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CLINICAL TRIAL REPORT

Comparison of Ciprofol Versus Propofol for the General Anaesthesia During Gynecological Day Surgery: A Prospective, Randomized, Double-Blind, Non-Inferiority Trial

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Purpose: To compare the safety and efficacy of ciprofol and propofol in general anesthesia for gynecological day surgery.

Patients and Methods: A total of 196 patients undergoing gynecological day surgery under general anesthesia were randomly divided into ciprofol and propofol group. All patients received total intravenous anesthesia. Anesthesia induction in the ciprofol group: ciprofol 0.5 mg/kg was given intravenously within 1 minute, alfentanil 20 μg/kg was given intravenously within 30 seconds, mivacurium 0.2 mg/kg was given intravenously within 30 seconds, and anesthesia maintenance: ciprofol 1.25 mg/kg/h combined with alfentanil 40 μg/kg/h was given intravenously. Anesthesia induction in the propofol group, propofol 2 mg/kg was administered intravenously within 1 min, alfentanil 20μg/kg was given intravenously within 30s, mivacurium 0.2 mg/kg was administered intravenously within 30s, and anesthesia maintenance: propofol 5 mg/kg/h combined with alfentanil 40 μg/kg/h was administered intravenously. The primary outcome was the success rate of anesthesia (defined as the number of additional study drugs administered ≤ 2 times during anesthesia induction and ≤ 2 times within 10 min during anesthesia maintenance). The secondary outcomes included time to loss of consciousness, hemodynamic changes, depth of anesthesia at different time points, additional narcotic drugs during anesthesia, use of vasoactive agents, awakening time, and incidence of adverse reactions.

Results: The success rate of anesthesia in both groups was 100%. There was no difference in the time of consciousness disappearance between the two groups during induction (81.95 vs 79.54s). Compared with the propofol group, the hemodynamics in the ciprofol group were more stable, the depth of anesthesia was better, the number of additional medications was significantly reduced, and the incidence of postoperative adverse reactions was significantly reduced. However, the awakening time of the ciprofol group was significantly longer than that of the propofol group (7.57 vs 5.52 min).

Conclusion: Ciprofol demonstrated non-inferior efficacy to propofol for gynecological day surgery anesthesia, while offering superior hemodynamic stability and reduced adverse effects.

Keywords: ciprofol, day surgery, general anaesthesia, propofol

Introduction

Day surgery has been widely promoted in China in recent years because it can significantly shorten patients' hospital stay and reduce the risk of nosocomial infections and venous thromboembolism. It has now developed into a new and more mature mode of surgical management.[1] Gynecological day surgery is characterized by small surgical trauma, short hospitalization time, and rapid postoperative recovery, and is a common surgical modality for day surgery. As a widely used drug for clinical anesthesia, propofol has been regarded as an ideal choice because of its rapid onset of action and recovery. However, propofol also has shortcomings, such as injection pain, hemodynamic instability, and other adverse

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effects, which limit its application in specific patient groups.[2] Ciprofol is a new intravenous anesthetic drug developed in China that has the characteristics of rapid onset, high potency, and less injection pain.[3,4] This study aims to compare the safety and efficacy of ciprofol versus propofol for anesthesia in gynecological daytime surgery through a prospective, randomized, double-blind, non-inferiority trial. Key comparison metrics include the success rate of anesthesia, time to loss of consciousness, hemodynamic changes and variations in anesthetic depth (Ai, depth of anesthesia index) at different time points, additional administration of anesthetic drugs during anesthesia, use of vasoactive drugs, awakening time, and incidence of adverse reactions such as injection pain and postoperative nausea and vomiting. The findings are expected to provide new evidence for the selection of clinical anesthesia regimens.

Patients and Methods

Ethics and Registration

This study was approved by the Medical Ethics Committee of the Weifang People's Hospital (approval number: KYLL20231226-1). Registered in the Chinese Clinical Trial Registry (www.chictr.org.cn;registration number: ChiCTR2400080000), the study was conducted at Weifang People's Hospital and all enrolled patients provided signed informed consent.

