

## **The effect of general anesthesia compound thoracic paravertebral blockade on postoperative pain relief for patients in thoracic surgery.**

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### **Abstract**

**Objectives:** To analyze the effect of general anesthesia compound thoracic paravertebral blockade on postoperative pain relief for patients in thoracic surgery.

**Methods:** Patients were divided into two groups according to the anesthesia method they received. In group 1, the control group, patients only got general anesthesia. In group 2, on the basis of general anesthesia, patients were jointly used paravertebral nerve block anesthesia. After operation, the visual analogue scale (VAS) was adopted to grade patients' pain on 4 h, 8 h, 12 h, 24 h after operation in quiet and cough, and the usage amounts of analgesic of patients in two groups were taken statistic within 24 hours after operation.

**Results:** In quiet and cough, the postoperative VAS scores of patients in group 2 were significantly lower than those in group 1, the usage amounts of analgesic of patients in group 2 less than those in group 1.

**Conclusion:** General anesthesia compound thoracic paravertebral blockade has significantly analgesic effect on patients after surgery, which is benefit to relieve pain and signally reduce the usage amounts of analgesic after surgery.

**Keywords:** Thoracic paravertebral blockade, Postoperative pain, Pain score.

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### **Introduction**

The main purpose of anesthesia is to dispel the pain and discomfort, to relax muscle and easy to surgery procedures. At present, according to the scope of anesthesia, it can be divided into two main types: general anesthesia and local anesthesia. Local anesthesia is mainly to reduce the stress response in the process of operation by blocking corresponding afferent nerve and interdicting harmful impulsion into nerve center [1]. Nerve block anesthesia is a kind of local anesthesia acting on special regions of particular human body. Compared with the general anesthesia, nerve block anesthesia can efficiently decrease the adverse reactions, such as nausea and mental confusion [2] and some research had showed that the application of nerve block in cancer operation can reduce the recurrence of cancer [3]. The use of local anesthetic combined with general anesthetics can significantly reduce the dosage of general anesthetics in perioperative period, shorten anesthetic effective time, and reduce complications caused by drug toxicity to improve success rate of surgery [4,5], which has more and more wide clinical application. Postoperative pain has an obvious effect on patients' recovery. So, it is important to enhance cognition and evaluation about postoperative pain to improve operation and postoperative health [6]. Our research evaluates the effect of general anesthesia compound thoracic paravertebral blockade on postoperative pain of patients in thoracic surgery by assessing postoperative pain of clinical patients and analyzing the using status of postoperative painkillers.

### **Participants and Methods**

#### **Participants**

The participants are patients in thoracic surgery who need operations. The inclusive criteria are: patients with 1) no smoking; 2) ages between 18 and 50; 3) level and II level according to American society of anesthesiologists (ASA); 4) height with 160-180 cm, weight with 55-70 kg; 5) thoracopathy with video-assisted thoracoscopic surgery. The exclusive criteria are: patients with 1) renal function and liver function damage; 2) history of central nervous system disease; 3) history of smoking, drug and alcohol abuse; 4) chronic paining diseases or intaking analgesic every day; 5) diabetes or high blood pressure; 6) taking NSAID or opium analgesic in 24 hours before operation; 7) allergy to therapeutic; 8) patients with blood coagulation disorders. Patient meeting one condition of above cannot be an object of this study. The study was supported by patients and their families. All patients involved had signed the informed consent form. The study was approved by ethics committee of Yishui Central Hospital in Linyi city, Shandong province.

#### **Grouping**

Patients were divided into two groups according to the anesthesia method they received. In group 1, the control group, patients only got general anesthesia. In group 2, on the basis of

general anesthesia, patients were jointly used paravertebral nerve block anesthesia. The two groups matched according to patients' age, weight and conditions on admission.

