greater pain severity.

(4) The total dosages of atropine and ephedrine consumed were recorded for both groups.

(5) Blood pressure parameters (diastolic blood pressure [DBP] and systolic blood pressure [SBP]) were recorded at four critical time points: T0 (upon entering procedure room), T1 (post-anesthesia induction), T2 (2 minutes after scope insertion), and T3 (upon discharge from procedure room).

(6) Satisfaction levels were assessed using our institutional painless endoscopy satisfaction scale (0-10 points). 8-10: Satisfied; 5-7: Moderately satisfied; 0-4: Dissatisfied [13]. Overall satisfaction rate = (satisfied + moderately satisfied cases)/total cases × 100%.

(7) The incidences of respiratory depression (defined as SpO_2 < 90% for > 30 seconds [14]), dizziness, hypotension (defined as a decrease in SBP > 20% from baseline or SBP < 90 mmHg [15]), injection pain, involuntary movements, nausea/vomiting, and bradycardia were recorded.

(8) The study conducted comparative analyses between the ASA I + ciprofol group and the ASA I + propofol group, as well as between the ASA II + ciprofol group and the ASA II + propofol group, focusing on diastolic blood pressure (DBP) and systolic blood pressure (SBP) at T0, T1, T2, and T3 and the incidence of adverse reactions.

Statistical analysis

As this was a retrospective study with consecutive enrolment, a post-hoc power analysis was conducted using G*Power 3.1.9.7. For key outcomes, including anesthesia satisfaction (99.5% power) and respiratory depression (99.9% power), the sample size (n=200) provided power well above the 80% threshold (α= 0.05), confirming its sufficiency to detect the observed clinical differences.

For statistical analysis, SPSS 20.0 (IBM Corp., Armonk, NY, USA) was employed for data processing, while GraphPad Prism 7 (GraphPad Software Inc., San Diego, CA, USA) was used for graphical representations. Counting data were presented as frequencies and percentages [n (%)], with between-group comparisons performed using chi-square test or Fisher's exact test (if expected cell counts < 5). Normality of continuous variables was assessed using the Kolmogorov-Smirnov test. All continuous variables were normally distributed and expressed as mean ± standard deviation, with their between-group comparisons conducted using the independent samples t-test. For longitudinal comparisons of hemodynamic parameters (e.g., blood pressure at T0-T3), a two-way repeated measures ANOVA was performed. A P value of < 0.05 was considered as a statistical difference.

Results

Baseline characteristics

Statistical analysis of baseline characteristics revealed no significant differences between the two groups in terms of age and sex distribution, BMI, or hypertension history (all P > 0.05; **Table 1**).

Anesthesia-related parameters

No significant differences were observed between the propofol and ciprofol groups regarding anesthesia induction time, gastrointestinal endoscopy duration, time to recovery of orientation, and recovery time from anesthesia (all P > 0.05; **Figure 2**).

Table 1. Baseline data of enrolled individuals

	Propofol group (n=109)	Ciprofol group (n=91)	z/χ²	*P*
Age (year)	67.6±3.2	67.0±3.5	1.232	0.220
Sex			0.254	0.615
Male	56 (51.38%)	50 (54.95%)		
Female	53 (48.62%)	41 (45.05%)		
BMI	21.68±0.50	21.69±0.42	0.185	0.853
Hypertension			0.140	0.708
Yes	10 (9.17%)	7 (7.69%)		
No	99 (90.83%)	84 (92.31%)		
Diabetes mellitus			0.043	0.837
Yes	11 (10.09%)	10 (10.99%)		
No	98 (89.91%)	81 (89.01%)		
ASA classification			0.060	0.806
Class I	58 (53.21%)	50 (54.95%)		
Class II	51 (46.79%)	41 (45.05%)		
Place of residence			0.206	0.650
Urban areas	49 (44.95%)	41 (41.76%)		
Rural areas	60 (55.05%)	50 (58.24%)		