Patients

This study included 212 patients who underwent gynecological day surgery under general anesthesia between January 2024 and September 2024. The inclusion criteria were as follows: American Society of Anesthesiologists (ASA) grade I–II, age between 18–65 years old, body mass index 18.5–27.9 kg/m^2. Exclude patients with a history of allergy to anesthetic drugs, severe cardiovascular or respiratory diseases, recent respiratory tract infections, pregnancy, or plans to become pregnant. If the patient was lost to follow-up or the recorded research data was incomplete during the study, the patient will be drop out of the study.

Randomization and Masking

A researcher who only participated in the randomized grouping used the random number table method to randomly assign patients to the ciprofol or propofol group in a 1:1 ratio, with 106 patients in each group. The randomization results were sealed in sequentially numbered envelopes, and the study drugs were prepared by personnel who did not participate in data collection, according to the grouping in the envelopes. Both ciprofol and propofol are white emulsions, and the volumes of the two drugs used in this study were the same; therefore, patients, anesthesiologists, and researchers responsible for postoperative follow-up and data processing did not know the grouping.

Anesthesia

The patients were routinely fasted for more than 6 hours and were not allowed to drink water for at least 2 hours before the surgery. After entering the operating room, the patients were monitored for continuous ECG, non-invasive arterial pressure, respiratory rate (RR), pulse oximetry (SpO^2), and anesthesia depth index (Ai). An upper-extremity peripheral intravenous catheter was placed, followed by an infusion of lactated Ringer's solution . Before anesthesia induction, oxygen inhalation through mask was 6 L/min, and flurbiprofen axetil 50 mg, dexamethasone 5 mg and droperidol 1 mg were intravenously injected. During anesthesia induction, 0.5 mg/kg of ciprofol was pumped intravenously with a syringe pump for a limited period of 1 minute in the propofol group, and 2 mg/kg of propofol was pumped intravenously with a syringe pump for a limited period of 1 minute in the propofol group (both in a volume of 0.2 mL/kg). The patient's sedation level was assessed using the Modified Observer's Assessment of Alertness/Sedation (MOAA/S) scale 30s after initiating drug administration and then reassessed every 5 s until the MOAA/S≤1. If the patient did not fall asleep after 2 min, administer ciprofol 0.25 mg/kg or propofol 1 mg/kg was administered. If still awake, an additional dose was administered 1 min after the additional dose. If the patient failed to fall asleep after two supplemental doses, induction failure was considered; switch to alternative anesthetic agents for induction assistance. After the patient fell asleep, intravenous administer alfentanil 20μg/kg within 30 seconds and mivacurium 0.2 mg/kg within 30 seconds, insert the

laryngeal mask after 2 minutes. Mechanical ventilation was set to volume-controlled ventilation mode, with a tidal volume of 6–8 mL/kg, a respiratory rate of 12 breaths per minute, and an inspiratory-to-expiratory ratio of 1:2.

During anesthesia maintenance, in the ciprofol group, 1.25 mg/kg/h of ciprofol and 40μg/kg/h of alfentanil were injected intravenously; 5 mg/kg/h of propofol and 40μg/kg/h of alfentanil were injected intravenously to maintain the depth of the anesthesia index (Ai) between 40–60. When the patient showed signs of inadequate anesthesia, such as somatic movement during anesthesia, additional intravenous ciprofol 0.25 mg/kg or propofol (1 mg/kg) was administered, and anesthesia maintenance was considered to have failed if more than two additional doses were administered within 10 min. Norepinephrine was administered when blood pressure dropped more than 30% of the basal blood pressure, and atropine was administered when the heart rate was less than 50 beats per minute (bpm). Anesthesia maintenance medication was discontinued at the end of the surgery, and the laryngeal mask was removed after the patient awoke and sent to the post-anesthesia care unit (PACU). The patient will be transferred to the general ward after meeting the PACU discharge criteria and can leave the hospital with family members once the discharge criteria are met. A follow-up questionnaire survey will be conducted within 24–48h after discharge, which mainly includes whether they have postoperative pain, whether they have taken painkillers, whether they have nausea and vomiting, and whether they were satisfied with anesthesia.

The patients' vital signs were recorded at the following time points: after the patient was admitted to the room (T0), at the beginning of anesthesia (T1), before the laryngeal mask was inserted (T2), after the insertion and fixation of the laryngeal mask (T3), at the beginning of the surgery (T4), 5 minutes after the start of the surgery (T5), 10 min after the start of the surgery (T6), 15 minutes after the start of the surgery (T7), at the end of the surgery when anesthesia was discontinued (T8), and 1 min after the removal of the laryngeal mask (T9) (Table 1).

