Clinical Effect of Target-Controlled Infusion of Sufentanil and Remifentanil for Internal Thoracoscopy

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Abstract: Objective: To analyze the anesthetic effect of internal thoracoscopic surgery with sufentanil and remifentanil target-controlled infusion intravenous anesthesia. Methods: Eighty patients who underwent internal thoracoscopic examination at the endoscopy center of our hospital were selected for analysis. The selected 80 patients were grouped by random number table. 40 patients received sufentanil target-controlled infusion vein. Anesthesia was used as the study group. The remaining 40 patients received remifentanil target-controlled infusion intravenous anesthesia as a control group, and the anesthetic effects of the two groups of patients after receiving different anesthetic target-controlled infusion measures were compared. Results: After the two groups of patients received different anesthetic drug target-controlled infusion measures, the circulation was stable during the operation. The difference of pain visual analog scores was not obvious 30 minutes after the end of the operation. There was a significant difference in the wake-up time between the two groups. There was no significant difference in the incidence of adverse reactions between the two groups after surgery. Conclusions: In patients with clinical thoracoscopic surgery, remifentanil and remifentanil can be used for target-controlled infusion intravenous anesthesia, but patients in the remifentanil group can wake up more quickly and can be promoted and applied.

Keywords: Internal Thoracoscopy; Remifentanil; Sufentanil; Target-controlled Intravenous Anesthesia

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1 Introduction

Nowadays, internal thoracoscopic has been widely used in clinical practice for some poorly diagnosed lung diseases and pleural diseases, it can be used as a new technical means. Compared with traditional thoracotomy biopsy, internal thoracoscopic has the advantages of low trauma and low risk [1].

After years of development, medicalthoracoscopy has become a particularly important interventional examination method for respiratory diseases, such as tuberculous and malignant pleural effusion which cannot be identified by routine methods, diagnosis of pleural mesothelioma, etc. It is more accurate than other diagnostic methods [2]. In recent years, medical thoracoscopy has been continuously improved in technology, innovated in equipment, and expanded in application fields, as well as in treatment.

Target-controlled infusion is a new type of intravenous anesthesia administration based on the theory of pharmacokinetics and pharmacodynamics, which is more simple, safe and effective [3]. The TCI system takes the plasma or effector chamber concentration as the regulatory variable, which determines the superior drug infusion scheme according to the pharmacokinetic model, and controls the drug concentration of the target plasma or effector compartment by adjusting the infusion curve to

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maintain the regulatory index at the target value [4]. According to the basis of clinical anesthesia sedation and analgesic requirements, anesthesiologists can control injection rate by adjusting the target concentration, which can provide smooth, and control the blood concentration accurately, like torsion inhalation anesthetic volatile tank easily controlling anesthesia depth, thus reduce the fluctuation of drug concentration in the body, increased the controllability of intravenous anesthesia effection. Sufentanil and remifentanil are opioid analgesics with stronger efficacy, and target-controlled infusion mode can be applied in clinical practice [5]. In this paper, we selected 80 cases of thoracic surgery patients in our hospital for analysis.

2 Data and Methods

2.1 General Data

Data of 80 patients undergoing medical thoracoscopy in our hospital were selected for analysis. Among the 80 patients intending to undergo medical thoracoscopy, 47 were males and 33 were females, ranging from 20 years old to 69 years old, with an average age of 39.68±7.3 years old. 49 patients underwent left-side thoracoscopy. Thirty-one patients underwent right side thoracoscopy, and 80 patients selected by medical thoracoscope were divided into groups by random number table. 40 patients received sufentanil target controlled infusion intravenous anesthesia as the study group and 40 patients received remifentanil target controlled infusion intravenous anesthesia as the control group. The general data of the two groups were compared, and the difference was not statistically significant (Table 1). This study was approved by the Ethics Committee of the Institute and informed consent was signed.

