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Clinical analysis of different anesthesia methods for pulmonary infection after perioperative operation

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ABSTRACT

The purpose is to explore the effect of different anesthesia methods on pulmonary infection after the operation. 120 patients who underwent surgery from January 2015 to August 2018 were selected in three groups: group A (n = 40), group B (n = 40), and group C (n = 40). Group A was given inhalation anesthesia, group B was given total intravenous anesthesia, and group C was given epidural block combined with general anesthesia. In addition to lung imaging examination, the postoperative parameters of patients such as leukocyte count and mean arterial pressure were recorded. Through image analysis, the case of pulmonary infection after epidural block combined with general anesthesia was 1, while that of inhalation anesthesia and intravenous injection was 7 and 8. In terms of the fluctuation of heart rate and mean arterial pressure, patients in group C had lower levels of heart rate and mean arterial pressure, while patients in groups A and B had higher levels of these parameters. There was no significant difference between inhalation anesthesia and intravenous injection for pulmonary infection after the operation. Thus, it can be concluded that the negative effects of epidural block combined with general anesthesia are much less than those of the other two anesthesia methods, which has the smallest effect on pulmonary infection after the operation. Therefore, the epidural block combined with general anesthesia has the smallest effect on pulmonary infection after the operation. This study is of great significance, and more anesthesia methods can be further studied in subsequent works.

Introduction

The postoperative infection has become one of the major complications of the surgery, especially after major surgery [1], which seriously affects the effect of medicine and causes economic waste [2]. Common types of post-operative infections include surgical site infections, pulmonary infections, urinary tract infections, bacteremia caused by Staphylococcus aureus, and catheter-related infections [3]. The postoperative disease is caused by pathogenic microorganisms (contamination and degree of pathogenic bacteria), patient's condition (immune status), intraoperative operation (operation time and tissue damage), postoperative nursing and anesthesia-related factors. It is generally believed that the surgeon's operation and the patient's immune status are the main factors affecting postoperative infection [4]. In recent years, through the analysis of the related elements of postoperative infection [5], it is found that different anesthesia methods, anesthesia operation, and post-operative infection have a specific correlation [6]. The related factors of surgery and anesthesia affect the incidence of postoperative infection to a certain extent. Some of these factors may be altered by the behavior of the anesthesiologist [7]. At present, there are many studies on pulmonary infection after the operation at home and abroad. Some related factors of pulmonary infection after surgery have been determined [8], but there are still some controversial factors [9]. Age, malnutrition, and congestive heart failure are the risk factors of pulmonary infection after oral and abdominal surgery [10].

Domestic research on post-operative pulmonary infection is mainly limited to some specific operations or specific anesthesia methods [11]. The number of cases collected is relatively small. There are many constraints and many clinical factors which are difficult to control [12]. Therefore, the conclusion has certain limitations. In this study, the factors affecting postoperative pulmonary infection of patients with different anesthesia methods are analyzed [13], and statistical variables are screened for analysis, providing data support and reference for the prevention and

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treatment of postoperative pulmonary infection [14]. The postoperative pulmonary infection has a very negative impact on the recovery of patients [15] because infection means that there will be many uncertain complications, and the emergence of complications means that recovery will become extremely difficult [16]. Complications are not a single or single disease, and they can cause the occurrence and outbreak of other diseases continuously. Therefore, the study of pulmonary infection after the operation is critical [17].

To sum up, the clinical effects of three different anesthesia methods on pulmonary infection after the operation are studied and analyzed. The results show that among the three different anesthesia methods, epidural block combined with general anesthesia has the least effect on pulmonary infection after the operation. There is no significant difference in the impact of pulmonary infection between the other two groups. Through image analysis, the number of pulmonary infection after epidural block combined with general anesthesia is 1, while that of inhalation anesthesia and intravenous injection is 7 and 8. The innovation of this study lies in the careful post-operative analysis of different anesthesia methods commonly used in combination with pulmonary infection, and the interpretation of the results of the best anesthesia methods using figures. The results of this study still provide some guidance for future research, so this study is a valuable research topic.