Outcomes

The primary outcome was the success rate of anesthesia (defined as the number of additional study drugs administered ≤ 2 times during anesthesia induction and ≤ 2 times within 10 min during anesthesia maintenance).

The secondary outcomes included time to loss of consciousness, hemodynamic changes, depth of anesthesia at different time points, additional narcotic drugs during anesthesia, use of vasoactive agents, awakening time, and incidence of adverse reactions, such as injection pain (we asked patients if they feel pain in their arms when the study drug was injected, and if so, whether the pain was mild or severe) and postoperative nausea and vomiting (follow up through a survey questionnaire).

Sample Size and Statistical Analysis

In this study, the sample size estimation was based on the primary outcome measure, the anesthesia success rate, and the sample size was calculated using the sample size of a non-inferiority trial, assuming a 96% anesthesia success rate for both propofol and ciprofol, with a non-inferiority margin of 8%, power of 80%, one-sided α of 2.5%, and total sample size of 190. Assuming a dropout rate of 10%, 212 patients (106 patients per group) were recruited.

Statistical analyses were performed using SPSS Statistics version 25.0. The Kolmogorov–Smirnov test was used to determine whether the continuous variables were normally distributed. Normally distributed continuous variables were

Table 1 Time Points

Timing	Event
T0	After the patient was admitted to the room
T1	At the beginning of anesthesia
T2	Before the laryngeal mask was inserted
T3	After the insertion and fixation of the laryngeal mask
T4	At the beginning of the surgery
T5	5 minutes after the start of the surgery
T6	10 min after the start of the surgery
T7	15 minutes after the start of the surgery
T8	At the end of the surgery when anesthesia was discontinued
T9	1 min after the removal of the laryngeal mask

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expressed as mean±standard deviation, and the data were analyzed using independent samples *t*-test. Non-normally distributed continuous variables were presented as median (interquartile range). The Mann–Whitney *U*-test was used to analyze non-normally distributed continuous variables. Categorical variables were expressed as frequency (percentage) and analyzed using Pearson's chi-square test. $P<0.05$ was considered statistically significant.

Results

Demographic Data and Surgical Characteristics

A total of 212 patients were enrolled in this study, including two patients with incomplete data records and five patients lost to follow-up in the ciprofol group and three patients with incomplete data records and six patients lost to follow-up in the propofol group; 196 patients were ultimately included in the statistical analysis (Figure 1). The final sample size was aligned with the pre-specified statistical power requirements, and there were no statistically significant differences in age, height, weight, body mass index (BMI), ASA physical status classification, type of surgery, or duration of anesthesia (Table 2).

Primary Outcome

The success rate of anesthesia was 100% in both groups, and the success rate of ciprofol was non-inferior to that of propofol (Table 3).

Secondary Outcomes

There was no statistically significant difference between the two groups in terms of time to loss of consciousness (Table 3).

In terms of hemodynamics, there was no statistically significant difference between the baseline blood pressure and heart rate of the two groups, and the trends of intraoperative changes in vital signs, such as blood pressure, heart rate, and Ai, were similar. The systolic and mean arterial pressures in the propofol group were significantly lower than those in the ciprofol group at T2, and the systolic, diastolic, and mean arterial pressures were significantly lower than those in the

