Short Communication

Effect of Propofol in Conjunction with Sevoflurane in Anesthesia of Individuals Undergoing Laparoscopic Cholecystectomy

CONGYOU ZHAO*, WANGUI WANG AND CHUNLIAN LIAO

Department of Anesthesiology, The Second People's Hospital of Pidu District of Chengdu, Chengdu, Sichuan Province 611733, China

To observe the effect of propofol in conjunction with sevoflurane in the anesthesia of individuals undergoing laparoscopic cholecystectomy. Randomly divided into a control and observation group, a total of 200 patients undergoing laparoscopic cholecystectomy between June 2022 and June 2023. Propofol was used for maintenance anesthesia in the control group, while a combination of sevoflurane and propofol was administered to the observation group. The observer's assessment of alertness/sedation score was employed to evaluate the quality of patient recovery at extubation and 15 min post-extubation. Assessment of recovery conditions encompassed the duration required for spontaneous breathing recovery, awakening, and extubation. Furthermore, stress response-related indicators, such as nitric oxide and adrenocorticotropic hormone, were measured. Additionally, any adverse reactions during the treatment period were carefully recorded. Remarkably higher observer's assessment of alertness/sedation score were observed in the observation group at both extubation and 15 min post-extubation, as opposed to the control group ($p<0.05$). Prior to the surgery, there were no substantial variations observed in the levels of nitric oxide and adrenocorticotropic hormone between the two groups ($p>0.05$). Nevertheless, after a 2 d interval from the surgery, both groups experienced a significant escalation in nitric oxide and adrenocorticotropic hormone levels, with the observation group displaying comparatively lower levels than the control group ($p<0.05$). The administration of propofol in conjunction with sevoflurane demonstrates a positive impact on anesthesia in patients receiving laparoscopic cholecystectomy. This approach not only improves the quality of recovery but also reduces the time required for anesthesia recovery and lowers stress response-related indicators. Most importantly, it ensures safety and provides controllability.

Key words: Propofol, sevoflurane, laparoscopic cholecystectomy, anesthesia, gallbladder

Gallbladder diseases, such as gallstones and cholecystitis[1], may arise when the body encounters conditions like gallbladder duct obstruction, inflammation, or bacterial invasion. Recognized for its advantages encompassing minimal trauma, prompt recovery, and mitigated postoperative pain[2], laparoscopic cholecystectomy is a commonly employed treatment modality for gallbladder diseases. The effective management of anesthesia during the surgical procedure plays a pivotal role in ensuring optimal surgical quality and facilitating postoperative recovery for patients[3,4]. Over the past years, propofol and sevoflurane have emerged as commonly utilized drugs in clinical anesthesia. Propofol, administered intravenously, is recognized for its rapid onset, adjustable depth, and potent analgesic properties[5,6]. Conversely, sevoflurane, an inhalation anesthetic, excels in providing precise control over anesthesia depth while effectively maintaining lung functionality[7,8]. However, there is ongoing controversy surrounding the ideal anesthesia technique for laparoscopic cholecystectomy. Thus, the aim of this study is to investigate the effects of propofol in conjunction with sevoflurane in the anesthesia of individuals undergoing laparoscopic cholecystectomy. By providing valuable insights, the results of this study can aid clinical anesthesiologists in deciding upon the most suitable anesthesia approach. Furthermore, the study offers strategies to optimize anesthesia management, ultimately leading