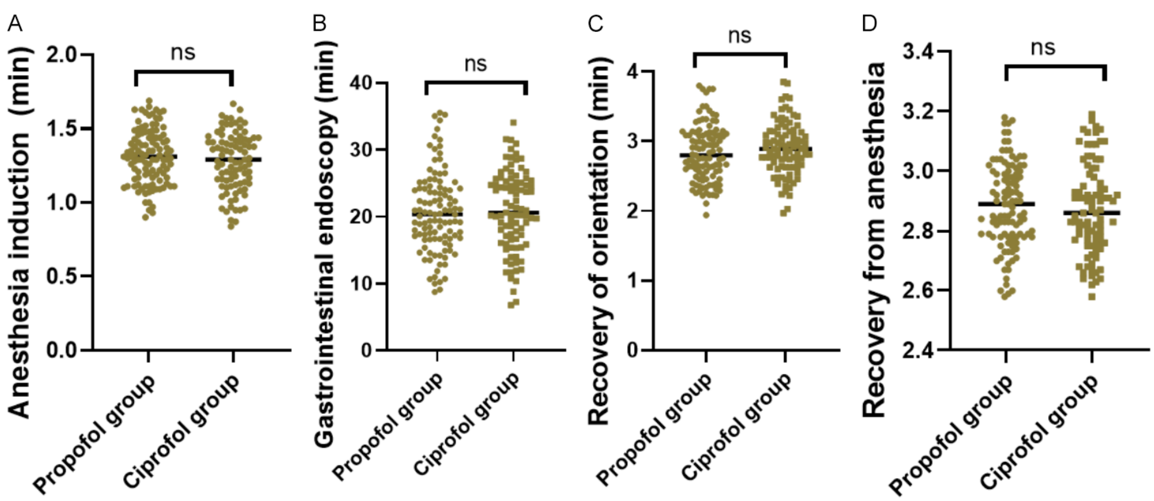

Figure 2. Comparison of anesthesia induction time (A), gastrointestinal endoscopy duration (B), time to recovery of orientation (C), and recovery time from anesthesia (D) between the two groups. Note: ns, non-significant.

Pain levels

The ciprofol group demonstrated notably lower VAS scores compared with the propofol group ($P < 0.05$; **Figure 3**).

Medication consumption

No significant differences were observed between the two groups in the consumption dosages of atropine and ephedrine (both $P > 0.05$; **Figure 4**).

Rescue medication and induction success

The requirements for rescue medication and the final anesthesia induction success were compared between the two groups. As detailed in **Table 2**, there were no significant differences in the proportion of patients requiring rescue medication, the total number of rescue doses administered, or the cumulative supplemental drug consumption between the ciprofol and propofol groups (all $P > 0.05$). The anesthesia

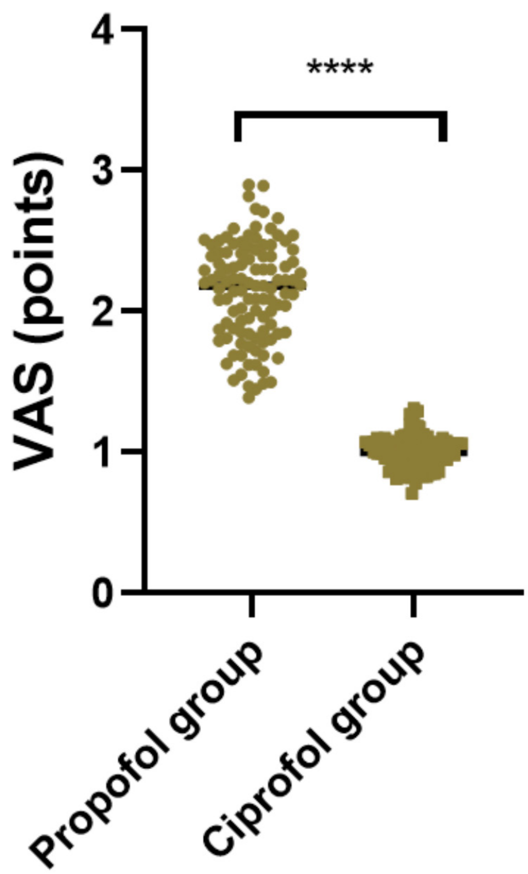

Figure 3. Comparison of VAS scores between groups. Note: VAS, visual analog scale; ****P < 0.0001.