Materials and methods

Research objective

120 patients who underwent surgery from January 2015 to August 2018 are selected and divided into three groups: group A (n = 40), group B (n = 40), and group C (n = 40). In this study, patients have signed the informed letter, and the experiment has been approved by the ethics committee.

Exclusion criteria: Patients undergoing cardiac surgery and preoperative pulmonary infection are excluded. Patients with circulatory system diseases are excluded. Patients with immune system diseases are excluded. Patients with anesthetic drug allergies are eliminated. Patients with severe liver and kidney dysfunction are excluded. Patients with endocrine diseases are excluded. Patients with mental disorders are excluded. Patients who do not sign informed consent are excluded. Patients with incomplete information are excluded.

Inclusion criteria: ASA grade I-II patients are included. No anesthesia or contraindication is found during the first operation. CT or MRI shows peripheral lung lesions, no distant metastasis. Patients without severe liver and kidney diseases, cardiovascular and cerebrovascular diseases, endocrine diseases, and other diseases are included.

Experimental methods

Anesthesia induction: 40 min before the operation, patients are given an intramuscular injection of diazepam 15 mg and atropine 0.6 mg. After a patient is formally admitted to the operating room for surgery, the patient's body must be connected to a medical monitoring instrument-monitor. Its purpose is to monitor the body's non-invasive systolic blood pressure continuously, blood oxygen saturation, mean arterial pressure, diastolic blood pressure, heart rate, and electrocardiogram in real-time and non-operative venous access are created. Before induction of anesthesia, the patient is injected with Ringer's solution 15 mL/kg/h. During the operation, the liquid concentration is maintained at 6–8 mL/kg/h. The induced drugs used in this study are midazolam 0.1 mg/kg, propofol 1 mg/kg, and fentanyl 4 ug/kg. Medications are given in turn according to the sequence of drug requirements. After the patient's brain has completely lost consciousness, 1.3 mg/kg of succinylcholine is injected intravenously into the patient. When the muscles are fully restored and relaxed, the patient is given intubation. The patient's two lungs are then diagnosed to determine whether the intubation is adequately inserted and whether the location is appropriate. After confirmation, the patient is given atracurium 0.4–0.7 mg/kg intravenously. During the operation, the concentration of atracurium should be kept at 0.2–0.3 mg/kg. After 40 min each time, patients need to be given intravenous atracurium and then maintain regular muscle relaxation. The patient's intubation and Drager anesthesia machine are connected to mechanize the delivery of gas. The numerical value of the device is set to tidal volume 9–11 mL/kg, and oxygen flow is 3 L/min, the ratio of inhaling and exhaling is set to 1:2, and the breathing frequency is 11–13 times/min. Then, the end-inspiratory and end-expiratory concentration, tidal volume and airway pressure, end-expiratory carbon dioxide partial pressure and respiratory rate of anesthetic gases need to be monitored in real-time. During the operation, breathing should be monitored throughout the surgery and the breathing values should be modified in time to maintain the end-expiratory partial pressure of carbon dioxide within the range of 35–40 mmHg.

