10.70711/pmr.v2i3.5462

Dose-Effect Analysis of Esketamine Combined with Sufentanil in Postoperative Pain Management after Laparoscopic Cholecystectomy and Its Impact on Quality of Life

Fei Chai

Affiliated Hospital of Hebei University, Baoding, Hebei 071000

Abstract: **Objective:** To evaluate and compare the dose-effect of esketamine and sufentanil during the induction phase of general anesthesia on postoperative pain management after thoracoscopy surgery and their impact on the quality of recovery. **Methods:** A total of 80 patients, aged 25 to 60, undergoing thoracoscopy surgery under general anesthesia were randomly assigned to two groups: the esketamine group (Group A) and the sufentanil group (Group B), with 40 cases in each group. **Results:** Intraoperatively, there were no significant differences in mean arterial pressure (MAP) and heart rate (HR) between the two groups at time points T0 to T5 ($P > 0.05$). Compared with the baseline values, both groups decreased at T2, with Group B being closer to the baseline values; at T3, both groups showed a transient increase, with Group B being closer to the baseline values.Postoperatively, the times of the analgesic pump was pressed was also significantly reduced ($P < 0.05$). **Conclusion:** Compared with sufentanil, the use of esketamine during the induction phase of general anesthesia in patients surgery can effectively alleviate postoperative pain and is worth promoting and applying in clinical practice.

Keywords: Esketamine; Sufentanil; Laparoscopic Cholecystectomy; Pain; Dose-Effect; Quality of Life

Introduction

Laparoscopic cholecystectomy is a common surgical procedure, yet postoperative pain management remains a significant clinical challenge. Esketamine and Sufentanil, as commonly used analgesics, have shown good results when used in combination for postoperative pain management.The purpose of this article is to explore the optimal dose-effect of esketamine combined with sufentanil in postoperative pain management after laparoscopic cholecystectomy and to analyze its specific impact on patients' quality of life, with the aim of providing more precise and effective strategies for clinical postoperative pain management.

1. Data and Methods

1.1 General Information

In this study, 80 patients were included, consisting of 46 males and 34 females. In terms of distribution, there were 22 patients aged 30 to 40, 30 patients aged 41 to 50, and 28 patients aged 51 to 60. The main conditions were intra-abdominal tumors and gallbladder diseases that required laparoscopic surgery.Inclusion criteria included patients who met the indications for laparoscopic surgery under general anesthesia and those who signed the informed consent form; exclusion criteria involved patients with severe cardiopulmonary dysfunction, allergies to the study drugs, etc. This study adhered to general ethical principles, ensuring that patients gave informed consent, protecting patient privacy, and the research protocol was approved by the hospital's ethics committee.

1.2 Anesthesia Methods

Before anesthesia induction, all patients received pretreatment with Droperidol Hydrochloride injection at a dosage of 0.012~0.02mg/kg and Flurbiprofen Ester injection at 60mg.Subsequently, all patients were given a loading dose of Dexmedetomidine at a dosage of 0.6μg/(kg·15min) and continuously infused at a rate of 0.3μg/(kg·h). Upon entering the anesthesia induction phase, Group F was administered Sufentanil at 0.6μg/kg, while Group B received Esketamine intravenously at a dosage of 0.6mg/kg.Immediately thereafter, all patients received Etomidate emulsion injection at a dosage of 0.35mg/kg and Rocuronium at a dosage of 0.7~1.2mg/kg. Subsequently, mask-assisted ventilation was performed, and once the conditions for intubation were met, tracheal intubation was carried out immediately, followed by the initiation of mechanical ventilation.In addition, all patients received bilateral transversus abdominis plane (TAP) block under ultrasound guidance, using 0.3% Ropivacaine, with an injection volume of 20 mL on each side.

1.3 Observational Indicators

To compare the stability of anesthesia induction and maintenance between the two groups, the fluctuation of vital signs such as heart rate and blood pressure was monitored for assessment; The effectiveness of postoperative pain control is assessed by observing the demand for analgesia after surgery and the recovery of sensation in the nerve block area; as well as the incidence of adverse reactions, including nausea and vomiting, hypotension, and respiratory depression.

1.4 Statistical Methods

Data collected from the study subjects were analyzed using SPSS 25.0. Quantitative data are expressed as means ± standard deviations; categorical data are expressed as percentages, and the chi-square test is used for data verification.

