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Observation on the Nursing Effect of Atomization on Patients with Postoperative Sore Throat after Tracheal Intubation General Anesthesia

Huaze Qu

Department of Anesthesiology, Sun Yat-sen University Cancer Center, Guangzhou, China
Email: quhz@sysucc.org.cn

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Abstract

Objective: To explore the nursing effect of nebulization intervention on patients with sore throat after tracheal intubation general anesthesia. **Methods:** A total of 80 patients with sore throat after tracheal intubation general anesthesia admitted to our hospital from December 2023 to December 2024 were divided into a control group (40 cases, receiving routine nursing) and a research group (40 cases, receiving nebulization intervention on the basis of the control group) according to the random number table method. The nursing intervention effects of the two groups were compared and analyzed. **Results:** Compared with before the intervention, half an hour, 1 hour and 2 hours after the intervention, the Visual Analogue Scale (VAS) scores of both groups decreased, and the scores gradually decreased with the extension of the intervention time ($P < 0.05$). The time for the complete disappearance of throat dryness and foreign body sensation in the research group was shorter than that in the control group ($P < 0.05$). The total nursing satisfaction rate in the research group was 95.00%, which was higher than 80.00% in the control group ($P < 0.05$). **Conclusion:** Applying nebulization treatment to patients with sore throat after tracheal intubation general anesthesia can effectively relieve the degree of throat pain, accelerate the disappearance of throat dryness and foreign body sensation, and improve nursing satisfaction, which has clinical reference value.

Keywords

Tracheal Intubation, General Anesthesia, Sore Throat, Atomization

1. Introduction

General anesthesia with tracheal intubation is a commonly used anesthesia method in surgical operations. It maintains airway patency through a tracheal tube to ensure oxygen supply during the operation [1]. However, tracheal intubation is an invasive procedure. During the insertion and indwelling of the tube, it will cause mechanical stimulation to the pharyngeal and laryngeal mucosa, leading to mucosal congestion, edema and even damage. Patients are prone to experience discomfort symptoms such as sore throat, dryness and foreign body sensation after the operation [2]. These symptoms not only increase the patients' pain, but may also affect postoperative eating, cough and expectoration, and even increase the risk of complications such as pulmonary infection. At present, there are various clinical nursing measures for postoperative sore throat. Routine nursing mainly includes oral care, position nursing and diet guidance. Although it can relieve the patients' discomfort symptoms, its effect on improving pharyngeal and laryngeal mucosal edema is limited, and it is difficult to meet the patients' needs for rapid postoperative recovery. Aerosol inhalation converts drugs into tiny particles through a nebulizer and directly acts on the pharyngeal and laryngeal and tracheal mucosa. It can make the drugs reach the lesion directly, and has the advantages of quick onset and few adverse reactions [3]. Salbutamol is a selective β2-receptor agonist, which can relax the smooth muscles of the pharynx, larynx and airway, relieve airway spasm, reduce airway resistance, improve the tense state of the pharyngeal and laryngeal mucosa, and promote the discharge of airway secretions, thus relieving the pain symptoms caused by tracheal spasm. Budesonide can enhance the stability of bronchial smooth muscle cells, reduce the activity of histamine-like mediators, and effectively relieve the symptoms of tracheal swelling. The combination of the two can exert a synergistic effect and effectively relieve symptoms such as sore throat. Since there are few relevant clinical studies and no systematic conclusion has been formed, in view of this, this study established a control group and a study group to explore the nursing effect of aerosol inhalation on patients with sore throat after general anesthesia with tracheal intubation, so as to provide a reference for clinical nursing. The results are reported as follows:

2. Materials and Methods

2.1. General Information

According to the random number table method, 80 patients with sore throat after tracheal intubation general anesthesia surgery admitted to our hospital from December 2023 to December 2024 were divided into two groups, with 40 cases in each group. In the study group, there were 25 males and 15 females, aged from 23 to 64 years old, with an average age of (43.58 ± 5.02) years. The types of surgeries included 18 cases of abdominal surgery, 10 cases of orthopedic surgery, 8 cases of thoracic surgery, and 4 cases of other surgeries. In the control group, there were 22 males and 18 females, aged from 25 to 63 years old, with an average age of

(44.02 ± 5.11) years. The types of surgeries included 16 cases of abdominal surgery, 12 cases of orthopedic surgery, 9 cases of thoracic surgery, and 3 cases of other surgeries. There was no statistically significant difference in the general data between the two groups of patients ($P > 0.05$), indicating comparability. This experiment has been approved by the hospital ethics committee (Ethics No. G2023-238).