Anesthesia maintenance and intraoperative management: Group A: After induction of anesthesia in group A, enflurane is inhaled into the patient's body. The concentration of anesthetics in the end-expiratory segment of the patient's breathing needs to be maintained at 0.8%–1.4%. The patient's inhalation of anesthetics should be stopped 30 min before the operation is completed. Then, oxygen and nitrous oxide mixture are inhaled slowly at a ratio of 1:1. The inhalation of mixed gases should be stopped 5–9 min before the operation is completed. Group B: The anesthetic propofol is continuously injected through the vein. The patient's carrying capacity is 9–11 mg/kg/h. After 7–8 min, the dose is modified to 45 mg/kg/h. The injection should be stopped until 30 min before the operation is completed. During the surgery, compound fentanyl is injected from the patient's vein at 2ug/kg/h as required. Sixty minutes before the operation is completed, the patient's drug injection should be stopped. Group C: After opening the patient's vein, the first step is to perform epidural T45 puncture and put a catheter 5 cm on the side of the head. After lying down, 4 mL of 1.3% lidocaine is injected from the epidural catheter, and the placed catheter is removed. Then, after injecting the drug from the subarachnoid space, only 6 mL of local anesthetic is injected into the patient for the first time, and the level is maintained at C-T8. After the confirmation of epidural block function, general anesthesia-induced intubation is required. The patient is continuously injected with propofol at a load of 5–6 mg/kg/h for about 6–8 min. Next, it needs to be modified to a range of 3–5 mg/kg/h and input continuously until 30 min before the operation is completed. After the skin is disinfected, 6 mL of local anesthetic (2.5% lidocaine + 0.6% bupivacaine) is injected into epidural space. According to the requirement, the dosage of injection increases by 6 mL every 50–65 minutes. During the operation, atracurium 0.2–0.5 mg/kg is injected intravenously into all patients. It is necessary to continue for 40–50 min or so to maintain the patient's muscle relaxation and healthy state. The depth of anesthesia should be kept at 15% fluctuation of blood pressure and heart rate during the operation, and the vital signs should be stable. According to this requirement, the inhalation concentration of enflurane or the intravenous injection rate of propofol is adjusted. At the same time, according to the procedure of operation, fentanyl, or epidural injection of bupivacaine (2.5% lidocaine + 0.6% bupivacaine) is increased at the appropriate time. After the surgery, the patient completely recovers spontaneous breathing. The ventilation volume per minute reaches about 85% of the requirement. The respiratory rate is more than 15 times per minute. The patient's brain recovers consciousness and recovery. The reflex of cough and

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swallowing also meet the requirement. At this point, the patient's tracheal tube can be removed. Neostigmine 0.04–0.05 mg/kg and atropine 15–30 ug/kg can be injected intravenously to restore the relaxation and healthy function of other muscles when necessary. Three groups of patients control analgesia after the operation. Group A and B are given inhalation anesthesia and intravenous controlled analgesia, while group C is given epidural controlled analgesia. Materials used: The patient-controlled analgesia pump volume is 100 mL. The intravenous analgesia is fentanyl, and the epidural analgesia is fentanyl and bupivacaine.

Drug formula: patient-controlled intravenous analgesia group: fentanyl 1 mg, adding normal saline to 100 mL; Patient-controlled epidural analgesia group: bupivacaine 150 mg, fentanyl 0.4 mg, adding normal saline to 100 mL. Method of administration: Patient-controlled analgesia pump parameters: loading dose: 15 min before the end of the operation, fentanyl 1 ug/kg is intravenously administered in PICA group, 0.5% lidocaine 3 mL is epidurally administered in PECA group. The background infusion rate is 2 ml/h. The single dose is 0.5 mL. The locking time is 15 min. At the end of the operation, the patient-controlled analgesia pump is connected immediately, and the analgesic solution is infused. Continuous infusion is required 48 h after the operation. Patients with nausea and vomiting during analgesia are given ondansetron 4–8 mg intravenously.

Observation indicators

The complications of expectoration, electrolyte disturbance, expectoration dysfunction, and fever are observed in the three groups. According to the vital signs of patients after operation, such as heart rate, respiratory rate, mean arterial pressure, and blood oxygen saturation within 72 h after operation, venous blood 2.0 mL is collected 72 h after operation, and blood cell analyzer detector (Weier Medical Instrument Co., Ltd., China) is used to measure blood white blood cells and neutrophils. After thoracic CT examination (Thermo Fisher Scientific Co., Ltd., US), the incidence of pulmonary inflammation, infection, respiratory failure, and lobe recruitment are revealed. The hs-CRP is detected by instrument (Weier Medical Instrument Co., Ltd., China). Also, PCT is tested with instruments (Weier Medical Instrument Co., Ltd., China). Among them, the infection criteria are hs-CRP $\geq$10 mg/L and PCT $\geq$ 20.5 ug/L. The double antibody sandwich method (Weier Medical Instrument Co., Ltd., China) is used to determine the serum levels of TNF-a and IL-6 in the patients studied above, which should be operated in strict accordance with the instructions. Visual analogue scale (VAS) is used to evaluate the pain and satisfaction of patients after operation. Satisfaction = (very satisfied + satisfied)/total number of cases *100%.