## Methods

**Anaesthesia method:** Patients in group 1, a control group, were taken intravenous induction of conventional general anesthesia: 2 mg midazolam, 1.5-2.0 mg/kg propofol, 0.5-0.8 µg/kg sufentanil, 0.1 mg/kg vecuronium, and mechanical ventilation after tracheal intubation. Patients in group 2 were adopted general anesthesia compound continuous thoracic paravertebral blockade. Before general anesthesia induction, oxygen was given by mask, and 1-2 mg midazolam and 5 µg sufentanil were taken to make patients calm down. After local infiltration made by nerve block with 1% lidocaine, in patients' thoracic wall outside puncture area, electrode slices and needle electrodes respectively linked the positive and negative electrode of nerve stimulator. The initial current parameter was set as 3 mA, 2 Hz and 6V. After inserting needle, intercostals muscles shrink significantly. Then current was adjusted as 0.3-0.6 mA. In this case, if intercostals muscles shrink, gas inject without resistance, pump back without gas, cerebrospinal fluid and blood, it showed that the point of needle had been entering paravertebral space, and then 2-2.5 mg/kg bupivacaine was injected. The puncture needle was fixed. Less than 3 cm puncture needle with catheter inside was indwelled in paravertebral space, which was fixed by surgical adhesive membrane, and then blocking flat was measured and recorded. 15 min after taking effect, general anesthesia induction was got the ball rolling. The method of general anesthesia induction mentioned above. During the operation, patients in both groups were taken intravenous injection with sufentanil and vecuronium bromide, and continuously pumped in propofol with constant speed. The depth of anesthesia BIS (Bispectral index) of patients should keep between 45 and 60. The dosage of propofol made appropriate readjustment according to BIS data. ECG and SpO<sub>2</sub> were also continuously monitored during operation. 15 min before the end of operation, propofol infusion was stopped.

**Observation target:** Patients' awakening time of anesthesia in both groups was observed after operation, and VAS [7] was adopted to grade patients' pain on 4 h, 8 h, 12 h, 24 h after operation in quiet and cough. After operation, pethidine was taken to relieve pain, and the usage amount of analgesic was counted within 24 hours.

**Table 2.** SpO<sub>2</sub> comparison of patients among groups.

	Before induction <sup>a</sup>	The time of trachea cannula <sup>b</sup>	2 h after operation	End of operation
G1 (n=50)	98.3 ± 1.8	99.2 ± 1.0	100.0 ± 0	99.8 ± 0.1
G2 (n=50)	97.7 ± 2.1	99.0 ± 1.0	100.0 ± 0	100.0 ± 0

Note: Repeated measures analysis of variance was adopted;  $F_{\text{management}}=1.268$ ,  $p>0.05$ ;  $F_{\text{time}}=6.214$ ,  $p<0.05$ ; LSD was applied for pairwise comparison; <sup>a</sup>the difference from data before induction compared with data in the time of trachea cannula, 2h after operation and end of operation had statistically significance,  $p<0.05$ ; <sup>b</sup>the difference from data in the time of trachea cannula compared with data in 2 h after operation and end of operation had statistically significance,  $p<0.05$ ;

## Statistical analysis

SPSS 21.0 software was applied for statistically analysis. Measurement data was showed as mean ± standard deviation. T-test was adopted to compare the usage variance of painkillers between two samples. Repeated measures analysis of variance was applied for patients' pain score in different timing between two groups. The difference with  $P<0.05$  was statistically significant.

## Results

### General information

According to the screening criteria, 100 patients met the conditions were averagely divided into control group and test group. There are no statistically differences in age, gender, height, weight and ASA classification of patients in both groups. Details are showed in Table 1. Patients in both groups were tested SpO<sub>2</sub> before operation, by trachea cannula and after operation. In the same group, SpO<sub>2</sub> tested before and after operation had significantly statistical difference. However, comparison among groups showed that SpO<sub>2</sub> tested before and after operation had no significantly statistical difference. Details are showed in Table 2.

**Table 1.** Basic data.

Characteristic	G1 (n=50)	G2 (n=50)	P
Age, mean(yr) <sup>*</sup>	36.6 ± 12.4	34.9 ± 10.7	0.465
Gender <sup>#</sup>			
Male	37	35	
Female	13	15	0.677
Height, mean (cm) <sup>*</sup>	171.2 ± 8.3	169.4 ± 7.8	0.267
Weight, mean (kg) <sup>*</sup>	65.7 ± 10.3	66.3 ± 8.6	0.753
ASA <sup>#</sup>			
I level	22	20	
II level	28	30	0.685
dosage of analgesic , mean (mg) <sup>*</sup>	70.5 ± 17.6	54.6 ± 15.8	0.009

**Note:** <sup>\*</sup>The statistical method is t-test. <sup>#</sup>The statistical method is chi-square test.

**Pain score and dosage of analgesic**

After operation, VAS was adopted to grade patients' pain in both groups regularly. Whether in quiet or in cough, postoperative VAS scores of patients in group 2 were significantly lower than those in group 1, and the difference had statistical significance ( $p < 0.05$ ). Details are showed in Table 3.