2.2. Inclusion and Exclusion Criteria

Inclusion criteria: 1) American Society of Anesthesiologists (ASA) physical status classification [4] I-II; 2) Patients who underwent tracheal intubation for general anesthesia for the first time, and complained of persistent throat pain, dryness or foreign body sensation 1 h after tracheal extubation, with a score of ≥4 on the Visual Analogue Scale (VAS) at rest; 3) Patients who voluntarily signed the informed consent form; 4) Patients who were awake after surgery and able to cooperate in completing the pain assessment.

Exclusion criteria: 1) Patients with pre-operative pharyngeal and laryngeal diseases (such as pharyngolaryngitis, tonsillitis); 2) Patients with swallowing dysfunction or impaired consciousness; 3) Patients who developed severe complications (such as laryngeal edema, massive hemorrhage) later.

2.3. Methods

All patients underwent surgical anesthesia and tracheal intubation by the same group of senior anesthesiologists: 1) Anesthesia protocol: Patients were routinely fasted and prohibited from drinking water before surgery. After entering the operating room, intravenous access was established, vital signs were monitored, and general anesthesia was induced with propofol, sufentanil, and rocuronium. During the operation, anesthetic drugs were continuously infused via an intravenous pump to maintain the depth of anesthesia. 2) Tracheal tube parameters: A 7.5# tracheal tube was selected for adult males, and a 7.0# tracheal tube was selected for adult females. All tubes were disposable sterile medical tracheal tubes. 3) Cuff pressure management: After successful intubation, a cuff pressure monitor was used to adjust the cuff pressure, maintaining it at 20 - 25 cmH_2O. The pressure was monitored every 6 - 8 hours to avoid mucosal damage caused by excessive pressure and air leakage due to insufficient pressure. 4) Intubation operation: The operation was strictly standardized, with a single intubation attempt. The number of intubation failures was ≤1, and the total intubation operation time was ≤30 s. During the operation, the tube was properly fixed to prevent tube displacement and friction against the airway mucosa. 5) Intubation indwelling time: The indwelling time of the tracheal tube during the operation was controlled within 1 - 3 hours for all patients, with no significant difference between groups. 6) Perioperative medication: None of the patients received glucocorticoids, non-steroidal anti-inflammatory drugs, or other drugs that could relieve pharyngeal edema and pain during the operation and within 6 hours after the operation. Meanwhile,

nursing measures were provided on this basis.

Control group: Routine nursing: 1) Postoperative nursing: After the patient returns to the ward, place the patient in a supine position without a pillow and turn the head to one side to keep the airway unobstructed and monitor vital signs. 2) Oral care: If the patient is awake and has no discomfort such as vomiting or choking 6 hours after the operation, assist the patient to rinse the mouth with warm boiled water twice a day. 3) Dietary guidance: The patient can have warm and cool liquid diet 6 hours after the operation, and gradually transition to semi-liquid and soft food. Avoid spicy and irritating foods. 4) Health education: Explain to the patient the cause of postoperative sore throat, inform the patient that it is a common phenomenon and generally will gradually relieve. Guide the patient to speak less and avoid overusing the voice.

Research group: On the basis of the control group, nebulization intervention was given. When the patient was awake after surgery, with stable vital signs and no symptoms such as nausea and vomiting, the patient was assisted to maintain a semi-sitting or sitting position, with the head tilted slightly backward to fully protect the throat. Then, 1 ml of Salbutamol Sulfate Solution for Inhalation (Shandong Jingwei Pharmaceutical Co., Ltd., Approval Number of National Medicine H20213251, specification 2.5 ml: 5 mg), 1 ml of Budesonide Suspension for Inhalation (Changfeng Pharmaceutical Co., Ltd., Approval Number of National Medicine H20213357, specification 2 ml: 1 mg), and 2 ml of 0.9% normal saline were injected into a medical nebulizer (Hebei Rongxiang Medical Device Co., Ltd., Hebei Medical Device Registration No. 20222080016, model NB01A01) for nebulization inhalation intervention. The nebulization airflow rate was 6 - 8 L/min, the nebulization time was 15 minutes each time, and it was given twice a day. Before the intervention, the performance of the nebulizer was checked to ensure the normal operation of the equipment, and the patient was explained in detail the purpose, operation process, precautions, etc. of nebulization inhalation. During the nebulization intervention, the patient's vital signs were continuously monitored, and whether there were symptoms such as nausea and chest tightness was also continuously observed. Once any abnormality occurred, the doctor should be reported immediately for treatment. Meanwhile, after nebulization inhalation, the patient was assisted to rinse the mouth and cough effectively.