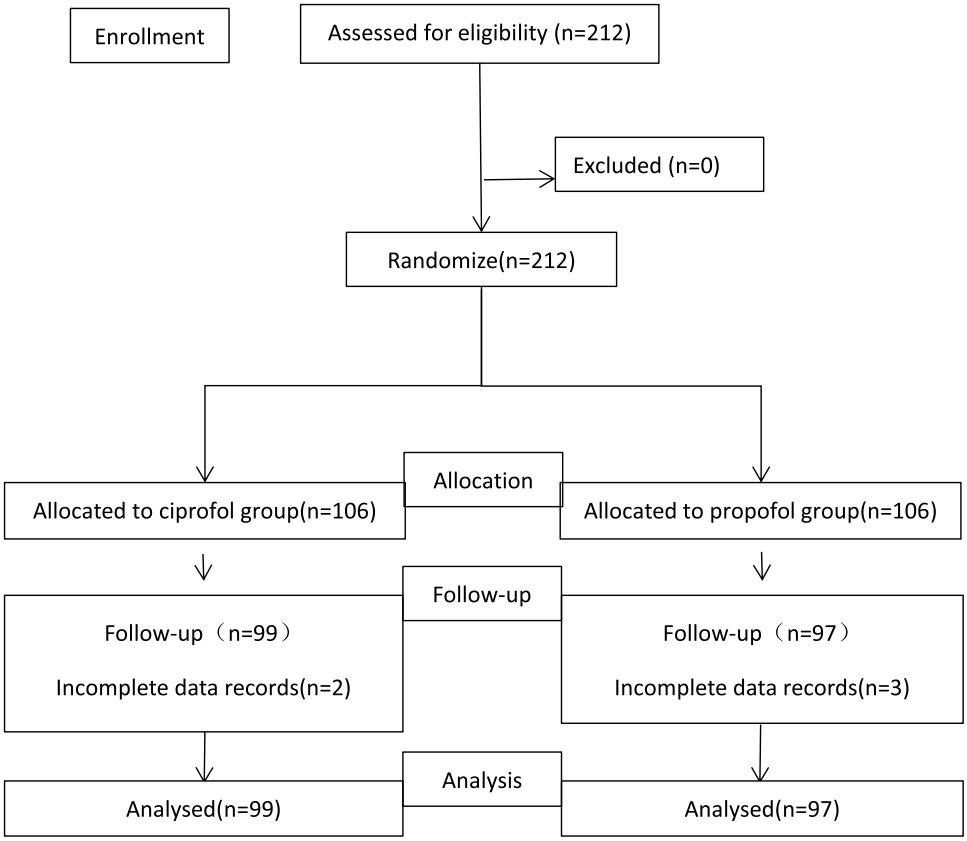

Figure 1 Flow diagram of the study.

Table 2 Comparison of the General Situation of the Two Groups of Patients

	Group Ciprofol	Group Propofol	*P*
Age(years)	43.22±8.673	42.57±9.165	0.608
Height(cm)	162.40±5.579	161.21±5.695	0.139
Weight(kg)	60.54±6.598	59.83±6.889	0.446
BMI(kg/m^2)	23.94±2.075	23.00±2.174	0.837
ASA			
I	15 (15.2%)	12 (12.4%)	0.572
II	84 (84.8%)	85 (87.6%)	
Type of surgery			
Hysteroscopy	88 (88.9%)	90 (92.8%)	0.345
Cervical Conization	11 (11.1%)	7 (7.2%)	
Duration of anesthesia (min)	21.15±9.136	21.35±7.965	0.869

Notes: Data are presented as the mean ± standard deviation or n(%). Data of frequency-(percentage) are analyzed using Pearson's chi-square test. The other data are compared between groups using independent samples *t*-test.

Table 3 Outcomes

	Ciprofol	Propofol	*P*
The success rate of anesthesia (n, %)	99(100%)	97(100%)	1.000
Time to loss of consciousness (S)	81.95±17.534	79.54±14.612	0.297
Awakening time (min)	7.57±2.031	5.52±2.089	0.000
Additional drugs for induction of anesthesia			
Yes	1(1.0%)	0(0%)	1.000
No	98(99.0%)	97(100%)	
Additional drugs for anesthesia maintenance			
Yes	1(1.0%)	10(10.3%)	0.005
No	98(99.0%)	87(89.7%)	
Incidence of injection pain			
No	98(99.0%)	26(26.8%)	0.000
Mild pain	1(1.0%)	53(56.4%)	
Severe pain	0(0.0%)	18(18.6%)	
Postoperative nausea and vomiting			
No	85(85.9%)	78(80.4%)	0.282
Mild nausea, but no vomiting	11(11.1%)	17(17.5%)	
Significant nausea and vomiting	1(1%)	2(2.1%)	
Severe vomiting	2(2.0%)	0(0.0%)	
Use of vasoactive drugs			
No	86(86.9%)	70(72.2%)	0.013
Yes	12(13.1%)	27(27.8%)	

Notes: Data are presented as the mean ± standard deviation or n(%). Data of frequency(percentage) are analyzed using Pearson's chi-square test. The other data are compared between groups using independent samples *t*-test.

ciprofol group at T3, T4, T5, T8, and T9 ($P<0.05$). Heart rates at T5, T6, and T8 were significantly lower in the ciprofol group than in the propofol group ($P<0.05$) (Figure 2).