Statistical analysis

SPSS23.0 software is used for statistical analysis of the data. Measurement data are expressed as ($\overline{X} \pm s$). The comparison between the two groups is performed by t-test, and the comparison between groups is performed by variance analysis. The counting data are expressed by the rate (%) and compared by x^* test. The difference is statistically significant, with $P < 0.05$.

Results

Analysis of the number of pulmonary infections

The number of pulmonary infections under three different anesthesia methods is shown in Fig. 1. From Fig. 1, it can be clearly seen that there are apparent differences in pulmonary infection after operation between group A inhalation anesthesia, group B total intravenous anesthesia and group C epidural block combined general anesthesia. The number of pulmonary infections after epidural block combined with general anesthesia is 1, while that of inhalation anesthesia and intravenous injection is 7 and 8. There is a clear difference. It can be seen from this that epidural block combined with general anesthesia for postoperative pulmonary infection has a better prominent effect. There is little difference between intravenous and inhalation anesthesia, but it has a significant disadvantage compared with epidural anesthesia combined with general anesthesia. Therefore, epidural anesthesia combined with general anesthesia has a positive effect on pulmonary infection after the operation, which significantly reduces the probability of pulmonary infection after the operation, reduces the possibility of complications after the operation, and strengthens the confidence of patients in physical and psychological aspects.

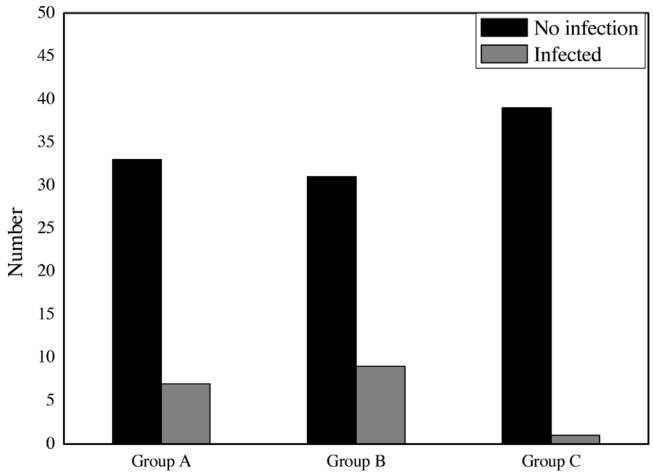

Fig. 1. Comparison of the number of pulmonary infections under different anesthesia methods.

A comparative study of anesthesia methods on recovery time and extubation time of patients

The recovery time and extubation time of the patients after operation under three different anesthesia methods are compared, as shown in Fig. 2. As can be seen from the figure, compared with group A inhalation anesthesia and group B intravenous anesthesia, group C patients with epidural block combined with general anesthesia had significantly shorter recovery time and extubation time. However, there is no significant difference between group A and group B. It can be concluded that epidural block combined with general anesthesia has a significant positive effect on patients after operation, which dramatically reduces the probability of pulmonary infection, and has a vital significance for the recovery of patients after operation. Once there is a pulmonary infection, it will cause many complications of post-operative diseases, which is a complicated situation in post-operative recovery. In this study, epidural block combined with general anesthesia for post-operative patients with pulmonary infection has been fully verified.