2.4. Observation Indicators

1) Compare the sore throat conditions of the two groups at different time points: The Visual Analogue Scale (VAS) [5] was used for evaluation before the intervention (when the patient had not received any pain-relieving measures, such as 30 minutes after extubation), half an hour, 1 hour, and 2 hours after the intervention. The total score was 10 points, and the higher the score, the more obvious the pain.

2) Compare the time when the symptoms of throat discomfort (throat dryness and foreign body sensation) completely disappear between the two groups.

3) Compare the nursing satisfaction levels between the two groups: Evaluate

using the Newcastle Satisfaction with Nursing Scale (NSNS) [6]. The total score is 95 points. Scores > 75 points, 57 - 75 points, and <57 points correspond to satisfaction, average satisfaction, and dissatisfaction respectively. The total satisfaction rate = (number of satisfied + number of average − satisfied cases)/total number of cases participating in the study in this group * 100%.

4) Compare the safety between the two groups, including nausea, chest tightness, palpitations, bronchospasm, oral discomfort, etc.

2.5. Statistical Analysis

The collected data were statistically analyzed using SPSS 23.0 software. Count data and measurement data conforming to the normal distribution were expressed as cases (%) and ($\overline{x} \pm s$) respectively. The c^2 test and t-test were used in sequence. Repeated-measures analysis of variance was used for the VAS repeated-measurement data at different time points to analyze the main effect of the group, the main effect of time, and the group-time interaction effect. A difference was considered statistically significant when $P < 0.05$.

3. Results

3.1. Compare the Sore Throat Conditions of the Two Groups at Different Time Points

Before the intervention, there was no statistically significant difference in VAS scores between the two groups ($P > 0.05$). However, the scores decreased at half an hour, 1 hour, and 2 hours after the intervention, and the scores gradually decreased with the extension of the intervention time ($P < 0.05$), as shown in Table 1.

Table 1. Comparison of sore throat conditions between the two groups at different time points ($\overline{x} \pm s$, score).

Group	Before intervention	Half an hour after the intervention	One hour after the intervention	Two hours after the intervention
Control group (n = 40)	6.26 ± 1.23	5.50 ± 1.06*	4.16 ± 1.01*	2.66 ± 0.52*
Research group (n = 40)	6.34 ± 1.28	4.21 ± 0.89*	3.65 ± 0.45*	2.02 ± 0.32*
t	0.285	5.895	2.917	6.629
P	0.776	<0.001	0.005	<0.001
Inter-group F value/P value	F = 15.270, P < 0.05			
F time value/P value	F = 86.540, P < 0.05			
F interaction value/P value	F = 12.890, P < 0.05			

Note: Compared with before the intervention, *P < 0.05, indicating statistical significance.

3.2. Compare the Time for the Complete Disappearance of Throat Discomfort Symptoms between the Two Groups

The time for the complete disappearance of throat dryness and foreign body sen-

sation in the study group was shorter than that in the control group (P < 0.05), as shown in Table 2.

Table 2. Comparison of the time for the complete disappearance of pharyngeal discomfort symptoms between the two groups ($\bar{x} \pm s$, h).

Group	Complete disappearance time of throat dryness	The time when the foreign body sensation completely disappears
Control group (n = 40)	22.23 ± 2.65	25.46 ± 3.98
Research group (n = 40)	15.65 ± 2.04	16.32 ± 2.01
t	12.444	12.965
P	<0.001	<0.001

3.3. Compare the Satisfaction Levels of the Two Groups with Nursing Care

The total nursing satisfaction rate in the research group was 95.00%, higher than 80.00% in the control group (P < 0.05), as shown in Table 3.

Table 3. Comparison of the satisfaction with nursing between the two groups ([n(%)], cases).

