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*Observational Study*

**Evaluation of bronchoscopic direct vision glottis anesthesia method in bronchoscopy**

Lang J *et al.* Evaluation of bronchoscopic direct vision anesthesia

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## **Abstract**

### **BACKGROUND**

Fibrobronchoscopy is a common adjunct tool that requires anesthesia and is widely used in the diagnosis and treatment of various respiratory diseases. However, current anesthesia methods, such as spray, nebulized inhalation, and cricothyroid membrane puncture, have their own advantages and disadvantages. Recently, studies have shown that bronchoscopic direct-view glottis anesthesia is a simple and inexpensive method that shortens the examination time and provides excellent anesthetic results.

### **AIM**

To evaluate the effectiveness of bronchoscopic direct vision glottis anesthesia for bronchoscopy.

### **METHODS**

The study included 100 patients who underwent bronchoscopy during thoracic surgery. A random number table method was used to divide the patients into control and observation groups (50 patients each). The control and observation groups were anesthetized using the nebulized inhalation and bronchoscopic direct vision glottis method, respectively. Hemodynamic indices [systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and oxygen saturation (SpO<sub>2</sub>) before (T1), 5 min after anesthesia (T2), and at the end of the operation (T3)] serum stress hormone indices [norepinephrine (NE), epinephrine (E), adrenocorticotrophic hormone (ACTH), and cortisol (Cor) before and after treatment] were compared between the 2 groups. Adverse effects were also compared between the two groups.

### **RESULTS**

At T2 and T3, SBP, DBP, and HR were lower in the observation group than the control group, whereas SpO<sub>2</sub> was higher than the control group [(119.05 ± 8.01) mmHg *vs* (127.05 ± 7.83) mmHg, (119.35 ± 6.66) mmHg *vs* (128.39 ± 6.56) mmHg, (84.68 ± 6.04)

mmHg *vs*  $(92.42 \pm 5.57)$  mmHg,  $(84.53 \pm 4.97)$  mmHg compared to  $(92.57 \pm 6.02)$  mmHg,  $(74.25 \pm 5.18)$  beats/min compared to  $(88.32 \pm 5.72)$  beats/min,  $(74.38 \pm 5.31)$  beats/min compared to  $(88.42 \pm 5.69)$  beats/min,  $(97.36 \pm 2.21)\%$  *vs*  $(94.35 \pm 2.16)\%$ ,  $(97.42 \pm 2.36)\%$  *vs*  $(94.38 \pm 2.69)\%$ , with statistically significant differences (all  $P < 0.05$ ). After treatment, NE, E, ACTH, and Cor were significantly higher in both groups than before treatment, but were lower in the observation group than in the control group [ $(68.25 \pm 8.87)$  ng/mL *vs*  $(93.35 \pm 14.00)$  ng/mL,  $(53.59 \pm 5.89)$  ng/mL *vs*  $(82.32 \pm 10.70)$  ng/mL,  $(14.32 \pm 1.58)$  pg/mL *vs*  $(20.35 \pm 3.05)$  pg/mL,  $(227.35 \pm 25.01)$  nmol/L *vs*  $(322.28 \pm 45.12)$  nmol/L], with statistically significant differences (all  $P < 0.05$ ). The incidence of adverse reactions was higher in the control group than in the observation group [12.00% (12/50) *vs* 6.00% (3/50)] ( $P < 0.05$ ).

## CONCLUSION

The use of bronchoscopic direct vision glottis anesthesia method for bronchoscopy patients is beneficial for stabilizing hemodynamic indices during bronchoscopy and reducing the level of patient stress, with good safety and practicality.

**Key Words:** Direct bronchoscopy; Glottis anesthesia method; Bronchoscopy; Airway; Sedation

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**Core Tip:** We evaluated the use of bronchoscopic direct vision glottis anesthesia method for bronchoscopy patients, and found it was beneficial for stabilizing hemodynamic indices during bronchoscopy and reducing the patient stress level with good safety and practicality.