The Ai of patients in the ciprofol group was significantly lower than that of patients in the propofol group at T3-T6, T8 and T9, and the difference was statistically significant ($P<0.05$) (Figure 2).

There were no statistically significant differences between the two groups in the number of cases requiring additional medication during induction of anesthesia; however, during maintenance of anesthesia, there were more cases requiring

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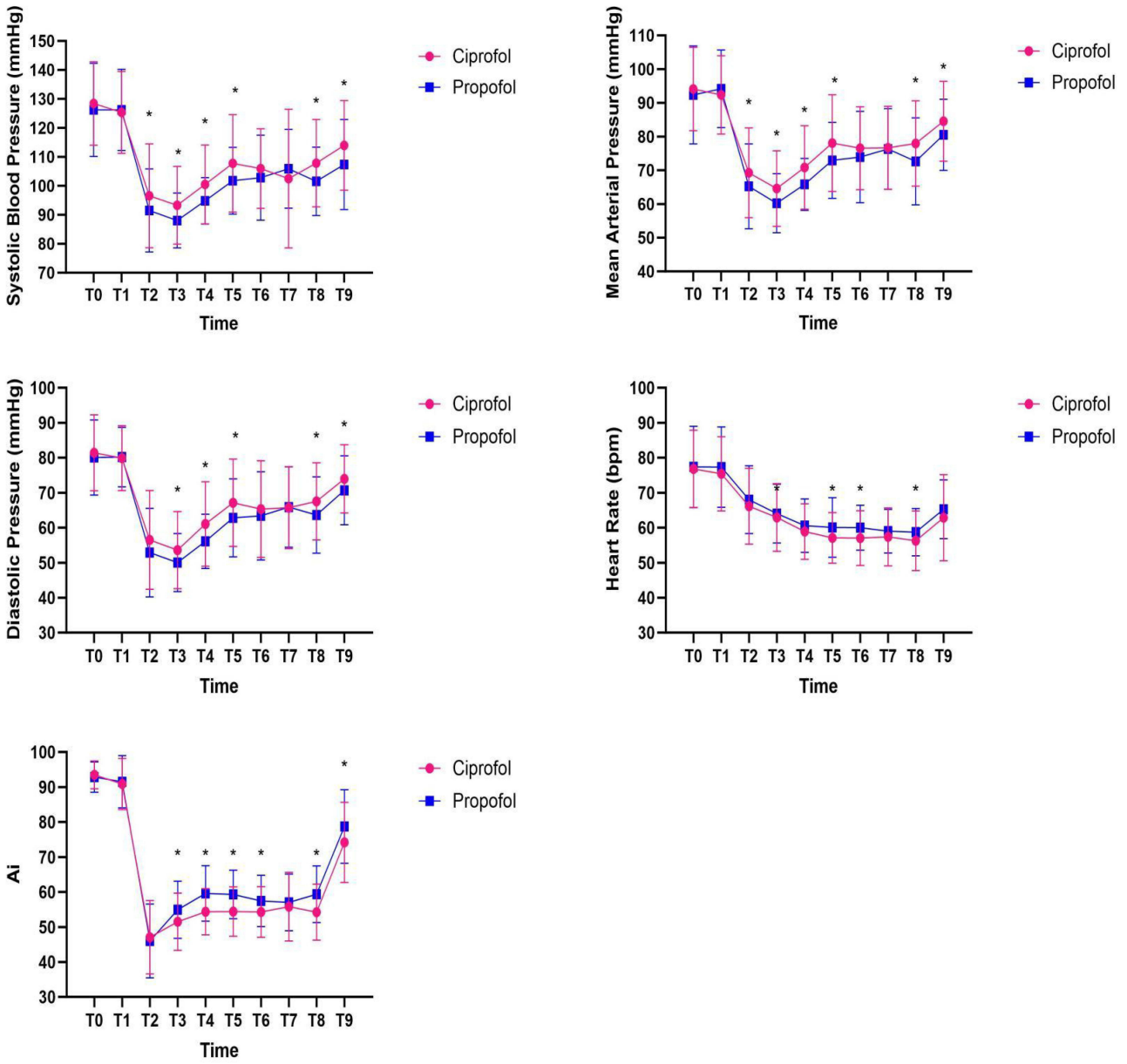

Figure 2 Changes in blood pressure, heart rate, and Ai at different time points during the patient's perioperative period. *P<0.05.

additional medication in the propofol group than in the ciprofol group, and the difference was statistically significant (P<0.05), but none of them exceeded 2 times in 10 min (Table 3).