Table 1 Comparison of general data between the two groups

Group	Number of cases	Age	Gender composition	ASA grading	Operation time
		years	(male/female)	(I/II)	(min)
Research group	40	38.5±5.4	25/15	28/12	54.4±6.7
Control group	40	41.8±6.3	22/18	31/9	59.1±7.4

2.2 Methods

Patients in the two groups who planned to undergo medical thoracoscopy were intramusculally injected with atropine 0.5mg after admission, and venous access was opened, sodium lactate Ringer injection was injected with 10ml/kg, dexamethasone was injected with 5mg, lidocaine local anesthesia was performed to monitor invasive systolic blood pressure, diastolic blood pressure, heart rate and blood oxygen saturation, and anesthesia was performed after completion of fluid rehydration [6]. Induction scheme of general anesthesia; Midazolam was injected intravenously at 0.05mg/Kg. After intravenous injection, the dual-channel micro-target controlled pump was simultaneously opened for infusion of Sufentanil, remifentanil and propofol. The study group received target controlled infusion of sufentanil and propofol, while the control group received target controlled infusion of remifentanil and propofol. The plasma target concentration of sufentanil was adjusted to be between 0.3ng/ml and 0.8ng/ml, the plasma target concentration of remifentanil was adjusted to be between 2ng/ml and 4ng/ml, and the target controlled infusion of propofol was given at a dose of 2ug/ml to 4ug/ml. When the target concentration reached the preset value, cisatracurium was injected intravenously. The dose was 0.15mg/kg. Video laryngoscope was used for double-chamber bronchial intubation. Electronic bronchoscopy was used to check and locate the catheter to determine its good position. During the operation, cisatracurium was added intermittently, and the target concentration levels of sufentanil and reifentanil were adjusted to ensure the stable anesthetic effect [7]. According to the results of the muscle relaxation monitor, cisatracurium, the muscle relaxant drug, was discontinued when the TOF reaction ratio reached 0.75. Target-controlled propofol infusion was stopped at the end of the operation, and when the TOF response ratio reached 0.9 according to the index of the muscle relaxation monitor, neostigmine 1mg and atropine 0.5mg were given respectively for antagonist. The plasma target concentration of Sufentanil was maintained at 0.1ng/ml and the plasma target concentration of remifentanil was maintained at 1ng/ml until the tracheal catheter was removed [8].

2.3 Observation Index

Hemodynamic changes during anesthesia induction and maintenance as well as pain visual simulation score 30 minutes after surgery were recorded in the two groups of patients with thoracoscopy [9]. The recovery time after operation was recorded in both groups. The incidence of adverse reactions after surgery was recorded in both groups.

2.4 Statistical Calculation

SPSS18.0 statistical software was used to calculate and process the relevant data obtained, in which t value represented the test measurement data and Chi-square value represented the test count data. The difference between the two groups was calculated and compared with P value. If P value was less than 0.05, it indicated statistical significance between the data; if P value was greater than 0.05, There was no statistically significant difference between the groups.

3 Results

After receiving different target-controlled infusion modes of anesthesia drugs, the circulation during surgery was relatively stable in the two groups. The average pain score 30 minutes after surgery in the study group was 1.8±0.4 points, while that in the control group was 2.0±0.3 points (Table 3). There was no significant difference in the visual analog pain score 30 minutes after surgery (P> 0.05); The recovery time of the two groups after surgery was 20.8±1.9 minutes in the study group and 10.2±1.4 minutes in the control group, showing significant difference (Table 4). There was no significant difference in the incidence of nausea, vomiting and other adverse reactions after operation between the two groups (Table 5).

Table 2 Comparison of hemodynamic changes during anesthesia between the two groups (mmHg)

Group		Before induction	before intubation	1 minute after intubation	Drawing time	5 minutes after extubation
Research group	SBP	124.1±14.3	117.6±16.2	121.8±17.7	128.6±20.1	125.7±17.9
	DBP	81.4±10.1	72.8±9.3	70.9±8.9	76.6±9.5	70.8±7.3
	HR	82.5±7.7	73.3±7.2	70.8±8.3	74.9±7.8	73.1±8.1
Control group	SBP	126.9±14.4	111.5±16.5	109.9±14.2	128.9±19.9	127.8±18.5
	DBP	80.9±10.8	68.1±9.0	69.1±8.1	79.9±9.0	73.1±6.1
	HR	77.2±8.1	69.4±9.3	64.7±7.1	75.9±6.1	74.5±8.2