Group	Satisfied	Generally	Not satisfied	Total satisfaction rate (%)
Control group (n = 40)	14 (35.00)	18 (45.00)	8 (20.00)	32 (80.00)
Research group (n = 40)	16 (40.00)	22 (55.00)	2 (5.00)	38 (95.00)
c^2	-	-	-	4.114
P	-	-	-	0.043

3.4. Comparison of Safety between the Two Groups

No adverse reactions were observed in either group (P < 0.05).

4. Discussion

Muscle relaxants used in general anesthesia surgery may cause patients to lose consciousness and protective reflexes, which can easily lead to aspiration. At this time, tracheal intubation can ensure sufficient gas exchange for patients, maintain the balance of oxygen supply and demand, effectively correct the state of hypoxia, and tracheal intubation can also protect the patient's airway and prevent aspiration [7]. However, in recent years, studies have found [8] that the insertion of the catheter during tracheal intubation can cause friction and extrusion on the patient's pharyngeal mucosa, resulting in mucosal damage, congestion and edema. Moreover, the continuous compression of the catheter during intubation can af-

fect the blood circulation in the pharynx, aggravate mucosal damage, and induce pain. In the past, methods such as fasting, taking throat lozenges, and avoiding spicy and irritating foods could improve the patient's pain symptoms, but their effects were slow. Aerosol inhalation intervention is a local treatment method. By directly applying drugs to the patient's pharynx and tracheal mucosa, it can significantly improve the patient's throat discomfort symptoms and promote the improvement of their condition [9] [10].

This study found that nebulized inhalation intervention can relieve the pain symptoms of patients with sore throat after general anesthesia with tracheal intubation. The analysis is as follows: In the nebulized inhalation intervention of the study group, the selected drugs were salbutamol solution, budesonide suspension combined with normal saline. Among them, salbutamol solution can relax the airway smooth muscles of patients, improve their airway ventilation, and relieve the tension of the pharyngeal mucosa, thus assisting in improving the pain symptoms; budesonide suspension can directly act on the airway mucosa of patients, reduce the release of inflammatory substances, and relieve the inflammatory reaction at the root, thereby reducing pain stimulation and improving pain; normal saline has a good moisturizing effect. By moistening the throat, it can timely moisten the dry mucosa of patients, supplement water to the pharyngeal mucosa, and keep it in a moist state. The moist mucosa can reduce mucosal friction and irritation, thus relieving the pain caused by dryness, which helps to relieve the patients' pharyngeal discomfort. Moreover, gargling with normal saline can improve the local microcirculation of patients and promote the repair of damaged mucosa [11] [12]. The combination of the three can synergistically improve the patients' pain symptoms. This study showed that nebulized inhalation can relieve the symptoms of throat dryness and foreign body sensation in patients with sore throat after general anesthesia with tracheal intubation. The reasons are considered as follows: Normal saline in nebulized inhalation has a moistening effect, which can supplement the water of the pharyngeal mucosa, relieve the dryness of the mucosa, and improve the patients' discomfort; the anti-inflammatory and detumescence effect of budesonide can reduce the swelling of the pharyngeal mucosa [13]. At the same time, adjusting the body position can make the nebulized drugs contact the pharyngeal mucosa of patients more fully, thereby improving the drug absorption efficiency and promoting mucosal repair [14]. In addition, assisting patients to cough effectively and take deep breaths after nebulization intervention can promote the discharge of residual secretions in the throat, thereby reducing the foreign body sensation and improving the discomfort.

This study shows that the application of atomization method in patients with postoperative sore throat after endotracheal intubation general anesthesia can achieve high nursing satisfaction and safety. The reasons are as follows: atomized inhalation is simple to operate, painless, low-cost, has no adverse reactions, is highly safe, and is easily accepted by patients. Moreover, this method can effectively relieve patients' discomfort symptoms such as throat dryness, pain and for-

eign body sensation, thus achieving high satisfaction. Meanwhile, a series of nursing measures during the atomized inhalation process can enable patients to feel the professionalism and humanistic care of nursing, enhancing their trust in nursing staff, so high satisfaction can be obtained [15].

In conclusion, aerosol inhalation can improve the symptoms of pharyngalgia in patients with pharyngalgia after general anesthesia with endotracheal intubation, accelerate the rapid disappearance of throat dryness and foreign body sensation, and improve nursing satisfaction. It is safe and reliable, and has clinical reference value. However, there are also certain deficiencies in this study. For example, the number of patients included in the sample is limited. Therefore, the sample size of patients should be gradually increased in subsequent clinical research to further ensure the validity of the research.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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