***Address for correspondence**
E-mail: 15196660054@163.com

to enhanced surgical quality and postoperative recovery outcomes for laparoscopic cholecystectomy patients. In the period from June 2022 to June 2023, a total of 200 patients who were scheduled to undergo laparoscopic cholecystectomy were recruited from our hospital. These patients were randomly assigned to a control group and an observation group, with 100 participants in each group. The control group comprised 53 males and 47 females, ranging in age from 24 y to 74 y, with an average age of (54.65±8.57) y. Similarly, the observation group consisted of 51 males and 49 females, aged between 22 y and 73 y, with an average age of (55.03±8.96) y. No notable distinctions were observed in the general characteristics between the two groups ($p>0.05$), suggesting their comparability. This study has received approval from the Hospital Ethics Committee, and all participants have duly completed informed consent forms. Inclusion criteria for this study consisted of the following; diagnosed with acute cholecystitis or gallstones as confirmed by B-ultrasound, Computed Tomography (CT), blood routine, and biochemical tests[9]; experiencing varying degrees of biliary colic, persistent right upper abdominal pain, nausea, and vomiting. In exclusion criteria, the presence of circulatory and respiratory system dysfunction; prior use of sedatives or opioids before the surgery; coexistence of cardiovascular and cerebrovascular diseases, severe heart, liver, kidney dysfunction, or endocrine disorders; long-term use of sedatives or hypnotics; diagnosis of mental illness or cognitive impairment and contraindications for surgery or anesthesia were excluded. Prior to the surgery, both groups followed the routine protocol of fasting from food and drink for 8 h. Additionally, intramuscular injections of 0.5 mg atropine (H23021177, Three-Jing Pharmaceutical, China) and 100 mg phenobarbital sodium (H44021888, Bangmin Pharmaceutical, Guangdong, China) were administered. Upon arrival in the operating room, patient's vital signs were vigilantly monitored. Following the establishment of venous access, a push of propantheline bromide (H20163116, Qidu Pharmaceutical, Shandong, China) at a dose of 5 mg was administered. This was succeeded by an intravenous infusion of scopolamine butyl bromide (H20123332, Shangyi Oriental Pharmaceutical, Jiangsu, China) at a dosage of 0.15 mg/kg, along with a 5 ml dosage of midazolam (H20031071, Enhua Pharmaceutical, Jiangsu, China), 1.5 mg/kg of propofol (H20163406, Jiabo Pharmaceutical, Guangdong, China), and 4 μg/kg of fentanyl (H20030200, Renfu Pharmaceutical, Yichang, China). Anesthesia induction was performed, followed by endotracheal intubation and general anesthesia. The control group received propofol intravenous infusion at a rate of 200 μg/(kg/min) for maintenance anesthesia, while the observation group received 5 % sevoflurane (H20173007, Hengrui Pharmaceutical, Shanghai, China) inhalation therapy on top of the propofol infusion, with an oxygen flow rate of 3 μg/(kg/h). The dosage was adjusted according to the actual situation during the surgery. Using the Observer's Assessment of Alertness/ Sedation Score (OAAS), the quality of awakening was assessed immediately after extubation and again at the 15 min mark[10]. The OAAS score, ranging from 1 to 5, provides an indication of the awakening quality, with higher scores representing a better outcome. Anesthetic recovery encompasses the duration required for the patient's spontaneous respiration recovery, awakening, and extubation. Stress response-related indicators has the fasting peripheral venous blood samples, comprising 5 ml, were collected from patients a day before the surgical procedure and 2 d post-surgery. These samples were subsequently analyzed using enzyme-linked immunosorbent assay to measure the levels of Nitric Oxide (NO) and Adrenocorticotropic Hormone (ACTH). The reagents required for the assay were supplied by Qingdao Hantang Biotechnology Company. Statistical Package for the Social Sciences (SPSS) 25.0 will be employed to perform the statistical analysis in this research. Continuous variables will be presented as means and standard deviations, and their analysis will be conducted using t-tests. Categorical variables, on the other hand, will be expressed as frequencies and percentages (n (%)) and assessed using Chi-square (χ^2) tests. To establish statistical significance, a threshold of $p<0.05$ will be utilized. The OAAS scores in the observation group immediately after extubation and 15 min after extubation were higher than those in the control group ($p<0.05$) as shown in Table 1. Statistically, the observation group exhibited notably shorter intervals for spontaneous respiration recovery, awakening, and extubation as opposed to the control group ($p<0.05$) as shown in Table 2. The levels of NO and ACTH showed no remarkable differences between the two groups on the day preceding the surgery ($p>0.05$). However, following a 2 d interval after the surgery, both groups displayed a marked increase in