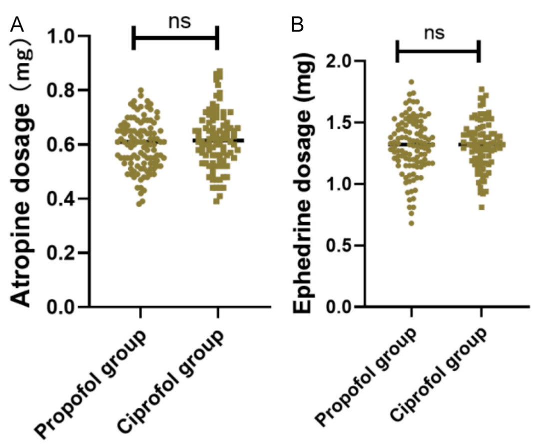

Figure 4. Comparison of atropine (A) and ephedrine (B) consumption between the two groups. Note: ns, non-significant.

induction success rate was 100% in both groups. Furthermore, the time from drug administration to successful endoscope insertion was comparable between the groups ($P > 0.05$).

Hemodynamic parameters

Compared with baseline (T0), both the propofol and ciprofol groups exhibited progressive declines in DBP and SBP from T1 to T3 (all $P < 0.05$). Two-way repeated measures ANOVA revealed significant Group × Time interactions for SBP and DBP in the overall population, as well as for all parameters in ASA I patients (all $P < 0.05$, **Table 3**). Post-hoc comparisons indicated significantly lower blood pressures in the ciprofol group at specific time points (T1 and T2 for overall; T1 and T3 for ASA I subgroup, all $P < 0.05$, **Figure 5**).

In ASA II patients, while a significant Group × Time interaction was observed for SBP ($P = 0.007$), no significant difference in the pattern of DBP change was found between groups ($P = 0.274$), although ciprofol still resulted in lower DBP and SBP values at T1 and T3 ($P < 0.05$).

Anesthesia satisfaction

The ciprofol group expressed notably higher anesthesia satisfaction (91.21%, 83/91) compared with the propofol group (71.56%, 78/109) ($P < 0.05$; **Table 4**).

Adverse events

As shown in **Table 5**, the ciprofol group demonstrated significantly lower incidences of injection pain (10.99% vs. 56.88%, $P < 0.001$) and respiratory depression (8.79% vs. 34.86%, $P < 0.001$) compared to the propofol group, with similar trends observed in ASA-stratified subgroups (ASA I: injection pain 10% vs. 56.9%, respiratory depression 8% vs. 34.48%; ASA II: injection pain 12.2% vs. 56.86%, respiratory depression 9.76% vs. 35.29%, all $P < 0.05$). No significant differences were observed in nausea/vomiting, dizziness, bradycardia, or body movement responses between groups (all $P > 0.05$).

Discussion

With the accelerated aging of the population, there is a growing demand for PGE among elderly patients [16, 17]. The selection of anesthetic agents is crucial for patient comfort, safety, and recovery quality [18]. This study compared the efficacy and safety of ciprofol versus propofol for anesthesia in elderly patients undergoing PGE.

Table 2. Comparison of rescue medication and induction characteristics

Characteristic	Propofol Group (n=109)	Ciprofol Group (n=91)	χ^2/z/t	*P*-value
Patients requiring rescue doses, n (%)	15 (13.8%)	11 (12.1%)	0.124	0.724
Total number of rescue doses, mean ± SD	0.18±0.45	0.15±0.41	-0.489	0.625
Supplemental drug consumption (% of initial dose), mean ± SD	2.1±8.0%	1.8±7.5%	-0.201	0.841
Time from drug onset to scope insertion (s), mean ± SD	125.6±25.3	122.9±23.8	0.783	0.435
Final Induction Success Rate, n (%)	109 (100%)	91 (100%)	N/A	> 0.999

Notes: Values are presented as n (%), mean ± SD, or as indicated. The test statistic column (χ^2/z/t) reports the Chi-square value (χ^2), Mann-Whitney Z value (Z), or independent samples t-value (t) as appropriate for each comparison. *P*-values > 0.05 indicate no significant difference.