2. Results

2.1 Comparison of Surgical Conditions between Two Groups

The surgical duration and postoperative awakening time of the two groups of patients were compared, and the differences were not statistically significant ($P > 0.05$), as shown in Table 1 below:

Table 1. Comparison of surgery in two groups of patients

Group	awakening time	**Surgical time**
GroupA	9.67±1.84	92.43±20.58
GroupB	10.23±2.11	88.12±18.76
t	-1.563	0.987
p	0.643	0.876

2.2 Comparison of HR and MAP at Various Time Points between Two Groups

The results of the two-way ANOVA for HR and MAP between the two groups showed that there were statistically significant differences in the main effects of group and time. Further simple effect analysis indicated that, when controlling for the time factor and comparing between groups, there were no statistically significant differences between the two groups at T0, T1, T2, T3, T4, and T5 ($P > 0.05$).Controlling for the grouping factor and comparing the results at different time points showed that there were statistically significant differences in HR for Group E at time point T0 compared to all other time points, and for Group S, there were statistically significant differences in HR at time point T0 compared to time points T2, T4, and T5 ($P < 0.05$).Group E and Group S showed statistically significant differences in MAP at time point T0 compared to time points T2, T4, and T5 ($P < 0.05$). As shown in Tables 2 and 3 below:

Table 2. Comparison of HR at different moments between the two groups of patients

Group	T0	T1	T2	T3	T4	T5	F time	F interaction	F intergroup
GroupA	83.30±13.78	86.39±10.99*	85.36±10.99*	85.36±10.99*	85.36±10.99*	85.36±10.99*	71.616**	3.034	0.156
GroupB	85.99±14.59	86.33±13.47	86.22±14.69*	85.93±12.99	70.01±10.89*	72.58±10.49*			
t	-0.459	-0.029	-0.349	0.863	1.832	1.243			
p	0.463	0.983	0.683	0.433	0.083	0.211			

Table 3. Comparison of MAP at different moments in the two groups of patients

Group	T0	T1	T2	T3	T4	T5	F time	F interaction	F intergroup
GroupA	99.46±13.30	100.14±10.92*	92.34±9.98*	100.63±9.01*	85.37±9.08*	90.01±10.49*	65.136**	0.641	0.512
GroupB	98.63±14.13	99.31±10.69	91.89±8.99*	97.89±8.99	85.06±9.80*	89.68±11.95*			
t	0.189	0.833	0.723	1.607	0.109	0.231			
p	0.869	0.436	0.433	0.115	0.899	0.788			

3. Discussion

The dose-effect of medication in pain management after laparoscopic cholecystectomy significantly impacts patients' quality of life. An appropriate drug dosage can effectively control postoperative pain, reduce the patient's suffering and anxiety, and is conducive to the recovery of the patient's physical and mental health.However, if the drug dosage is too high, it may lead to adverse reactions, such as nausea, vomiting, and hypotension, which could negatively affect the patient's recovery process and quality of life.Therefore, in pain management, it is necessary to choose the type and dosage of medication reasonably according to the patient's specific condition to achieve the best analgesic effect while reducing the occurrence of adverse reactions, thereby improving the patient's quality of life.

The study indicates that the MAP and HR of patients in both groups remained relatively stable from time point T0 to T5 during surgery, suggesting that esketamine and sufentanil have comparable effects in anesthetic induction and maintenance, both effectively maintaining the stability of vital signs.Compared to the baseline values, at T2, both groups showed a decrease in MAP and HR, but Group B was closer to the baseline values, which may be related to the analgesic and sedative effects of esketamine. At T3, there was a transient increase in MAP and HR in both groups, but Group B was again closer to the baseline values, which further demonstrates the advantage of esketamine in maintaining the stability of vital signs.Postoperatively, the number of times patients in Group B pressed the analgesic pump was significantly reduced, which directly reflects the effectiveness of esketamine in postoperative pain management. It can reduce patients' dependence on analgesic drugs and improve comfort.

As the dextrorotatory form of ketamine, esketamine has multiple pharmacologic effects, including analgesia, sedation, and antidepressancy, and has shown significant value in pain management after laparoscopic cholecystectomy. Compared to traditional analgesic drugs, esketamine has less respiratory depression and fewer cardiovascular system side effects, making it particularly suitable for patients with respiratory or cardiovascular diseases.In the pain management after laparoscopic cholecystectomy, esketamine can be used alone or in combination with other analgesic drugs to achieve better pain relief. Additionally, the use of esketamine can promote early postoperative activity in patients, accelerate the recovery of gastrointestinal function, and reduce the occurrence of postoperative complications.

4. Conclusion

In summary, the combination of esketamine and sufentanil demonstrates a significant dose-effect in the management of postoperative pain following laparoscopic cholecystectomy. A proper dosage combination not only effectively controls postoperative pain but also reduces the occurrence of adverse reactions, thereby positively impacting the quality of life for patients.

References

[1] Li Tongzhou. The Impact of Esketamine on Hemodynamics and Stress Response in Patients Undergoing Laparoscopic Cholecystectomy [D]. North China University of Science and Technology, 2023.

[2] Yang Lijuan, Chen Jun, Luo Yun, Ren Zhendong, Cui Yongliang, Luo Zili. Observation on the Effect of Esketamine Combined with Sufentanil for Postoperative Pain Relief after Laparoscopic Hysterectomy [J]. Frontiers of Medicine, 2023, 13(15): 84-86.

[3] Li Mengtao. The Impact of Esketamine on Early Cognitive Function in Elderly Patients Undergoing Laparoscopic Cholecystectomy [D]. Hebei Medical University, 2023.