NO and ACTH levels. Moreover, the levels of NO and ACTH in the observation group were found to be substantially lower than those in the control group ($p<0.05$) as shown in Table 3. Both groups of patients encountered adverse reactions, such as nausea, vomiting, bradycardia, and increased secretions. Nevertheless, there was no notable distinction seen in the overall incidence of adverse reactions between the observation group and the control group ($p>0.05$) as shown in Table 4. In recent years, with the widespread adoption of minimally invasive techniques, laparoscopic cholecystectomy has become the preferred surgical method for treating diseases such as gallstones and cholecystitis due to its advantages of minimal trauma, fewer complications, and faster postoperative recovery[11,12]. General anesthesia with endotracheal intubation is the usual approach for performing the surgery, but postoperative pain at different levels remains an ongoing concern. Notably, postoperative pain is a primary factor contributing to patient agitation during the recovery phase[13,14]. Consequently, the careful selection of suitable anesthetic agents during the surgical procedure holds great significance. The purpose of this research was to figure out the influence of propofol in conjunction with sevoflurane in anesthesia for laparoscopic cholecystectomy, comparing its effects on the quality of awakening, anesthetic recovery, and stress response-related indicators in patients. The results showed that the OAAS scores in the observation group immediately after extubation and 15 min after extubation were higher than those in the control group, and the observation group had shorter times for spontaneous respiration recovery, awakening, and extubation compared to the control group. Additionally, the levels of NO and ACTH in the observation group were significantly lower than those in the control group after 2 d of surgery. Firstly, the higher OAAS scores in the observation group indicate that propofol in conjunction with sevoflurane can improve the quality of awakening during the postoperative recovery process. The higher OAAS scores may be attributed to the effects of propofol, which possesses sedative and anxiolytic properties, promoting patient comfort and a sense of calmness during anesthesia[15]. Secondly, the shorter times for spontaneous respiration recovery, awakening, and extubation in the observation group suggest that propofol in conjunction with sevoflurane can facilitate the recovery of spontaneous respiration and consciousness, thereby shortening the anesthetic recovery time. This may be attributed to the characteristics of propofol, which include rapid metabolism and quick recovery of wakefulness. Additionally, sevoflurane, as an inhalation anesthetic, also exhibits faster onset and offset effects, and its combined application with propofol may enhance the effectiveness of anesthetic recovery. Moreover, after a 2 d period following the surgery, the observation group displayed remarkably lower levels of both NO and ACTH in comparison to the control group. These findings indicate a potential enhancement in suppressing the postoperative stress response in the propofol combined with sevoflurane group. NO is an essential cellular signaling molecule, and its increased levels may be associated with postoperative inflammation and oxidative stress[16]. ACTH, on the other hand, is an important regulator of the body's stress response, and its elevated levels may be associated with the enhancement of postoperative stress response[17]. The lower levels of NO and ACTH in the observation group compared to the control group may suggest that propofol in conjunction with sevoflurane can attenuate the occurrence of postoperative stress response, demonstrating certain anti-inflammatory and anti-stress effects. Both patient groups encountered adverse reactions, including nausea, vomiting, bradycardia, and increased secretions. However, the overall incidence of adverse reactions did not substantially differ between the observation group and the control group. These findings suggest that the application of propofol combined with sevoflurane is associated with a comparable safety profile in terms of adverse reactions. However, this study is subject to certain limitations. Firstly, as a single-center study, potential selection bias could arise. It is advisable to explore further multicenter studies with increased sample sizes to corroborate the findings of this study and examine the indications and benefits of incorporating propofol combined with sevoflurane in anesthesia for laparoscopic cholecystectomy. The administration of propofol in conjunction with sevoflurane demonstrates a positive impact on anesthesia in patients receiving laparoscopic cholecystectomy. This approach not only improves the quality of recovery but also reduces the time required for anesthesia recovery and lowers stress response-related indicators. Most importantly, it ensures safety and provides controllability.

TABLE 1: QUALITY OF AWAKENING (POINTS, x±s)

Group	n	OAAS score	
		Immediately after extubation	15 min after extubation
Observation	100	3.87±0.81	4.68±0.58
Control	100	2.84±0.63	3.81±0.77
t		-9.008	-8.829
p		0.000	0.000

TABLE 2: ANESTHESIA RECOVERY STATUS (min, x±s)

Group	n	Autonomous breathing recovery time	Wake-up time	Extubation time
Observation	100	7.58±1.81	8.87±1.72	11.94±3.28
Control	100	9.20±1.82	12.82±2.69	14.79±3.89
t		6.595	12.451	5.895
p		0.000	0.000	0.000

TABLE 3: STRESS RESPONSE RELATED INDICATORS

Group	n	NO (μmol /ml)		ACTH (pg/ml)	
		Before	After	Before	After
Observation	100	413.35±107.22	201.81±67.28*	30.18±4.76	36.38±5.93*
Control	100	416.14±102.85	252.27±78.34*	29.61±4.88	43.73±6.46*
t		-1.287	4.842	0.073	7.270
p		0.200	0.000	0.942	0.000

