

# Application Value of High-Flow Nasal Cannula Therapy in Sequential Treatment of Chronic Obstructive Pulmonary Disease After Weaning from Invasive Mechanical Ventilation

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## ABSTRACT

**Objective:** To investigate the application value of high-flow nasal cannula (HFNC) therapy in the sequential treatment of chronic obstructive pulmonary disease (COPD) after weaning from invasive mechanical ventilation.

**Methods:** A total of 100 COPD patients who were admitted to our hospital from October 2017 to March 2019 were selected and divided into two groups using a random number table (n=50). After weaning from invasive mechanical ventilation, the patients in control group received non-invasive mechanical ventilation, while those in observation group underwent HFNC therapy. The total effective rate, relief time of symptoms, auxiliary oxygen inhalation time, hospital stay, serum inflammatory factors, pulmonary ventilation function indices, arterial blood gas indices and incidence rate of complications were compared between the two groups.

**Results:** The total effective rate was higher in observation group than that in control group (96.00% vs. 80.00%,  $P < 0.05$ ). The relief time of symptoms such as cough, expectoration and short breath was shorter in observation group than that in control group, and the auxiliary oxygen inhalation time and hospital stay were shorter in observation group than those in control group ( $P < 0.05$ ). After treatment, the levels of C-reactive protein, interleukin-6 and procalcitonin were lower in observation group than those in control group ( $P < 0.05$ ). Besides, after treatment, the forced expiratory volume in one second (FEV1), FEV1 to forced vital capacity ratio, arterial partial pressure of oxygen and blood oxygen saturation level were higher in observation group than those in control group ( $P < 0.05$ ), while the arterial partial pressure of carbon dioxide was lower in observation group than that in control group ( $P < 0.05$ ). The incidence rate of complications was lower in observation group than that in control group (2.00% vs. 14.00%,  $P < 0.05$ ).

**Conclusion:** After weaning from invasive mechanical ventilation, the adoption of HFNC therapy in sequential treatment can effectively improve the curative effect of COPD patients, accelerating the relief of symptoms, shortening the treatment time, reducing the inflammatory response in the body, improving the pulmonary ventilation function and arterial blood gas status, and also decreasing complications.

**Keywords:** chronic obstructive pulmonary disease; sequential treatment; non-invasive mechanical ventilation; high-flow nasal cannula therapy

## INTRODUCTION

Compared to the placebo community following medication Persistent obstructive pulmonary disorder (COPD) is a common chronic respiratory

disorder in clinical practise.. The acute assault COPD patients were followed by symptoms such as toux, expectoration and quick respiration that severely affect patients' physical and mental wellbeing. As the disease progresses, patients' respiratory function is compromised and is easily complicated by respiratory failure which threatens patients' lives and protection [1,2]. A typical form of care for acute exacerbation of COPD is mechanical ventilation,

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which can efficiently provide patients with auxiliary inhalation of oxygen [3,4]. But it remains for the series of therapy to study what kind of auxiliary oxygen inhalation should be required during weaning. In the present analysis, between October 2017 and March 2019, 100 COPD patients were enrolled and clustered in our hospital. In concurrent patient treatment, the role of HFNC therapy in concurrent post-weaning COPD therapy or in patients undergoing high-flow nasal cannula therapy (HFNC therapy) was assessed.

## MATERIALS AND METHODS

### General information

A total of 100 COPD patients were chosen and divided into two classes using random number table ( $n=50$ ) from October 2017 until March 2019. The test community comprised 26 men and 24 women aged 50-79, with a mean age of  $(63.89 \pm 9.02)$  years. There were 27 men in the study community, and 23 women 50-78 Age, with a cumulative aged of  $63.54 \pm 9.27$  years. There were no statistically important gender and age discrepancies between the two groups ( $P < 0.05$ ). The report was approved by the Medical Ethics Committee of the Hospital and informed consent was granted to patients and their families.

Criteria for inclusion: (1) patients that have been confirmed through a clinically in-depth examination as a serious exacerbation of COPD; (2) patients who have been properly educated and (3) weaned comfortably after intrusive mechanical ventilation.

Criteria for exclusion: (1) survivor with mental disease, (2) severe complicated influenza, or (3) complicated coronary or stroke.

### Methods

The waitorante, antitussive, anti-Infective and invasive mechanical ventilation was used for all the patients and after the weaning orders they were effectively withdrawn from invasive mechanical ventilation.

Since extreme weaning, non-invasive mechanical ventilation in the control group was done using a non-invasive BiPAP ventilator. Ventilation mode was described as S / T mode, air velocity was 12-14 breaths / min, pressure was inspired and expirative were 8-20 cm H<sub>2</sub>O and 4-6 cm H<sub>2</sub>O and oxygen flow was 5-8L / min.

HFNC procedure with the MR810 humidifier (Fisher & Paykel) is taken in patients in the study community following weaning. The humidifier was attached through the nasal catheter, and every day the moisturizer obtained 500 ml of sterilizing water.

Oxygen was inhaled to patients with 30-40 percent oxygen concentration and a 50 L / min oxygen flow rate before the arterial gas became natural.

### Observation indices

Comparisons between two classes have been correlated with their average successful duration, relaxation periods (cough, sputum and breathing shorter), inhalation period for supplementary oxygen, hospital stay, serum inflammation causes, pulmonary circulation index, arterial blood gas state indexes and the concentrations of complexities.