Since patients in the propofol group had lower blood pressure than those in the ciprofol group during anesthesia, more patients in the propofol group required vasoactive drugs, with a statistically significant difference (P<0.05) (Table 3).

The awakening time of patients in the ciprofol group was significantly longer than that of patients in the propofol group, and the difference was statistically significant (P<0.05) (Table 3).

Regarding adverse effects, the incidence of injection pain in the ciprofol group was significantly lower than that in the propofol group, with a statistical difference (P<0.05). There was no statistically significant difference in the incidence of nausea and vomiting between the two groups (Table 3).

Discussion

Ciprofol is a short acting GABAA receptor agonist. Structural modification of propofol through the introduction of a cyclopropyl group creates a chiral center, enhancing steric effects that improve its binding affinity to GABAA receptors.[3,4] Its mechanism of action involves potentiating GABA-mediated chloride ion influx to induce sedation or anesthesia.[3,5,6]

In this study, we systematically compared the clinical efficacy of ciprofol with propofol under general anesthesia for gynecologic day surgery using a prospective, randomized, double-blind, and non-inferiority trial design, which showed that the success rate of anesthesia with ciprofol during gynecological day surgery was non-inferior to that of propofol, the hemodynamics in the ciprofol group were more stable, and the incidence of injection pain was lower, which is consistent with the results of previous studies.[7]

In this study, the time to loss of consciousness was comparable between patients in the propofol and ciprofol groups, as a positive allosteric regulator of the GABAA receptor, ciprofol can enhance the chloride ion influx mediated by GABA, cause neuronal hyperpolarization, inhibit central excitability, and thus achieve the role of rapid induction of sedation or anesthesia. Optimizing the structure can enhance the binding capacity of the GABAA receptor with a potency of about 4–5 times that of propofol. Combined with the characteristics of rapid distribution in the brain and efficient metabolism, it achieves the same speed of action as propofol.[8] However, in this study, patients in the ciprofol group took longer to awaken than those in the propofol group, which was different from the results of some previous studies,[7,9] consistent with the results of a Phase III clinical trial on ciprofol[10] and a meta-analysis[11] results. The longer time to awakening in patients in the ciprofol group may be related to the higher binding of ciprofol to plasma proteins, which is 99%,[8] and lower free drug concentrations, resulting in a prolonged elimination half-life. Although the time to awakening was prolonged in the ciprofol group compared to that in the propofol group, the awakening times were within the clinically acceptable range, did not affect the time to discharge of the patients, and no adverse events related to delayed awakening were observed, which was of no practical clinical significance.

During the induction of anesthesia in this study, only one patient in the ciprofol group received additional medication once, and there was no statistical difference in the additional medication between the two groups. During anesthesia maintenance, the number of patients in the propofol group who required additional medication was higher than that in the ciprofol group, and the difference was statistically significant; therefore, the maintenance of anesthesia with ciprofol was more stable The Ai of patients in the ciprofol group was lower than that in the propofol group atT3-T6,T8, and T9, suggesting that the anesthetic effect of ciprofol was better than that of propofol, which is consistent with previous studies[12] and may be related to the higher potency of ciprofol than propofol.