Note: (*): Indicates significant difference after treatment compared with before treatment

TABLE 4: ADVERSE REACTIONS n (%)

Group	n	Nausea and vomiting	Bradycardia	Increased secretion	Overall incidence
Observation	100	3 (3.0)	2 (2.0)	5 (5.0)	10 (10.0)
Control	100	5 (5.0)	5 (5.0)	4 (5.0)	14 (14.0)
χ^2					0.758
p					0.384

Conflict of interests:

The authors declared no conflict of interests.

REFERENCES

1. Li X, Wu F. The effect of propofol combined with sevoflurane anesthesia on cognitive dysfunction in elderly patients after laparoscopic cholecystectomy. Syst Med 2023;8(14):77-104.
2. Qiu J, Xie M, Qu R. The influence of etoricoxib on pain control for laparoscopic cholecystectomy: A meta-analysis of randomized controlled trials. Surg Laparosc Endosc Percutan Techniq 2019;29(3):150-4.
3. Shao T, Hu H. Comparison of the effects of general anesthesia with sevoflurane and propofol on hemodynamics in patients undergoing laparoscopic cholecystectomy. Chin Pharmacol 2014;17(9):1529-31.
4. Chen Z, Qiu C. The effect of sevoflurane on perioperative inflammatory factors in patients undergoing laparoscopic cholecystectomy. J Pract Med 2014;30(4):622-4.
5. Liu H, Sun B, Guo L. Comparative study of etomidate combined with propofol in the anesthesia induction stage of complex surgical procedures. J Harbin Med Univ 2019;53(5):4.
6. Shi J. Anesthetic effect of propofol combined with remifentanil on elderly laparoscopic cholecystectomy and its impact on cardiovascular stress. J Chuanbei Med Coll 2020;35(1):4.
7. Cui D, Fang L, Feng C. The effect of sevoflurane combined with propofol inhalation duration on postoperative cognitive function of patients undergoing breast cancer radical surgery. Hebei Med J 2021;27(4):700-4.
8. Luo L, Xiao Y. The effect of sevoflurane combined with dexmedetomidine anesthesia on lung function and postoperative analgesia in patients undergoing gastrointestinal surgery. J Clin Ration Drug Use 2022;15(8):105-8.
9. He X, Shi J. Consensus on diagnosis and treatment of chronic cholecystitis and gallstones in China (2018). J Clin Hepatobiliary Dis 2019.
10. Xu S. Exploration of the effect of remifentanil combined with propofol anesthesia in laparoscopic cholecystectomy. Renren Health 2020;521(12):281.
11. Zheng X, Miao X, Yu W. Early postoperative psychomotor

function in adult patients under 65 y old undergoing laparoscopic cholecystectomy without damage to sevoflurane. Shanghai Med J 2014;37(6):479-81.
12. Yu J, Shao X, Zheng L. The effect of dexmedetomidine on agitation during sevoflurane anesthesia recovery in patients undergoing laparoscopic cholecystectomy. Chin J Endosc 2015;21(2):159-62.
13. Bian B, Xue R, Guo Y. The effects of etomidate and propofol on cognitive impairment in elderly patients after laparoscopic cholecystectomy. Chin J Pharm 2015.
14. Chen Y, Xu L, Lan Z. The effects of sevoflurane and propofol combined with dexmedetomidine on postoperative cognitive function and oxidative stress response in patients undergoing laparoscopic cholecystectomy. Chin J Gen Med 2017;15(8):1283-5.
15. Ye W. Clinical efficacy of propofol in sedation during epidural anesthesia. Chin Med J 2011;9(20):2.
16. Huang B, Chen C. The function and mechanism of action of nitric oxide (I)-Properties and functions. J Biophys 2012.
17. Yin X, Huang F, Xu Z. The effects of general anesthesia combined with epidural anesthesia on postoperative adrenal cortex, stress factors, and immune levels in lung cancer patients. J Hainan Med Coll 2018;24(1):83-9.

This article was originally published in a special issue, "Recent Progression in Pharmacological and Health Sciences" Indian J Pharm Sci 2024:86(2) Spl Issue "279-283"