Comparative analysis of mean arterial pressure before and after the operation

The comparison of mean arterial pressure before and after three different anesthesia methods is shown in Fig. 3. As can be seen from the figure, the difference of mean arterial pressure between group C and group C is the smallest before and after the operation. The difference of arterial pressure between group A inhalation anesthesia

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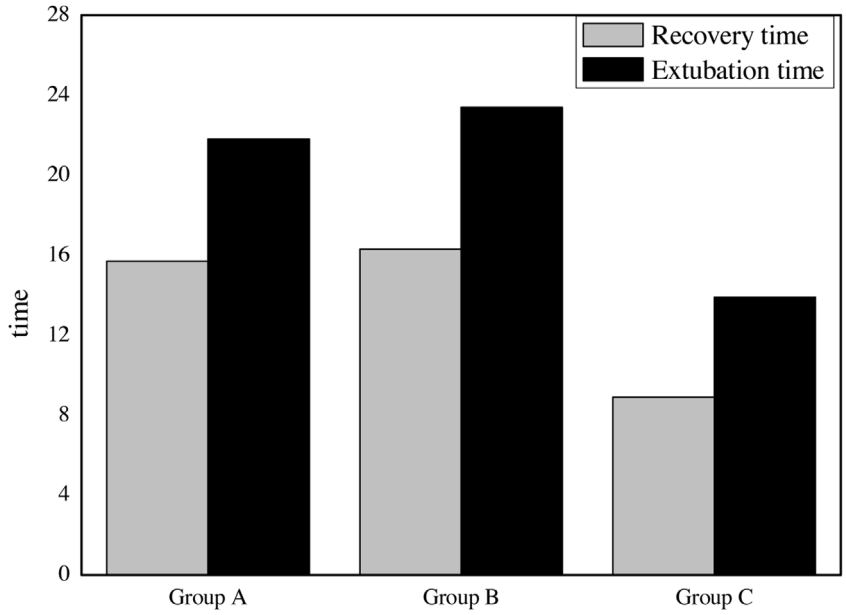

Fig. 2. Comparison of recovery time and extubation time after operation with different anesthesia methods.

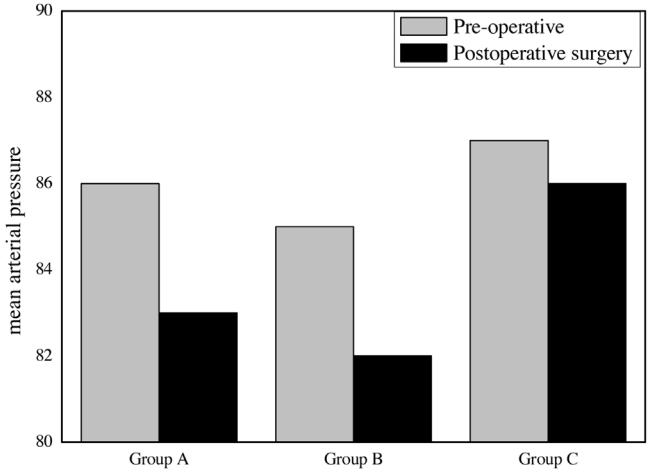

Fig. 3. Comparison of mean arterial pressure before and after different anesthesia.

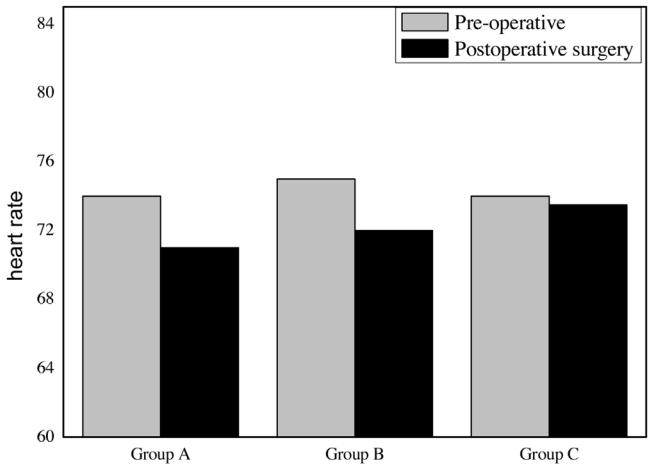

Fig. 4. Comparison of preoperative and postoperative heart rate in patients with different anesthesia methods.