## **INTRODUCTION**

Fibrobronchoscopy is a common adjunct tool in the clinical setting, and with technological advancements it has been used in the diagnosis and treatment of various respiratory diseases<sup>[1,2]</sup>. This examination method is invasive and requires the placement of a bronchoscope into the lower respiratory tract through the oral or nasal cavity. It enters the airway and bronchi through the larynx or even more distally to examine the tracheal and bronchial lesions and provide appropriate treatment according to the condition of the lesions. During bronchial manipulation, patients experience significant discomfort; therefore, anesthesia is necessary<sup>[2]</sup>. Previously, nebulized inhalation anesthesia was used, which, to some extent, relaxed and opened the patient's vocal cords, reduced airway resistance, and prevented bronchospasm; however, the overall anesthetic effect was poor<sup>[3]</sup>. Recent studies have shown that bronchoscopic direct vision vocal anesthesia-assisted bronchoscopy has better clinical performance<sup>[4]</sup>. Therefore, this study examined the effect of bronchoscopic direct vision vocal anesthesia on bronchoscopy in patients who underwent bronchoscopy.

## **MATERIALS AND METHODS**

### ***Subjects and methods***

In total, 100 patients who underwent bronchoscopy at the Department of Thoracic Surgery of Tangshan People's Hospital between June 2017 and June 2019 were included in the study. The random number table method was used to divide the patients into control and observation groups (50 patients each). The inclusion criteria were: (1) Patients with respiratory system diseases that require bronchoscopy; (2) are older than 18 years and younger than 65 years, with no restriction on gender; (3) patients and/or family members voluntarily participate in this study, ensure compliance with all measures, and sign an informed consent form; and (4) are receiving bronchoscopy for the first time, have American Society of Anesthesiologists classification of grade I or II,

and have been prescribed the anesthetic drugs used in this study. The exclusion criteria were: (1) Allergy to the drugs used in this study; (2) congenital malformations of the respiratory system; (3) mental disorders or cognitive abnormalities that prevent normal examination procedures; (4) women who are breastfeeding or pregnant; and (5) long-term alcohol or drug use resulting in increased tolerance of the body to anesthetic drugs. The control group comprised of 32 males and 18 females, aged 42-65 years, with an average age of  $(52.25 \pm 8.13)$  years, an average body mass index (BMI) of  $(23.18 \pm 3.50)$  kg/m<sup>2</sup>, with six cases of pneumonia, 22 cases of lung cancer, 8 cases of chronic obstructive pulmonary disease, eight cases of bronchiectasis, and six cases of tuberculosis as the primary disease. The observation group comprised of 34 males and 16 females aged 41-64 years, with a mean age of  $(51.70 \pm 8.05)$  years, a mean BMI of  $(23.22 \pm 2.87)$  kg/m<sup>2</sup>, seven cases of pneumonia, 23 cases of lung cancer, five cases of chronic obstructive pulmonary disease, 10 cases of bronchiectasis, and five cases of tuberculosis as the primary cause. The study was performed after obtaining approval from the Medical Ethics Committee of Tangshan People's Hospital.

### ***Examination methods***

Patients in the two groups routinely fasted for 8 h prior to the examination. Pulsed high-flow oxygen was used during the examination, and the patient vital signs were monitored. After completing the examination, all patients received supportive symptomatic treatment. An electronic bronchoscope (Olympus, BF-1T260, Japan) was used for the examination. The control group was anesthetized by the nebulized inhalation method using 15 mL of 2% lidocaine hydrochloride injection (Henan Province Shennong Pharmaceutical Co., Ltd., State Drug Quantifier H20043428, 5 mL:0.1 g, Lot No. 2017052258) for 10 min. Bronchoscopy was then performed, with the patients receiving oxygen during the operation. In the observation group, bronchoscopy was performed by direct vision bronchoscopy, and 1% lidocaine solution was injected directly into the vocal cords when the lens passed through the epiglottis for 2-3 mL. The patient was asked to breathe deeply to allow the anesthetic to enter the trachea through

the vocal cords. The patient was allowed to breathe deeply for 1 minute after removing the bronchoscope. Total amount of lidocaine was controlled under 300mg per patient. The procedure was repeated and venous blood was collected from the patient before and after treatment for testing.