**Table 3.** VAS score of patients in both groups in quiet and cough.

Condition	Group	4 h <sup>ac</sup>	8 h <sup>bd</sup>	12 h <sup>e</sup>	24 h
In quiet	G1	1.5 ± 0.9	1.8 ± 0.9	2.3 ± 0.8	2.9 ± 0.8
	G2	0.9 ± 0.6	1.4 ± 0.4	1.6 ± 0.6	2.0 ± 1.0
In cough	G1	2.3 ± 1.0	2.9 ± 0.9	3.6 ± 0.8	4.3 ± 0.7
	G2	2.1 ± 0.8	2.6 ± 1.2	3.2 ± 1.0	3.5 ± 0.9

**Note:** Repeated measures analysis of variance was adopted; LSD was applied for pairwise comparison;

In quiet:  $F_{\text{management}}=2.6713, p < 0.05; F_{\text{time}}=12.658, p < 0.05;$

<sup>a</sup>the difference from data in 4 h compared with data in 8 h, 12 h and 24 h had statistically significance,  $p < 0.05;$

<sup>b</sup>the difference from data in 8 h compared with data in 24 h had statistically significance,  $p < 0.05;$

In cough:  $F_{\text{management}}=8.361, p < 0.05; F_{\text{time}}=24.692, p < 0.05;$

<sup>c</sup>the difference from data in 4 h compared with data in 8 h, 12 h and 24 h had statistically significance,  $P < 0.05;$

<sup>d</sup>the difference from data in 8 h compared with data in 12 h and 24 h had statistically significance,  $p < 0.05;$

<sup>e</sup>the difference from data in 12 h compared with data in 24 h had statistically significance,  $p < 0.05.$

**Discussion**

General anesthesia is a common method of surgical anesthesia in thoracic surgical procedures. General anesthesia, by acting on the corresponding ion channel and receptor protein [8,9], promotes patients to enter a status of similar sleep. Then patients were performed a surgery and accompanied by pain during the surgery. In these years the researches for general anesthesia have been moving on. It has shown in some studies that anesthesia drugs block the conduction of nerve impulses by selectively cutting off calcium dependent pathway, thereby weakening patients' stress response to pain [10]. However, its specific molecular mechanism is still unclear. Due to the wide range of targets, while exerting the anesthesia action, it will also have some side effects. For instance, instability of the cell microtubule caused by anesthesia will result in corresponding cognitive dysfunction [11].

Nerve block anesthesia is relatively accurate for surgical spot, blocks the occurrence of stress response and reduces immunoreaction. Combination of surgery and anesthesia not only decreases the dose of general anesthesia and reduces the side effect of anesthesia but also is helpful to the recovery of patients' bodies and improve the prognosis [12,13]. Besides, postoperative pain is an important factor to prolong the time of hospitalization [14]. Some researches has indicated that after entering into nerve tissues, local anesthesia drugs selectively

block sodium pathway and its related action potential to inhibit pain [15]. This study was carried out to analyze the influence of two anesthesia solution to the relief for pain after surgery. The comparison result reveals that compared with patients who only accepted general anesthesia, the combination of general anesthesia and thoracic paravertebral blockade has a more significant analgesic effect which is beneficial to the relief of patients' pain after surgery. In addition, the combination obviously reduces the use of postoperative analgesics. It has demonstrated that nerve block can produce a long-time analgesic effect in surgery, even can be extended to more than 24 hours after surgery [12,16]. The dose of analgesics decreases because of the significant analgesia action of nerve block. Therefore, the side effects caused by nerve block drugs are reduced, too.

This research aims at the analysis of clinical treatment, which has certain limitation. The molecular mechanism of effect of general anesthesia combined with nerve block on pain is still not clear. At present, it has been indicated in some studies that the effect of nerve block on postoperative pain relief may be related to the blockade of sympathetic ganglia [17]. In other studies on pain, impulse conduction of sympathetic ganglia was blocked by paravertebral nerve block, which made contributions to relieving pain and improved the quality of patients' lives after surgery [18]. However, a large number of experiment and clinical researches are needed to analyze in-depth mechanism on general anesthesia.

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