and group B intravenous anesthesia before and after the operation is significant, and the fluctuation of data before and after the operation is considerable. It shows that the anesthesia method used has a positive influence on the recovery of patients' body index after the operation, and then increases the probability of infection. However, there is no apparent difference between group B and group C. It can be concluded that epidural block combined with general anesthesia can help patients reduce pulmonary infection more obviously. It is the smallest one of the three anesthesia methods for patients with pulmonary infection, and it is more helpful for patients. It also shows that epidural block combined with general anesthesia has a positive effect on improving pulmonary infection in patients after operation.

Comparative analysis of heart rate before and after the operation

The preoperative and postoperative heart rates of the patients under three different anesthesia methods are compared, as shown in Fig. 4. As can be seen from the figure, the heart rate difference of group C patients with epidural block combined with general anesthesia is the smallest before and after the operation. The heart rate difference between group A and group B before and after inhalation and intravenous anesthesia is massive, but there is no significant difference between group B and group C. It can be concluded that epidural block combined with general anesthesia can help patients reduce pulmonary infection more obviously after the operation. It is the smallest of the three anesthesia methods for patients with pulmonary infection. It also shows that epidural block combined with general anesthesia is the best of the three methods for patients' heart rate recovery after the operation. Low risk of infection is essential for patient recovery. Therefore, the appropriate anesthesia method is of great help to patients. It also shows that epidural block combined with general anesthesia has a positive effect on improving pulmonary infection in patients after operation.

Comparative analysis of satisfaction degree of patients with different anesthesia methods

The comparative analysis of patients' satisfaction with three different anesthesia methods is shown in Fig. 5. As can be seen from the figure, among the three anesthesia modes of intravenous injec-

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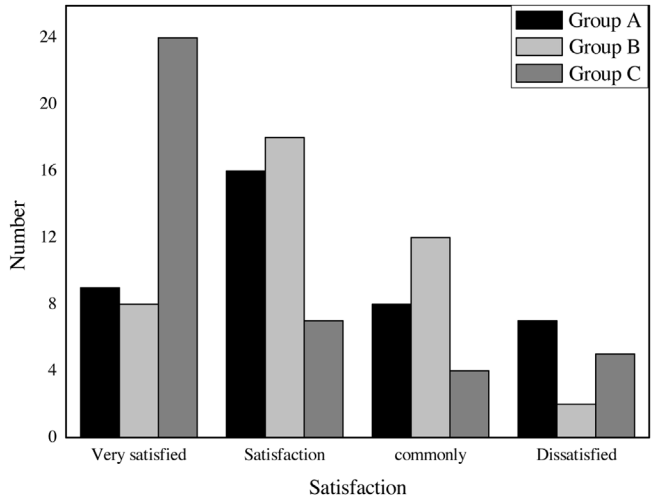

Fig. 5. Comparative analysis of patients' satisfaction with different anesthesia methods.

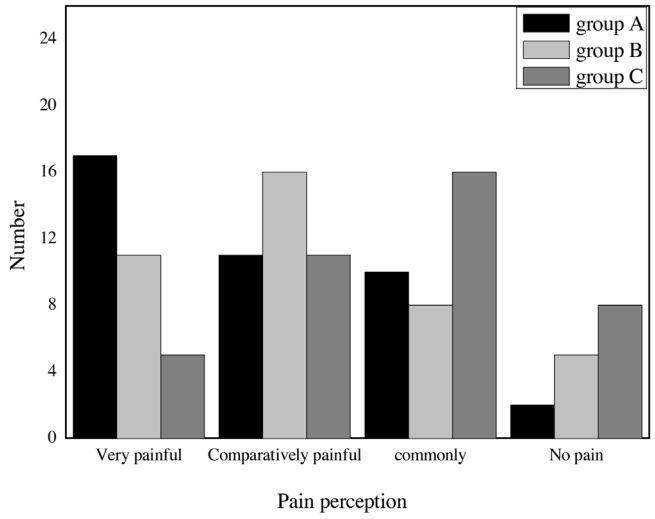

Fig. 6. Comparative analysis of pain in patients with different anesthesia methods.