Table 3. Results of two-way repeated measures ANOVA for hemodynamic parameters in the overall population and ASA subgroups

Population/Subgroup	Blood Pressure	Effect	F-value (df1, df2)	*P*-value
Overall Population	SBP	Group (Main Effect)	25.576 (1, 198)	< 0.001
		Time × Group (Interaction)	6.89 (3, 594)	< 0.001
	DBP	Group (Main Effect)	71.004 (1, 198)	< 0.001
		Time × Group (Interaction)	5.64 (3, 591)	0.001
ASA I Patients	SBP	Group (Main Effect)	37.174 (1, 90)	< 0.001
		Time × Group (Interaction)	2.89 (3, 318)	0.036
	DBP	Group (Main Effect)	33.538 (1, 106)	< 0.001
		Time × Group (Interaction)	5.06 (3, 318)	0.002
ASA II Patients	SBP	Group (Main Effect)	15.496 (1, 90)	< 0.001
		Time × Group (Interaction)	4.17 (3, 270)	0.007
	DBP	Group (Main Effect)	10.853 (1, 106)	0.001
		Time × Group (Interaction)	1.30 (3, 270)	0.274

Notes: SBP: systolic blood pressure; DBP: diastolic blood pressure; ASA: American Society of Anesthesiologists.

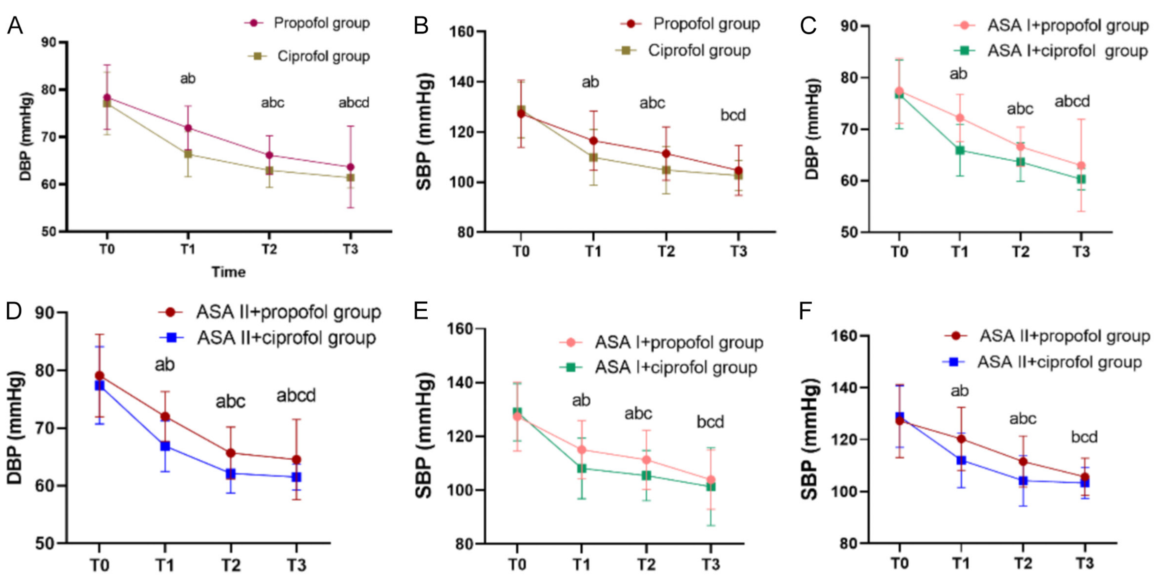

Figure 5. Comparison of DBP and SBP between groups at different procedural phases. A: Comparison of DBP between the propofol and ciprofol groups at various procedural phases; B: Comparison of SBP between the propofol and ciprofol groups at various procedural phases; C: Comparison of DBP between the ASA I + propofol and ASA I + ciprofol groups at various procedural phases; D: Comparison of DBP between the ASA II + propofol and ASA II +

ciprofol groups at various procedural phases; E: Comparison of SBP between the ASA I + propofol and ASA I + ciprofol groups at various procedural phases; F: Comparison of SBP between the ASA II + propofol and ASA II + ciprofol groups at various procedural phases; Notes: T0: upon entering the procedure room; T1: after anesthesia induction n; T2: 2 minutes after scope insertion; T3: upon leaving the procedure room; DBP: diastolic blood pressure; SBP: systolic blood pressure; ASA: American Society of Anesthesiologists. Post hoc comparisons (Sidak's test) were performed at individual time points only when a significant Group × Time interaction was found (see **Table 3**). a*P* < 0.05 *vs.* the corresponding other group at the same time point; b*P* < 0.05 *vs.* T0; c*P* < 0.05 *vs.* T1; d*P* < 0.05 *vs.* T2.