In the present study, with consistent baseline blood pressure, the propofol group had significantly lower blood pressure than the ciprofol group at some time points during anesthesia and a higher rate of application of vasoactive medication, suggesting that ciprofol provides better anesthesia with a milder effect on blood pressure, more stable hemodynamics during anesthesia, and a higher safety profile, which is consistent with previous studies.[12] Intraoperative mean arterial pressure <60-70 mmHg or systolic blood pressure <90-100 mmHg is associated with acute kidney injury, myocardial injury, and cardio-machine infarction, increasing postoperative complications and mortality.[13] Injury is related to the severity and duration of hypotension. The use of propofol during anesthesia may lower intraoperative blood pressure in patients through the following mechanisms: by acting on protein kinase C (PKC), it leads to a decrease in the concentration of free Ca^{2+} in myocardial cells, thereby weakening myocardial contractility; By reducing sympathetic nervous system activity, it leads to vasodilation and a decrease in blood pressure;[14,15] Directly inhibiting vascular smooth muscle tension, causing peripheral vascular dilation; By dilating peripheral blood vessels to reduce venous return and decrease cardiac preload, further reducing cardiac output.[16] The structure of ciprofol is similar to that of propofol, which may lead to the decrease of blood pressure through a similar way. However, ciprofol may have a higher selectivity for GABAA receptors owing to the optimization of its structure, which reduces its direct inhibition on the heart and peripheral blood vessels; thus, it has less impact on hemodynamic fluctuations and shows more stable hemodynamic characteristics. However, the specific molecular mechanisms involved require further investigation.

In terms of adverse reactions, the incidence of injection pain in the ciprofol group was significantly lower than that in the propofol group. Injection pain is one of the most common adverse reactions of propofol and its incidence has been reported to be as high as nearly 70%.[17] It was previously believed that injection pain produced by propofol is attributable to the absolute drug concentration in the aquatic phase[18] and is affected by factors such as injection site and injection speed.[16]

Injection pain causes discomfort, increases pain and tension, and decreases patient satisfaction, whereas the higher potency of ciprofol and lower drug concentration in the aquatic phase results in a subsequent decrease in the incidence of injection pain.[19] It has also been suggested that ciprofol is the introduction of cyclopropyl group in its chemical structure, which improves the pharmacological and physicochemical properties of propofol, thus reducing injection pain.[3,4] In this study, there was no difference in the incidence of postoperative nausea and vomiting between the ciprofol group and the propofol group. It was previously believed that propofol could reduce the incidence of nausea and vomiting after surgery by enhancing the GABAA receptor activity and inhibiting the central vomiting reflex. Ciprofol has a stronger affinity for GABAA receptors than propofol, and may inhibit the vomiting reflex through more efficient central sedation.

There are some limitations in this study. First, this study was conducted in patients with ASA I–II, and further studies are needed to determine whether the same results can be obtained in patients with ASA III–IV patients. Second, general anesthesia was used in this study and the effect of ciprofol on respiratory function was not studied. Third, this study is a single-center study and requires further research with multiple centers and larger sample sizes.

Conclusion

Ciprofol demonstrated non-inferior efficacy to propofol for gynecological day surgery anesthesia, while offering superior hemodynamic stability and reduced adverse effects.

Data Sharing Statement

The datasets generated in this study are available from the corresponding author (Fanceng Ji, Email: jifanceng@163.com) upon reasonable request.

Ethics Approval

This study was approved by the Medical Ethics Committee of the Weifang People's Hospital (approval number: KYLL20231226-1). Registered in the Chinese Clinical Trial Registry (www.chictr.org.cn;registration number: ChiCTR2400080000), the study was conducted at Weifang People's Hospital and all enrolled patients provided signed informed consent. This study was conducted in accordance with the principles of the Declaration of Helsinki. The study protocol followed the CONSORT guidelines.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no conflicts of interest.

References

1. Bailey CR, Ahuja M, Bartholomew K, et al. Guidelines for day-case surgery 2019: guidelines from the association of anaesthetists and the British association of day surgery. *Anaesthesia*. 2019;74(6):778–792. doi:10.1111/anae.14639
2. Marik PE. Propofol: therapeutic indications and side-effects. *Curr Pharm Des*. 2004;10(29):3639–3649. doi:10.2174/1381612043382846
3. Qin L, Ren L, Wan S, et al. Design, synthesis, and evaluation of novel 2,6-disubstituted phenol derivatives as general anesthetics. *J Med Chem*. 2017;60(9):3606–3617. doi:10.1021/acs.jmedchem.7b00254
4. Teng Y, Ou M, Wang X, et al. Efficacy and safety of ciprofol for the sedation/anesthesia in patients undergoing colonoscopy: phase IIa and IIb multi-center clinical trials. *Eur J Pharm Sci*. 2021;164:105904. doi:10.1016/j.ejps.2021.105904
5. Bian Y, Zhang H, Ma S, et al. Mass balance, pharmacokinetics and pharmacodynamics of intravenous HSK3486, a novel anaesthetic, administered to healthy subjects. *Br J Clin Pharmacol*. 2020;87(1):93–105. doi:10.1111/bcp.14363