tion, inhalation anesthesia, and epidural block combined general anesthesia, the satisfaction gap of patients and doctors is obvious. Epidural block combined with general anesthesia has the highest satisfaction. There is no significant difference between the other two groups, and compared with group C, there is a big gap in satisfaction. However, there is no apparent difference between the two. It can be seen from this that epidural block combined with general anesthesia has the greatest positive effect on patients compared with the other two anesthesia methods and has the most prominent help for patients with post-operative pulmonary infection.

Comparative analysis of pain in patients with different anesthesia methods

The comparative analysis of pain in patients with three different anesthesia methods is shown in Fig. 6. As can be seen from the figure, among the three anesthesia modes of intravenous injection, inhalation anesthesia, and epidural block combined general anesthesia, there is a significant difference in pain among patients. Patients with epidural block combined with general anesthesia have the lowest degree of pain. There is no significant difference between the other two groups. In terms of pain, there is a big difference compared with the anesthesia method of group C, but there is no apparent difference between the two groups. It can be seen that epidural block combined with general anesthesia has the greatest positive effect on patients' pain compared with the other two anesthesia methods, which reduces the pain feeling of patients after operation, and further shows that this anesthesia method can reduce the probability of infection and complications after the operation. Therefore, epidural anesthesia combined with general anesthesia has a good effect on postoperative pulmonary infection.

Discussion

In this study, the clinical effects of inhalation anesthesia, total intravenous anesthesia, epidural block combined with general anesthesia on pulmonary infection after surgery are analyzed. 120 patients who underwent surgery from January 2015 to August 2018 are selected and divided into three groups: group A (n = 40), group B (n = 40), and group C (n = 40). Group A is given inhalation anesthesia, group B is given total intravenous anesthesia, and group C is given epidural block combined with general anesthesia. After the operation, the patient undergoes lung imaging examination, and the time of awakening and extubation before and after the operation is recorded. Leukocyte count, breathing, and heart rate are measured before and after surgery. The mean arterial pressure is measured before and after the operation. The degree of pain and satisfaction of patients after the operation are analyzed. Result: Through image analysis, the number of pulmonary infection after epidural block combined with general anesthesia is 1, while that of inhalation anesthesia and intravenous injection is 7 and 8. In terms of the fluctuation of heart rate and mean arterial pressure, before and after pulmonary surgery in patients with combined epidural anesthesia, parameters of heart rate and mean arterial pressure is relatively small, while after inhalation anesthesia and intravenous injection, the fluctuation of heart rate and mean arterial pressure parameters is relatively large. However, no significant differences are found between the two groups. Among white blood cells, pain and respiratory failure, Epidural block combined with general anesthesia have a more positive effect on patients than those of the other two anesthesia methods. It also shows that epidural block combined with general anesthesia has the smallest effect on pulmonary infection after the operation.

Therefore, in this study, through different ways of anesthesia intervention and grouping, the situation of pulmonary infection in patients after the operation is analyzed and studied. Epidural block combined with general anesthesia can minimize the risk of postoperative pulmonary infection and improve the quality of life of patients. Epidural block combined with general anesthesia based on different anesthesia methods plays an essential role in its application. However, there are also some shortcomings in the process of this study, such as the small amount of data collected from samples, which leads to a certain degree of deviation in the results. Therefore, the data capacity will be further increased in the later research process to make the results more valuable for reference.

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