Objective. To investigate the anesthesia effect of remifentanil combined with propofol for laparoscopic cholecystectomy and its impact on postoperative cognitive recovery.

Methods. A total of 120 patients who underwent laparoscopic cholecystectomy in our hospital from February 2019 to June 2021 were recruited and assigned into either control group or experimental group at a ratio of 1:1 via the random number table method. The patients in the control group were anesthetized with fentanyl combined with propofol, and the patients in the experimental group were anesthetized with remifentanil combined with propofol. The clinical basic indicators (extubation time, recovery time, breathing recovery time, and orientation recovery time), and observer’s assessment of awareness/sedation (OAA/S) scores and complications were compared between the two groups.

Results. There was no significant difference in extubation time between the two groups (P > 0.05). The postoperative wake-up time, respiratory recovery time, and orientation recovery time of the experimental group were significantly better than those of the control group (P < 0.05). The OAA/S scores of the patients in the experimental group were significantly higher than those in the control group immediately after surgery, 1h after surgery, and 3h after surgery (P < 0.05). There was no significant difference in the OAA/S scores between the two groups on the 1st day after operation (P > 0.05). The incidence of complications in the experimental group was significantly lower than that in the control group (P < 0.05). Conclusion. Remifentanil + propofol for laparoscopic cholecystectomy patients has a significant anesthesia effect. This strategy effectively shortens the extubation, awakening, respiratory recovery, orientation recovery time of patients, and OAA/S score, suggest a minor impact on the postoperative cognitive function and state of consciousness. It has a high safety profile and thus is worthy of clinical application.
support of the above finding, Li et al. revealed an association between anesthesia factors and the occurrence of postoperative cognitive dysfunction [7]. The principal objective of this study was to investigate the impact of remifentanil plus propofol in laparoscopic cholecystectomy on anesthesia and postoperative cognitive recovery.

2. Materials and Methods

2.1. Participants. A total of 120 patients who underwent laparoscopic cholecystectomy in our hospital from February 2019 to June 2021 were recruited and assigned to either the control group or experimental group at a ratio of 1:1 via the random number table method. The control group included 37 males and 23 females; aged 60–81 years, mean age (69.28 ± 5.32) years; course of disease 1–3 years, mean course of disease (2.31 ± 0.46) years; ASA classification: 41 cases of grade I, 19 cases of grade II. In the experimental group, there were 39 males and 21 females; aged 60–80 years, with an average age of (69.17 ± 5.30) years; the course of the disease was 1–4 years, with an average course of (2.39 ± 0.52) years; ASA classification: 40 cases were grade I and 20 were grade II. This study has been approved by the Clinical Trial Ethics Committee of our hospital prior to the enrollment, and all patients and their families voluntarily participated in this study.

2.2. Inclusion and Exclusion Criteria. Inclusion criteria: (1) the patients had good compliance; (2) the patients have not received other surgery or anesthesia in recent years. Exclusion criteria: (1) patients with other organ diseases; (2) patients who are allergic to the study drug; (3) patients with communication disorders.

2.3. Methods of Anesthesia. Twenty minutes before surgery, 0.1 g of phenobarbital + 0.5 mg of atropine were intramuscularly injected into the two groups. After the patient entered the operating room, their vital signs were closely monitored, they were given mask oxygen, and intravenous access was established. The patients in the control group were anesthetized with fentanyl combined with propofol. The essence is intravenous injection of propofol 1.3 mg/kg + fentanyl 3.5 μg/kg + atracurium cissulfonate 0.5 mg/kg. They were then intubated and mechanically ventilated. Fentanyl 2.5 μg/kg was administered intravenously to the patient 2 min before the surgical procedure. During the operation, anesthesia was maintained with 40 μg/kg/min of propofol, and the propofol was stopped after the surgical treatment [8]. The patients in the experimental group were anesthetized with remifentanil combined with propofol. The essence is intravenous injection of propofol 1.3 mg/kg + remifentanil 2 μg/kg + atracurium cissulfonate 0.5 mg/kg. They were then intubated and mechanically ventilated. During the operation, 40 μg/kg/min of propofol and 0.4 μg/kg/min of remifentanil were used to maintain anesthesia, and the remifentanil and propofol were stopped after the surgical treatment [9].

2.4. Outcomes

(1) Basic clinical indicators were recorded by medical staff in our hospital including extubation time, recovery time, breathing recovery time, and orientation recovery time.

(2) The observer’s assessment of awareness/sedation (OAA/S) score [10] was used to evaluate the state of consciousness of patients immediately after operation, 1 h after operation, 3 h after operation, and 1 d after operation. The higher the OAA/S score, the better the patient’s state of consciousness. 5 points indicate rapid response to normal shouting; 4 points indicate indifferent response to normal shouting; 3 points indicate responding only to loud shouts; 2 points indicate responding only to gentle shaking; 1 point indicates no response to mild shaking; 0 point indicates no response to squeezing the trapezius.