Table 4. Comparison of anesthesia satisfaction between the propofol and ciprofol groups [n (%)]

Group	Satisfied	Moderately satisfied	Dissatisfied	Satisfaction rate
Propofol group (n=109)	39 (35.78)	39 (35.78)	31 (28.44)	78 (71.56)
Ciprofol group (n=91)	49 (53.85)	34 (37.36)	8 (8.79)	83 (91.21)
χ^2				12.201
P				0.001

Table 5. Comparison of adverse reactions in elderly patients undergoing painless gastrointestinal endoscopy between groups [n (%)]

Group	Nausea and vomiting	Dizziness	Injection pain	Bradycardia	Respiratory depression	Body movement response
Propofol group (n=109)	20 (18.35)	28 (25.69)	62 (56.88)	18 (16.51)	38 (34.86)	20 (18.35)
Ciprofol group (n=91)	10 (10.99)	18 (19.78)	10 (10.99)	11 (12.09)	8 (8.79)	12 (13.19)
χ^2	2.107	0.977	45.331	0.784	19.031	0.983
P	0.147	0.323	< 0.001	0.376	< 0.001	0.321
ASA I + propofol group (n=58)	10 (17.24)	15 (25.86)	33 (56.90)	10 (17.24)	20 (34.48)	11 (18.97)
ASA I + ciprofol group (n=50)	5 (10.00)	10 (20.00)	5 (10.00)	6 (12.00)	4 (8.00)	6 (12.00)
χ^2	1.177	0.519	25.901	0.585	18.321	0.982
P	0.2779	0.4714	< 0.001	0.445	< 0.001	0.322
ASA II + propofol group (n=51)	10 (19.61)	13 (25.49)	29 (56.86)	8 (15.69)	18 (35.29)	9 (17.65)
ASA II + ciprofol group (n=41)	5 (12.20)	8 (19.51)	5 (12.20)	5 (12.20)	4 (9.76)	6 (14.63)
χ^2	0.9152	0.049	19.461	0.228	8.147	0.151
P	0.339	0.826	< 0.001	0.633	0.004	0.698

Note: ASA: American Society of Anesthesiologists.

Through comparative analysis of their clinical effects, ciprofol demonstrated significant advantages over propofol across multiple key indices. In our study, the ciprofol group showed notably lower incidence rates of both injection pain and respiratory depression compared to the propofol group and also achieved a substantially higher anesthesia satisfaction rate compared to the propofol group. The markedly reduced injection pain with ciprofol is consistent with the findings from a recent meta-analysis by Akhtar et al. [19], which demonstrated a significantly lower incidence of injection pain compared to propofol. These results can be primarily attributed to its different solvent formulation (medium/long-chain triglyceride emulsion) compared to the soybean oil-based solvent of propofol, which is known to activate the kallikrein-kinin system and cause pain [20]. Furthermore, consistent with the lower incidence of injection pain, VAS scores were notably lower in the ciprofol group than in the propofol group. These findings align with the randomized controlled trial (RCT) results acquired by Gao et al. [21] where ciprofol substantially reduced the incidences of injection pain and respiratory depression, while achieving higher patient satisfaction scores. The results suggest a potentially weaker suppression on breathing, possibly due to its more selective binding affinity or modulation of GABA_A receptor subtypes involved in respiratory regulation [22]. Additionally, Ortegal et al. [23] demonstrated that ciprofol provided comparable clinical efficacy to propofol for adult sedation during gastrointestinal endoscopy but with superior patient satisfaction ratings. An analysis of 6 RCTs involving 712 patients conducted by Ainiwaer et al. [24] also confirmed significantly lower injection pain incidence in the ciprofol group versus propofol group. These consistent findings robustly demonstrate the dual advantages of ciprofol: effectively reducing propofol-associated adverse effects while substantially enhancing patient anesthesia experience and acceptance, thereby providing strong evidence-based support for the superior clinical profile of ciprofol in PGE.