Table 3 VAS scores ($\bar{x}$ ±s) for pain 30 minutes after surgery in both groups

Index	Group	Numbers	30 minutes after operation
VAS score	Research group	40	1.8±0.4
	Control group	40	2.0±0.3

Table 4 Comparison of recovery time ($\bar{x}$ ±s) between the two groups

Index	Group	Numbers	Recovery time
Recovery time	Research group	40	20.8±1.9
	Control group	40	10.2±1.4

Table 5 Occurrence of adverse reactions in two groups (%)

Group	Numbers	nausea	vomit	vertigo	respiratory inhibition	skin pruritus	Incidence (%)
Research group	40	2	4	0	0	1	14
Control group	40	3	3	1	0	2	18

4 Discussion

Thoracoscopy was first initiated in 1866 by physician Francis-Richard Cruise in Ireland. In 1910, the Swedish physician Jacobaeus reported 40 cases with resolution of pleural adhesion by this endoscopic technique. In the early stage, mediastinoscopy and joint endoscopy were often used as thoracoscopy for exploration, but mediastinoscopy showed more bleeding and postoperative complications; the length of joint endoscopy was limited to examine the entire pleural cavity [10]. In 1958, Abram first reported the closed pleural biopsy, to assist in the diagnosis of pleural disease. However, the amount of specimens obtained by

CPB was small and the lesion site could not be directly visually during operation. CPB can not fully meet the clinical diagnosis of pleural disease needs. In 1980, experts from all over the world held a thoracoscopic seminar in Marseille, and the concept of "medical thoracoscopy (medical thoracoscopy, MT)" officially appeared. Since thoracoscopy, which is specially used for thoracoscopic surgery, such as mediastinal cyst and tumor resection, called TV-assisted thoracoscopic technology (video-assisted thoracic surgery, VATS), is now widely used in thoracic surgery; the other is the more minimally invasive and convenient MT [11]. With the development of equipment, now MT mainly refers to half rigid steroscope (semi-rigid thoracoscopy), the pole is similar to ordinary rigid steroscope, easy to operate, the top can bend, multidirectional comprehensive observation in thoracic changes, can use the same light source monitoring system with tracheoscope, patients only cooperate with TV imaging under local anesthesia can accept endoscopy, has been widely used in clinical.

Through medical thoracoscopy, doctors can look directly at the lesions in the pleural cavity through the naked eye, not only can biopsy obtain pathological specimens, but also can perform pleural fixation treatment for malignant pleural effusion. Medical thoracoscopy is characterized by simple operation, high safety and less trauma. Medical thoracoscopy has more diagnostic advantages than pleural fluid cytology and pleural puncture biopsy [12]. Thoracoscopy can provide the exact basis for clinical diagnosis and treatment.

Application of medical thoracoscopy in treating pleural diseases. Another advantage of MT is reflected in its therapeutic value. Pleurodesis under MT is currently commonly used for the treatment of malignant and intractable benign pleural effusions. Meanwhile, MT can also be used for the treatment of empyema, pulmonary vesicles and other related diseases. Because of its advantages of local anesthesia and minimally invasive operation, it is safer than VATS and reduces the complication rate. MT can also be used for the removal of foreign bodies in the chest, or by thoracoscopic electrocoagulation, freezing and other techniques. With the development of technology, the therapeutic range of MT will be even broader [13]. For example 1. internal thoracoscopic treatment of malignant pleural effusion; 2. internal thoracoscopic treatment of empyema; 3. internal thoracoscopic treatment of large bubble-related diseases; 4. medical thoracoscopic treatment of tuberculosis coated pleuritis. With the development of The Times, MT is constantly improving and updated, such as microneedle thoracoscopy, thoracoscopy combined with fluorescent bronchoscopy and other new equipment, also began to be used in the clinical diagnosis and treatment of Traditional MT pleural biopsy is small, time-consuming and difficult to obtain some tissues [14]. In recent years, new biopsy methods including freezing, ROSE technology and Haibo knife were performed under medical thoracoscopy, providing a better means for the diagnosis and treatment of unknown pleural effusion and pleural diseases.