(3) Complications include nausea and vomiting, respiratory depression, restlessness, and urinary retention.

2.5. Statistical Analysis. Measurement data were expressed as the mean ± standard deviation, and count data were expressed as case or rate. Statistical analysis was performed using SPSS 22.0 (IBM, Armonk, NY, USA). Differences between measurement data and count data were compared using Student’s t-test and chi-square test, respectively. A P value < 0.05 was considered statistically significant.

3. Results

3.1. Baseline Data. There was no significant difference in baseline data between the two groups of patients (P > 0.05), as shown in Table 1.

3.2. Basic Clinical Indicators. There was no significant difference in extubation time between the two groups (P > 0.05). The postoperative wake-up time, respiratory recovery time, and orientation recovery time of the experimental group were significantly better than those of the control group (P < 0.05) (see Table 2).

3.3. OAA/S Score. The OAA/S scores of the patients in the experimental group were significantly higher than those in the control group immediately after surgery, 1 h after surgery, and 3 h after surgery (P < 0.05). There was no significant difference in the OAA/S scores between the two groups on the 1st day after operation (P > 0.05) (see Table 3).

3.4. Complications. The incidence of complications in the experimental group was significantly lower than that in the control group (P < 0.05, Table 4).

4. Discussion

Despite the widespread availability of laparoscopic cholecystectomy, it is associated with cognitive dysfunction in elderly patients [11]. The major contributor is the declined...
functions of the body in elderly patients, leading to a decreased ability in metabolizing anesthetic drugs and increasing the risk of postoperative cognitive dysfunction [12]. Patients with postoperative cognitive dysfunction show manifestations of disorders concerning orientation, memory, and abstract thinking, as well as social activity. In addition to hindering postoperative recovery and prolonging the hospitalization stay, it imposes a substantial medical cost burden on patients [13]. This suggests the potential value of providing options to treat postoperative cognitive dysfunction. There remains an urgent need to explore an anesthesia strategy that has a mild impact on postoperative cognitive function [14].

Propofol is an ultra-short-acting intravenous anesthetic with high lipid solubility and almost insoluble in water. Due to its rapid onset of action, rapid and stable recovery of patients, with slight discomfort after recovery, it has been well-recognized in clinical practice [15]. The molecule of the new ultra-short-acting opioid, remifentanil, contains an ester bond, and its drug is mainly hydrolyzed by nonspecific esterases, resulting in the drug metabolism insusceptible to liver and kidney functions [16]. Additionally, it has the advantages of a small volume of distribution, rapid onset of action, fast elimination, and no accumulation in the patient’s body [17], which makes the drug suitable for continuous infusion administration. Even if it is used in large quantities for a long time, it will not lead to the residual effect of the drug after stopping the drug, with no impact on the recovery of patients after surgery [18].

In this study, we found that the postoperative wake-up time, respiratory recovery time and orientation recovery time of the experimental group were significantly better than those of the control group. In addition, the OAA/S scores of the patients in the experimental group were significantly higher than those in the control group immediately after surgery, 1 h after surgery, and 3 h after surgery; there was no significant difference in the OAA/S scores between the two groups on the 1st day after operation. Encouragingly, the incidence of complications in the experimental group was

### Table 1: Baseline data.

|                         | Control group (n = 60) | Experimental group (n = 60) | t or χ² | P value |
|-------------------------|-----------------------|----------------------------|---------|---------|
| Gender                  |                       |                            |         |         |
| Male                    | 37                    | 39                         | 0.144   | 0.705   |
| Female                  | 23                    | 21                         |         |         |
| Age (year)              | X ± s                 | X ± s                      |         |         |
| Mean age (year)         | 69.28 ± 5.32          | 69.17 ± 5.30               | 0.113   | 0.91    |
| Course of disease (year)| X ± s                 | X ± s                      |         |         |
| Mean course (year)      | 2.31 ± 0.46           | 2.39 ± 0.52                | −0.893  | 0.374   |
| ASA                     |                       |                            |         |         |
| Grade I                 | 41                    | 40                         | 0.038   | 0.845   |
| Grade II                | 19                    | 20                         |         |         |