Moreover, this study revealed no notable differences between the propofol and ciprofol groups in key anesthesia efficacy indices, including anesthesia induction time, gastrointestinal endoscopy duration, time to recovery of orientation, and recovery time from anesthesia, with comparable requirements for rescue medication and induction success rates between groups, demonstrating that ciprofol maintains comparable anesthetic efficacy to propofol. These findings provide important evidence for clinical anesthetic selection, particularly suggesting ciprofol as a preferable choice for elderly patients. The superior performance of ciprofol may be attributed to its unique pharmacological properties. As a novel GABA receptor agonist, ciprofol shares core structural similarities with propofol but exhibits higher GABA receptor affinity, enabling ideal anesthetic effects at lower doses and consequently reducing drug-related adverse events [25, 26]. Additionally, a weaker inhibitory effect of ciprofol on the respiratory system likely explains its lower incidence of respiratory depression [27]. These pharmacological characteristics make ciprofol particularly suitable for elderly patients who often present with multisystem functional decline and reduced tolerance to anesthetics [28].

Regarding hemodynamic stability, this study revealed that while both ciprofol and propofol groups exhibited progressive decreases in blood pressure during post-induction periods (T1-T3), significant Group × Time interactions indicated differential patterns of change. Specifically, post-hoc comparisons showed that both ASA I and II patients receiving ciprofol had significantly lower DBP, SBP, and MAP at T1 and T3 compared to their propofol counterparts. It is noteworthy, however, that the overall pattern of DBP change in ASA II patients did not differ significantly between groups. These findings are consistent with the known cardiovascular depressive effects of general anesthetics [29]. While propofol reduces blood pressure through sympathetic inhibition and direct vasodilation, the observed effects of ciprofol in our elderly cohort suggest potential impacts on vascular tone or autonomic regulation. However, one study by Chen et al. [30] found ciprofol caused less hemodynamic fluctuation. This discrepancy may be attributable to our exclusive elderly cohort, as older adults' diminished baroreceptor reflexes may render them particularly sensitive [31]. Thus, ciprofol may exert more pronounced effects on aged vascular systems, necessitating vigilant blood pressure monitoring. Nevertheless, the study detected no statistically significant differences in emergency medication usage between groups.

Despite these encouraging findings, several limitations should be noted in this research. Its single-center, retrospective design and the exclusion of high-risk (ASA III+) patients limit the generalizability of our results. Furthermore, the interaction between anesthetic-induced blood pressure changes and key comorbidities such as hypertension were not analyzed, which is critical for individualized care. Additionally, the lack of follow-up data on postoperative cognitive function represents a significant gap. This omission precludes any assessment of postoperative cognitive dysfunction (POCD), a key safety concern in the elderly, and limits our understanding of the potential neurocognitive impact of the observed hemodynamic differences between anesthetics. Finally, anesthesia depth was managed clinically without objective monitoring (e.g., Bispectral Index) to detect transient fluctuations. Given these limitations, future multicenter RCTs with extended follow-up, systematic assessment of cognitive function using standardized tools at serial time points, and incorporation of objective depth-of-anesthesia monitoring are needed to comprehensively evaluate ciprofol in high-risk populations.

Conclusion

For elderly patients undergoing PGE, ciprofol effectively alleviates injection pain and improves patient satisfaction, making it a promising and viable anesthetic alternative to propofol, particularly for elderly patients in whom minimizing injection pain and respiratory depression is a priority. However, clinical application should be tailored to individual patient characteristics with adequate monitoring and emergency preparedness.

Disclosure of conflict of interest

None.

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References

[1] Wang G, Zhen B, Li JJ, Jin CN, Jia J, Liu BH and Bai YH. Insights into anesthesia administration for elderly individuals undergoing painless gastroenteroscopy: a bibliometric study. World J Gastrointest Endosc 2025; 17: 101382.

[2] Chai N. Gastrointestinal endoscopy. Vet Clin North Am Exot Anim Pract 2025; 28: 331-345.

[3] Li YW, Li HJ, Li HJ, Zhao BJ, Guo XY, Feng Y, Zuo MZ, Yu YP, Kong H, Zhao Y, Huang D, Deng CM, Hu XY, Liu PF, Li Y, An HY, Zhang HY, Wang MR, Wu YF, Wang DX and Sessler DI. Delirium in older patients after combined epidural-general anesthesia or general anesthesia for major surgery: a randomized trial. Anesthesiology 2021; 135: 218-232.