In the past, medical thoracoscopy used local infiltration anesthesia and artificial pneumothorax for biopsy sampling, but there was the possibility of unclear exposure of the lesion site, and it was easy to induce coughing and discomfort in patients, which had a great impact on circulation [15]. General anesthesia can ensure the stable circulation and respiration of patients, and unilateral lung ventilation can be adopted to ensure the collapse of the affected side of the lung, fully expose the operating field on the affected side, and facilitate the operation of doctors [16].

The TCI system has many advantages: (1) it can overcome the differences in pharmacokinetics and pharmacodynamics between different individuals; (2) adjust the concentration according to the patient pharmacodynamic index, combining medication management with the actual needs of the patients, optimize the anesthetic management of the patients, eliminate the risk of underor overdose of anesthetic drugs; (3) get better satisfaction of patients and surgeons, The patient received an adequate anesthetic effect, not only to ensure that the patient's analgesic forgetting, but also to improve the intraoperative patient compliance; (4) it can avoid the non-standard empirical drug use of anesthesiologists, so as to achieve accurate anesthesia; (5) with a more stable intraoperative hemodynamics, reduced incidence of adverse reactions, such as apnea; (6) provide patients with more safe and efficient anesthesia, optimize the anesthesia management and anesthesia recovery [17], it may also be related to the appropriate amount of anesthetic drugs used.

Currently, intravenous anesthetic drugs compound opioid analgesic drugs have been widely used in clinical anesthesia, sufentanil and remifentanil are both opioid receptor agonists, among which sufentanil has a long analgesic time, high analgesic intensity, and a good effect on inhibiting stress response [18]. The plasma protein

binding rate is 92.5%, fast onset, high fat solubility, weak inhibitory effect on respiration, but also has little effect on circulation, reduced systemic stress response caused by trauma, and stable hemodynamics. Remifentanil is a short-acting opioid analgesic with fast onset and clearance speed, its continuous infusion half-life is 5~8 min, elimination half-life is 8~20 min, without accumulation, and is relatively safe to use [11]. It is suitable for clinical continuous infusion. The metabolic pathways of the two drugs are different. Sufentanil is metabolized by liver and kidney, while remifanil is metabolized and degraded by non-specific esterase. Both anesthetic drugs can ensure the stable circulation and respiration of anesthesia [19]. For symptoms such as nausea and vomiting caused by opioids, anti-emetic drugs such as troianistron can be given to relieve them. In this study, although the analgesic effect of remifentanil is short in duration, the analgesic effect disappears quickly after drug withdrawal [20]. However, there was no significant difference in VAS scores between the two groups at 30 minutes after surgery, possibly because thoracoscopy is less invasive and the pain can be completely relieved by the two analgesic drugs.

The clinical application scope of sufentanyl TCI is gradually expanded, by selecting the appropriate pharmacokinetic model and regulating the target concentration of sufentanil reasonably, which can not only well meet the needs of surgery, but also ensure the smooth intraoperative hemodynamics and good postoperative recovery quality and analgesic effect [21]. At present, sufentanyl TCI has not yet widely used, because that there is no clinical pain degree monitoring gold standard and mature closed-loop target control infusion equipment, we expect to study the best index of pain degree monitoring, according to the patients with pain degree, automatically adjust the speed of analgesic infusion, and maintain the analgesia level within the scope of the target set. TCI may also be applied to systemic treatment of chronic cancer pain and severe patients [22]. Without inhibiting the patient's respiratory and circulatory system. We hope that in the future, the closed-loop target-controlled infusion pump for various analgesic drugs, and introducing artificial intelligence into the control algorithm will effectively identify the effective clinical data and noise interference, making the analgesic effect visible and controllable, and achieve more accurate management.

5 Conclusion

Both sufentanil and remifentanil target controlled infusion intravenous anesthesia can be used in patients undergoing medical thoracoscopy under general anesthesia. However, patients in the remifentanil group can recover more quickly and can be vigorously promoted and applied.

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