### Table 2: Comparison of basic clinical indicators (X ± s).

| Groups                        | Extubation time (min) | Wake-up time (min) | Breathing recovery time (min) | Orientation recovery time (min) |
|-------------------------------|-----------------------|--------------------|-------------------------------|--------------------------------|
| Control group (n = 60)        | 8.34 ± 1.27           | 8.57 ± 0.76        | 6.24 ± 0.46                   | 12.21 ± 1.44                   |
| Experimental group (n = 60)   | 8.24 ± 1.25           | 6.40 ± 0.43        | 2.11 ± 0.20                   | 8.09 ± 1.03                    |
| t                             | 0.435                 | 19.249             | 63.778                        | 18.026                         |
| P value                       | 0.664                 | <0.001             | <0.001                        | <0.001                         |

### Table 3: OAA/S score comparison (X ± s).

| Groups                        | Immediately after operation | 1 h after operation | 3 h after operation | 1 d after operation |
|-------------------------------|-----------------------------|---------------------|---------------------|---------------------|
| Control group (n = 60)        | 3.30 ± 0.25                 | 3.94 ± 0.38         | 4.24 ± 0.50         | 4.66 ± 0.61         |
| Experimental group (n = 60)   | 3.55 ± 0.27                 | 4.33 ± 0.36         | 4.59 ± 0.58         | 4.75 ± 0.64         |
| t                             | −5.263                      | −5.771              | −3.54               | −0.788              |
| P value                       | <0.001                      | <0.001              | 0.001               | 0.432               |

### Table 4: Comparison of complications.

| Groups                        | Nausea and vomiting | Respiratory depression | Restless | Urinary retention | Incidence (%) |
|-------------------------------|---------------------|------------------------|----------|------------------|---------------|
| Control group (n = 60)        | 2                   | 2                      | 3        | 1                | 8 (13%)       |
| Experimental group (n = 60)   | 1                   | 0                      | 1        | 0                | 2 (3%)        |
| χ²                            | —                   | —                      | —        | —                | 3.927         |
| P value                       | —                   | —                      | —        | —                | 0.048         |
显著低于对照组。可能的原因可能是与其他阿片类药物相比，瑞芬太尼更有效，具有快速起效和长麻醉时间的优点。阿片类受体是G蛋白偶联受体家族的成员，含有数百个基因在人类基因组中。其阿片类特性影响受体的活性和结构。钙调蛋白、Go/Gi蛋白、激酶和其他类型的调节蛋白，以及多域蛋白或分子伴侣也可以影响阿片类受体的药理特性。瑞芬太尼属于当前新类型的阿片类受体激动剂，具有较短作用时间，快速起效，且可控性强。此外，麻醉药物在认知功能和状态上的影响

**Data Availability**

No data were used to support this study.

**Conflicts of Interest**

All authors declare that they have no conflict of interest.

**Acknowledgments**

This study was supported by the Wuxi Youth Fund (Q202132).

**References**

[1] M. Iwata, N. Kuzumoto, Y. Akasaki et al., “The ultrasound-guided nerve blocks of abdominal wall contributed to anesthetic management of cholecystectomy in a patient with Becker muscular dystrophy without using muscle relaxants,” *Journal of Anesthesia Clinical Reports*, vol. 3, 2017.

[2] A. K. Staehr-Rye, L. S. Rasmussen, J. Rosenberg et al., “Surgical space conditions during low-pressure laparoscopic cholecystectomy with deep versus moderate neuromuscular blockade: a randomized clinical study,” *Anesthesia and Analgesia*, vol. 119, 2014.

[3] X. Su, W. Zhu, Y. Tian, L. Tan, H. Wu, and L. Wu, “Regulatory effects of propofol on high-dose remifentanil-induced hyperalgesia,” *Physiological Research*, vol. 69, 2020.

[4] J. Chen, X. Ying, and D. Yang, “Propofol combined with remifentanil reduces the adverse reactions of patients undergoing laparoscopic cholecystectomies,” *American Journal of Translational Research*, vol. 13, 2021.

[5] A. Fanelli, D. Ghisi, B. Bergolotti, M. Martinotti, G. Fanelli, and G. Danelli, “Pilot double-blind study to assess efficacy and tolerability of morphine sulphate oral solution (Oramorph®) given preoperatively as add-on therapy within a multimodal postoperative pain approach in patients undergoing laparoscopic cholecystectomy,” *Minerva Anestesiologica*, vol. 80, 2014.

[6] M. Bakan, T. Umutoglu, U. Topuz et al., “Opioid-free total intravenous anesthesia with propofol, dexmedetomidine and lidocaine infusions for laparoscopic cholecystectomy: a prospective, randomized, double-blinded study,” *Brazilian Journal of Anesthesiology (English Edition)*, vol. 65, 2015.

[7] S. H. R. Faiz, S. Seyed Siadoust, P. Rahimzadeh, and L. Houshamad, “An investigation into the effect of depth of anesthesia on postoperative pain in laparoscopic cholecystectomy surgery: a double-blind clinical trial,” *Journal of Pain Research*, vol. 10, 2017.