6. Liao J, Li M, Huang C, et al. Pharmacodynamics and pharmacokinetics of HSK3486, a novel 2,6-disubstituted phenol derivative as a general anesthetic. *Front Pharmacol*. 2022;13:830791. doi:10.3389/fphar.2022.830791
7. Lan HY, Shan WF, Wu YN, et al. Efficacy and safety of ciprofol for sedation/anesthesia in patients undergoing hysteroscopy: a randomized, parallel-group, controlled trial. *Drug Des Devel Ther*. 2023;17:1707–1717. doi:10.2147/DDDT.S414243
8. Liu J, Wang DX, Luo Z, et al. Guidelines on clinical application of ciprofol. *Chin J Anesthesiol*. 2021;41(2):4. doi:10.3760/cma.j.cn131073.20201011.00201
9. Man Y, Xiao HY, Zhu T, et al. Study on the effectiveness and safety of ciprofol in anesthesia in gynecological day surgery: a randomized double-blind controlled study. *BMC Anesthesiol*. 2023;23(1). doi:10.1186/s12871-023-02051-x
10. Li JX, Wang X, Liu J, et al. Comparison of ciprofol (HSK3486) versus propofol for the induction of deep sedation during gastroscopy and colonoscopy procedures: a multi-center, non-inferiority, randomized, controlled Phase 3 clinical trial. *Basic Clin Physiol Pharmacol*. 2022;131(2):138–148. doi:10.1111/bcpt.13761
11. Hung KC, Chen JY, Wu SC, et al. A systematic review and meta-analysis comparing the efficacy and safety of ciprofol (HSK3486) versus propofol for anesthetic induction and non-ICU sedation. *Front Pharmacol*. 2023;14:12. doi:10.3389/fphar.2023.1225288
12. Chen BZ, Yin XY, Jiang LH, et al. The efficacy and safety of ciprofol use for the induction of general anesthesia in patients undergoing gynecological surgery: a prospective randomized controlled study. *BMC Anesthesiol*. 2022;22(1):1–7. doi:10.1186/s12871-022-01782-7
13. Saugel B, Fletcher N, Gan JT, et al. PeriOperative quality initiative (POQI) international consensus statement on perioperative arterial pressure management. *Br J Anaesth*. 2024;133(2):264–276. doi:10.1016/j.bja.2024.04.046
14. Ebert TJ, Muzi M, Berens R, et al. Sympathetic responses to induction of anesthesia in humans with propofol or etomidate. *Anesthesiology*. 1992;76(5):725–733. doi:10.1097/00000542-199205000-00010
15. Coet Zee A, Fourie P, Coetzee J, et al. Effect of various propofol plasma concentrations on regional myocardial contractility and left ventricular afterload. *Anesthesia Analg*. 1989;69(4):473. doi:10.1213/00000539-198910000-00009
16. Boer F, Ros P, Bovill JG, et al. Effect of propofol on peripheral vascular resistance during cardiopulmonary bypass. *Br J Anaesth*. 1990;65(2):184–189. doi:10.1093/bja/65.2.184
17. Bakhtiari E, Mousavi SH, Fard MG. Pharmacological control of pain during propofol injection: a systematic review and meta-analysis. *Expert Rev Clin Pharmacol*. 2021;14(7):889–899. doi:10.1080/17512433.2021.1919084
18. Bachmannmennenga B, Ohlmer A, Boedeker R, et al. Preventing pain during injection of propofol: effects of a new emulsion with lidocaine addition. *Reg Anesth Pain Med*. 2006;31(5). doi:10.1016/j.rapm.2006.06.192
19. Zhu Q, Luo Z, Wang X, et al. Efficacy and safety of ciprofol versus propofol for the induction of anesthesia in adult patients: a multicenter phase 2a clinical trial. *Int J Clin Pharm*. 2023;45(2):473–482. doi:10.1007/s11096-022-01529-x