[4] Liu Y, Su M, Li W, Yuan H and Yang C. Comparison of general anesthesia with endotracheal intubation, combined spinal-epidural anesthesia, and general anesthesia with laryngeal mask airway and nerve block for intertrochanteric fracture surgeries in elderly patients: a retrospective cohort study. BMC Anesthesiol 2019; 19: 230.

[5] Barbosa EC, Espírito Santo PA, Baraldo S and Meine GC. Remimazolam versus propofol for sedation in gastrointestinal endoscopic procedures: a systematic review and meta-analysis. Br J Anaesth 2024; 132: 1219-1229.

[6] Zhang W, Liu Q, Wang J and Liu L. Anaesthesia and brain development: a review of propofol-induced neurotoxicity in pediatric populations. J Dev Orig Health Dis 2024; 15, e2.

[7] Teng Y, Ou MC, Wang X, Zhang WS, Liu X, Liang Y, Zuo YX, Zhu T, Liu B and Liu J. Pharmacokinetic and pharmacodynamic properties of ciprofol emulsion in Chinese subjects: a single center, open-label, single-arm dose-escalation phase 1 study. Am J Transl Res 2021; 13: 13791-13802.

[8] Lu M, Liu J, Wu X and Zhang Z. Ciprofol: a novel alternative to propofol in clinical intravenous anesthesia? Biomed Res Int 2023; 2023: 7443226.

[9] Wang X, Wang X, Liu J, Zuo YX, Zhu QM, Wei XC, Zou XH, Luo AL, Zhang FX, Li YL, Zheng H, Li H, Wang S, Wang DX, Guo QL, Liu CM, Wang YT, Zhu ZQ, Wang GY, Ai YQ and Xu MJ. Effects of ciprofol for the induction of general anesthesia in patients scheduled for elective surgery compared to propofol: a phase 3, multicenter, randomized, double-blind, comparative study. Eur Rev Med Pharmacol Sci 2022; 26: 1607-1617.

[10] Petkar S, Bele A, Priya V and Bawiskar D. Pharmacological insights and clinical applications of ciprofol: a narrative review. Cureus 2024; 16: e68034.

[11] Zhou R, Fu L, Liu S, Gao S, Zhao Z, Jiang W, Liu L, Ren W, Xiang D, You X, Tang C, Zhou Y, Song Y, Xie J, Xie L, Yu R, Zhang X, Zhou D, Han J, Xia L and Xiong L. Influences of propofol, ciprofol and remimazolam on dreaming during anesthesia for gastrointestinal endoscopy: a randomized double-blind parallel-design trial. Drug Des Devel Ther 2024; 18: 1907-1915.

[12] Hjermstad MJ, Fayers PM, Haugen DF, Caraceni A, Hanks GW, Loge JH, Fainsinger R, Aass N and Kaasa S. Studies comparing numerical rating scales, verbal rating scales, and visual analogue scales for assessment of pain intensity in adults: a systematic literature review. J Pain Symptom Manage 2011; 41: 1073-1093.

[13] Baroudi DN, Nofal WH and Ahmad NA. Patient satisfaction in anesthesia: a modified iowa satisfaction in anesthesia scale. Anesth Essays Res 2010; 4: 85-90.

[14] Strang J, Knight A, Baillie S, Reed K, Bogdanowicz K and Bell J. Norbuprenorphine and respiratory depression: exploratory analyses with new lyophilized buprenorphine and sublingual buprenorphine. Int J Clin Pharmacol Ther 2018; 56: 81-85.

[15] Wieling W, Kaufmann H, Claydon VE, van Wijnen VK, Harms MPM, Juraschek SP and Thijs RD. Diagnosis and treatment of orthostatic hypotension. Lancet Neurol 2022; 21: 735-746.

[16] Lim S, Cho K, Lee W, Kim J, Bang J and Ki S. Comparison of the performance of phase lag entropy and bispectral index for monitoring the depth of sedation under dexmedetomidine sedation: a prospective, observational, and non-inferiority trial. J Clin Anesth 2022; 82: 110945.

[17] Zhu Z. Efficacy and safety of remimazolam besylate and ciprofol in painless gastrointestinal endoscopy in the elderly. Acta Cir Bras 2024; 39: e399324.