### ***Observation indices***

Hemodynamic indices: Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and oxygen saturation (SpO<sub>2</sub>) before anesthesia (T1), 5 min after anesthesia (T2), and after the end of the operation (T3) in the two groups were measured. Serum stress hormone indicators: norepinephrine (NE), epinephrine (E), adrenocorticotrophic hormone (ACTH), and cortisol (Cor) were also measured. Serum was obtained after 5 mL of venous blood was drawn at 3000 r/min with a radius of 10 cm at high speed for 15 min, placed in a low temperature refrigerator at -20 °C and tested within 2 h by enzyme-linked immunosorbent assay (Wuhan Ruisheng Biotechnology Co., Ltd., China) using an automatic biochemistry instrument (Beckman Coulter, AU7900) following the kit and instrument's instructions. Adverse reaction indices: Adverse reactions that occurred during anesthesia in the two groups were recorded including limb twitching, abnormal breathing, choking, and poor memory.

### ***Statistical analysis***

SPSS24.0 software was used for statistical analyses; the results of measurement data are expressed as (mean ± SD), and the results of count data are expressed as number of cases (*n*) and percentage (%). Independent samples *t*-test was used to compare measurement data between groups, paired *t*-test was used to compare measurement data before and after treatment within groups, and  $\chi^2$  test was used to compare count data between groups. Statistical significance was set at  $P < 0.05$ .

## **RESULTS**

### ***Comparison of hemodynamic indexes between the two groups***

At T1, the differences between SBP, DBP, HR, and SpO<sub>2</sub> in the two groups were not statistically significant (all  $P > 0.05$ ); however, at T2 and T3, SBP, DBP, and HR were significantly higher and SpO<sub>2</sub> was significantly lower in the control group, whereas, none of the hemodynamic indices showed significant changes in the observation group. In T2 and T3, SBP, DBP, and HR in the observation group were lower than the control group, while SpO<sub>2</sub> was higher than the control group, and the differences were statistically significant ( $P < 0.05$ ) (Table 1). Plasma concentrations were investigated and no significance was found between the case and control groups (case:  $2.25 \pm 0.12$ ; control:  $2.21 \pm 0.14$ ;  $P > 0.05$ ).

#### *Comparison of serum stress hormone indexes between the two groups*

Prior to treatment, there was no statistically significant difference between the two groups in NE, E, ACTH, and Cor levels ( $P > 0.05$ ). Post treatment, the NE, E, ACTH, and Cor levels of the two groups were significantly higher, however, NE, E, ACTH, and Cor in the observation group were significantly lower than the control group ( $P < 0.05$ ) (Table 2).

#### *Comparison of adverse reaction indicators between the two groups*

The incidence of adverse reactions was higher in the control group than in the observation group ( $P < 0.05$ ) (Table 3).

### **DISCUSSION**

In the process of fiberoptic bronchoscopy, the bronchoscope will inevitably stimulate or pull on the pharynx and tracheal wall during surgery, and patients are prone to physiological reflexes such as wheezing, choking, and nausea, which not only seriously affect the operation of bronchoscopy but also cause anxiety, fear, and nervousness in patients<sup>[5]</sup>. Moreover, a significant proportion of patients are unable to cooperate with the completion of monitoring, making the examination meaningless<sup>[6]</sup>.