[8] T. Fujita, T. Takenami, S. Tsuru, M. Sakai, K. Tanaka, and H. Okamoto, “Anesthetic management of laparoscopic cholecystectomy in a patient with mitochondrial encephalopathy,” *Masui*, vol. 66, 2017.

[9] J. Lu, J. F. Wang, C. L. Guo, Q. Yin, W. Cheng, and B. Qian, “Intravenously injected lidocaine or magnesium improves the quality of early recovery after laparoscopic cholecystectomy: a randomised controlled trial,” *European Journal of Anaesthesiology*, vol. 38, 2021.
[10] T. W. Lim, Y. H. Choi, J. Y. Kim et al., “Efficacy of the bispectral index and Observer’s Assessment of Alertness/Sedation Scale in monitoring sedation during spinal anesthesia: a randomized clinical trial,” *Journal of International Medical Research*, vol. 48, 2020.

[11] H. S. Na, D. J. Lim, B. W. Koo, A. Y. Oh, and P. B. Lee, “The influence of moderate or deep neuromuscular block status on anesthetic depth monitoring system during total intravenous anesthesia using propofol and remifentanil: a randomized trial,” *Science Progress*, vol. 104, 2021.

[12] C. Ö. Çaparlar, M. O. Ozhan, M. A. Suzer et al., “Fast-track anesthesia in patients undergoing outpatient laparoscopic cholecystectomy: comparison of sevoflurane with total intravenous anesthesia,” *Journal of Clinical Anesthesia*, vol. 37, 2017.

[13] X. Yang, J. Xie, J. Liu, and T. Wang, “Effects of dexmedetomidine on the deformability of erythrocyte in patients with laparoscopic cholecystectomy,” *Pakistan Journal of Pharmaceutical Sciences*, vol. 29, 2016.

[14] S. Karabayırılı, O. Surgit, H. Kasikara et al., “The effects of adding ischemic preconditioning during desflurane inhalation anesthesia or propofol total intravenous anesthesia on pneumoperitoneum-induced oxidative stress,” *Acta Chirurgica Belgica*, vol. 117, 2017.

[15] Y. Wu, W. Yang, Z. Cai, and Z. Zhang, “The effect of ultrasound-guided low serratus anterior plane block on laparoscopic cholecystectomy postoperative analgesia: a randomized clinical trial,” *Medicine (Baltimore)*, vol. 100, 2021.

[16] N. M. Fonseca, L. R. Pedrosa, N. Melo, and R. d. A. Oliveira, “Effect of palonosetron, ondansetron and dexamethasone in the prevention of postoperative nausea and vomiting in video cholecystectomy with total venous anesthesia with propofol-remifentanil - randomized clinical trial,” *Brazilian Journal of Anesthesiology (English Edition)*, vol. 70, 2020.

[17] X. Z. Chen, Q. B. Lou, C. C. Sun, W. S. Zhu, and J. Li, “Effect of intraoperative esmolol infusion with lidocaine on rapid recovery of laparoscopic cholecystectomy,” *Zhonghua Yixue ZaZhi*, vol. 97, 2017.

[18] N. Dereli, Z. B. Tutal, M. Babayigit, A. Kurtay, M. Sahap, and E. Horasanli, “Effect of intraoperative esmolol infusion on anesthetic, analgesic requirements and postoperative nausea-vomiting in a group of laparoscopic cholecystectomy patients,” *Brazilian Journal of Anesthesiology (English Edition)*, vol. 65, 2015.

[19] J. H. Kim, E. K. Jwa, Y. Choung, H. J. Yeon, S. Y. Kim, and E. Kim, “Comparison of pupillometry with surgical pleth index monitoring on perioperative opioid consumption and nociception during propofol-remifentanil anesthesia: a prospective randomized controlled trial,” *Anesthesia and Analgesia*, vol. 131, 2020.

[20] X. Deng and T. Zhu, “Clinical comparison of propofol-remifentanil TCI with sevoflurane induction/maintenance anesthesia in laparoscopic cholecystectomy,” *Pakistan Journal of Medical Sciences*, vol. 30, 2014.

[21] A. Kisa, S. Koruk, H. Kocoglu, and I. M. Leblebici, “Comparison of general anesthesia with spinal anesthesia in laparoscopic cholecystectomy operations,” *Medeniyet Medical Journal*, vol. 34, no. 4, pp. 346–353, 2019.

[22] X. Liu, “Talking about the method and application of acupuncture anesthesia in traditional Chinese medicine,” *Shi Zhen Guo Yi Guo Yao*, vol. 23, 2012.