[18] Dossa F, Megetto O, Yakubu M, Zhang DDQ and Baxter NN. Sedation practices for routine

gastrointestinal endoscopy: a systematic review of recommendations. BMC Gastroenterol 2021; 21: 22.

[19] Akhtar SMM, Fareed A, Ali M, Khan MS, Ali A, Mumtaz M, Kirchoff R and Asghar MS. Efficacy and safety of ciprofol compared with propofol during general anesthesia induction: a systematic review and meta-analysis of randomized controlled trials (RCT). J Clin Anesth 2024; 94: 111425.

[20] Lee JS, Kim ES, Cho KB, Park KS, Lee YJ and Lee JY. Pain intensity at injection site during esophagogastroduodenoscopy using long- and medium-chain versus long-chain triglyceride propofol: a randomized controlled double-blind study. Gut Liver 2021; 15: 562-568.

[21] Gao SH, Tang QQ, Wang CM, Guan ZY, Wang LL, Zhang J and Yan ZL. The efficacy and safety of ciprofol and propofol in patients undergoing colonoscopy: a double-blind, randomized, controlled trial. J Clin Anesth 2024; 95: 111474.

[22] Jiang J, Jiao Y, Gao P, Yin W, Zhou W, Zhang Y, Liu Y, Wen D, Wang Y, Zhou L, Yu T and Yu W. Propofol differentially induces unconsciousness and respiratory depression through distinct interactions between GABAA receptor and GABAergic neuron in corresponding nuclei. Acta Biochim Biophys Sin (Shanghai) 2021; 53: 1076-1087.

[23] Ortegal GH, Barbosa EC, Faria PC, Couto JV, Silva GC, Souza MH, Ferreira LN, Moraes VR, Campos MC and Campos LA. Ciprofol versus propofol for adult sedation in gastrointestinal endoscopic procedures: a systematic review and meta-analysis. Minerva Anestesiol 2024; 90: 1013-1021.

[24] Ainiwaer D and Jiang W. Efficacy and safety of ciprofol versus propofol for anesthesia induction in adult patients received elective surgeries: a meta-analysis. BMC Anesthesiol 2024; 24: 93.

[25] Liang P, Dai M, Wang X, Wang D, Yang M, Lin X, Zou X, Jiang K, Li Y, Wang L, Shangguan W, Ren J and He H. Efficacy and safety of ciprofol vs. propofol for the induction and maintenance of general anaesthesia: a multicentre, single-blind, randomised, parallel-group, phase 3 clinical trial. Eur J Anaesthesiol 2023; 40: 399-406.

[26] Liu Y, Yu X, Zhu D, Zeng J, Lin Q, Zang B, Chen C, Liu N, Liu X, Gao W and Guan X. Safety and efficacy of ciprofol vs. propofol for sedation in intensive care unit patients with mechanical ventilation: a multi-center, open label, randomized, phase 2 trial. Chin Med J (Engl) 2022; 135: 1043-1051.

[27] Zeng J, Cao Q, Hong A, Gu Z, Jian J and Liang X. Incidence of respiratory depression between ciprofol and propofol after anesthesia: a systematic review and meta-analysis. Medicine (Baltimore) 2024; 103: e40037.

[28] Bloch F, Karoui I, Boutalha S, Defouilloy C and Dubaele JM. Tolerability of Midazolam to treat acute agitation in elderly demented patients: a systematic review. J Clin Pharm Ther 2019; 44: 143-147.

[29] Zhang X, Wei KY and Huang D. Effect of propofol in the cardiovascular system and its related mechanism research progress. Niger J Clin Pract 2024; 27: 938-944.

[30] Chen F, Xing F, Huang J, Zhu J, Jiang Y and Li C. Effect of ciprofol compared with propofol on hemodynamics in bronchoscope procedures during anesthetic induction: a randomized double-blind controlled study. Front Med (Lausanne) 2025; 12: 1545736.

[31] Pereira EM, Moraes VR, Gaya da Costa M, Nascimento TSD, Slawka E, Júnior CG and Struys MM. Remimazolam vs. propofol for general anaesthesia in elderly patients: a meta-analysis with trial sequential analysis. Eur J Anaesthesiol 2024; 41: 738-748.