In recent years, local anesthesia methods before bronchoscopy have included spray, nebulized inhalation, cricothyroid membrane puncture, tracheal drip, and nasal drip anesthesia methods; the first three are the most common<sup>[7,8]</sup>. Various local anesthesia methods have their own advantages and disadvantages; for example, for the cricothyroid puncture injection, endotracheal anesthesia effect is good. There is no anesthetic effect on the pear-shaped fossa, but it is an invasive operation, there is a risk of bleeding while increasing the patient's pain, and the patient compliance requirements are high<sup>[8]</sup>. The nebulized inhalation method is simple and easy, with high compliance; however, its anesthetic effect is impacted by many factors, such as awake patients, number of secretions in the airway, and individual differences, which have a greater impact on the amount of anesthetic required<sup>[9]</sup>. The use of intravenous anesthesia poses certain risks<sup>[10]</sup> requires the involvement of professional anesthesiologists, and the corresponding resuscitation measures need to be in a ready state. The bronchoscopic direct-view glottis anesthesia method has a good anesthetic effect on both the endotracheal and pear-shaped fossa<sup>[11]</sup>, which can improve the patient's tolerance to bronchoscopy and reduce the degree of postoperative pain recall. Bronchoscopic direct-view glottis anesthesia is simple, inexpensive, shortens examination time, and provides excellent anesthetic results. This greatly reduces or directly eliminates all types of physiological and psychological abnormalities caused by the stimulation and pulling of tissues during the endoscopy and improves the patient's ability to tolerate and complete the examination.

The observation group in this study received bronchoscopic direct vision glottis anesthesia. Compared to the nebulized anesthesia method, the direct-view subglottic drip anesthesia method can be performed under direct vision and is easy to operate and promote. Clinical research has shown that the application of the direct-view subsonic drip method of anesthesia has a rapid onset of action, an ideal anesthetic effect, and reduces the time required for bronchoscopy. Compared with other anesthesia methods, this method requires fewer instruments and can reduce the economic burden on patients; therefore, it can be promoted in primary hospitals.

The study compared anesthesia between the two groups in three dimensions: hemodynamics, stress indicators, and adverse reactions. In the control group, only nebulized inhalation anesthesia was used, and the patients inevitably experienced choking and dyspnea during the operation, which led to dramatic changes in HR, SBP, DBP and SpO<sub>2</sub> indices at various time points. Patients in the observation group showed relatively stable hemodynamic indices owing to the precise application of anesthetic drugs; low anesthetic dosage, good local anesthesia effect, minimal response to the operation, and minimal response to tracheal stimulation, thus reflecting a smooth and stable operation process. The levels of serum stress indicators in the two groups were compared before and after treatment. The human adrenal glands are important organs in the stress response. Sympathetic activation promotes the synthesis and secretion of adrenaline and noradrenaline from the adrenal medulla, while activation of the hypothalamic-pituitary-adrenocortical axis promotes the secretion of cortisol from the adrenal cortex *via* ACTH secretion from the pituitary gland. During bronchoscopy, physiological and psychological symptoms caused by stimulation of the tracheal wall and pulling can directly activate the stress response, leading to the release of adrenomedullary hormones and corticosteroids into the circulation<sup>[12]</sup>. From these results, it is clear that the anesthesia protocol in the observation group effectively alleviated the physiological and psychological stress symptoms of patients during bronchoscopy and inhibited the process of activation of synergistic hormone release by the stress response.

In the comparison of adverse reactions, the observation group also had a clear advantage, as the degree of anesthesia with the bronchoscopic direct-view subglottic anesthesia method was significantly higher than that with the nebulized inhalation anesthesia method, and the patients had a lower risk of various adverse reactions. It should be noted that the use of the bronchoscopic direct visual glottis anesthesia method causes heavy choking symptoms in the early stage of anesthesia, so it is necessary to monitor the patient's breathing, blood pressure, HR, *etc.* at all times to ensure the safety of the patient.

## **CONCLUSION**

The use of bronchoscopic direct-view subglottic anesthesia for bronchoscopy patients with adequate anesthesia of the pear-shaped crypt and tracheal mucosa is conducive to stabilizing hemodynamic indices during the operation and reducing the level of patient stress, with good safety and practicality.

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