Evaluation criterion for medicinal effects [5]: (1) Exceptional efficacy: the primary elimination of cough and sputum, and a return to usual respiratory function. (2) Effective: cough and sputum have been eased; respiratory symptoms have been strengthened. (3) Non-effective: cough and short-breathing problems have not been alleviated, nor has the respiratory situation changed. The maximum effective rate is determined in conjunction with the following formula: Average effective rate = (number of surprisingly effective cases + effective cases) / Average number of cases = 100%

Serum inflammatory factors such as C-reactive protein (CRP), interleukin-6 (IL-6) and procalcitonin (PCT) were detected in both situations. CRP is determined by immune transmission turbidity, IL-6 by immunosorbent enzyme-related assay, and PCT by immunochromatography are evaluated. Shanghai Kang Lang Biological Co., Ltd. had all billed these detection sets.

A Medisoft Body Box Lung Function Analyzer has been used to measure pulmonary ventilation indices consisting of a forced respiratory volume 1 second (FEV1) and FEV1 ratio to forced vital power (FVC).

Using a pHox Blood Gas Analyzer (Nova Biomedical), the blood gas indices, including a partial oxygen (PaO<sub>2</sub>), arterial carbon dioxide (PaCO<sub>2</sub>), and blood oxygen saturation (SpO<sub>2</sub>) were established.

Analysis scientific.

All data were evaluated by program SPSS 22.0. The numerical (n) data have been checked for  $\bar{X} \pm S$ . The quantitative data) (was t-tested. The statistically relevant  $P < 0.05$  was found.

## RESULTS

### Total effective rate

The average performance rate was higher in the measurement group than in the control group (96.00% vs. 80.00%,  $P < 0.05$ ) (Table 1).

Table 1. Total effective rates [case (%)]

Group	Case No.	Remarkably effective	Effective	Ineffective	Total effective rate
Control	50	21 (42.00)	19 (38.00)	10 (20.00)	40 (80.00)
Observation	50	26 (52.00)	22 (44.00)	2 (4.00)	48 (96.00) *

Compared with control group, \*P<0.05.

#### Relief time of symptoms, auxiliary oxygen inhalation time and hospital stay

The time of relief for symptoms such as cough, expectoration and shortness of breath was shorter

in the observation group than in the control group, and the auxiliary oxygen inhalation and hospital stay were shorter in the observation group than in the control group (P<0.05) (Table P<0.05) 2).

Table 2. Relief time of symptoms, auxiliary oxygen inhalation time and hospital stay ( $\bar{x} \pm s$ , d)

Group	Relief time of symptoms			Auxiliary oxygen inhalation time	Hospital stay
	Cough	Expectoration	Short breath		
Control (n=50)	4.73±1.67	3.36±1.28	2.84±0.90	7.23±1.78	13.91±2.57
Observation (n=50)	3.10±1.25*	2.01±0.96*	1.95±0.74*	5.49±1.35*	10.38±2.20*

Compared with control group, \*P<0.05.

#### Serum inflammatory factors

Compared to those previously caring for, CRP, IL-6 and PCT declined in both populations during care

and were lower in the observation population than in the control group during treatment (P<0.05) (Table 3).

Table 3. Serum inflammatory factors ( $\bar{x} \pm s$ )

Group	Time	CRP (mg/L)	IL-6 (ng/L)	PCT (ng/ml)
Control (n=50)	Before treatment	9.83±1.61	26.54±3.09	1.95±0.34
	After treatment	8.20±1.47 <sup>#</sup>	23.56±2.41 <sup>#</sup>	1.62±0.31 <sup>#</sup>
Observation (n=50)	Before treatment	9.72±1.64	26.29±3.15	1.93±0.37
	After treatment	6.69±1.29 <sup>#*</sup>	20.34±2.10 <sup>#*</sup>	1.30±0.29 <sup>#*</sup>

Compared with the same group before treatment, <sup>#</sup>P<0.05; compared with control group, \*P<0.05.

#### Pulmonary ventilation function and arterial blood gas indices

Compared to pre-treatment, FEV1, FEV1/FVC, PaO2, SpO2 and PaCO2 were elevated in both post-treatment groups (P<0.05), although FEV1,

FEV1/FVC, PaO2 and SpO2 were higher in the observation group than in the control group (P<0.05), while PaCO2 was lower in the observation group than in the post-treatment control group (P<0.05) (Table 4).

Table 4. Pulmonary ventilation function and arterial blood gas indices ( $\bar{x} \pm s$ )

Group	Time	FEV1 (L)	FEV1/FVC (%)	PaO2 (mmHg)	PaCO2 (mmHg)	SpO2 (%)
Control (n=50)	Before treatment	1.09±0.42	36.54±7.34	50.61±6.12	67.32±8.49	86.29±3.48
	After treatment	1.64±0.53 <sup>#</sup>	48.12±9.03 <sup>#</sup>	63.54±7.56 <sup>#</sup>	49.47±5.24 <sup>#</sup>	92.35±3.01 <sup>#</sup>
Observation (n=50)	Before treatment	1.10±0.45	36.69±7.25	50.76±6.03	67.09±8.72	86.40±3.43
	After treatment	2.09±0.69 <sup>#*</sup>	60.94±10.67 <sup>#*</sup>	71.92±7.84 <sup>#*</sup>	44.18±5.06 <sup>#*</sup>	95.67±3.25 <sup>#*</sup>

Compared with the same group before treatment, <sup>#</sup>P<0.05; compared with control group, \*P<0.05.

#### Incidence of complications

The incidence rate of complications was 2.00% in observation group, with 1 case of dry mouth, while that in control group was 14.00%, including 3 cases of dry mouth, 3 cases of dry nasal cavity and

1 case of eye discomfort. Thus, the incidence rate of complications was higher in the observation community than in the monitoring category (P<0.05) (Table 5).

Table 5. Incidence rates of complications [case (%)]

Group	Case No.	Dry mouth	Dry nasal cavity	Eye discomfort	Incidence rate
Control	50	3 (6.00)	3 (6.00)	1 (2.00)	7 (14.00)
Observation	50	1 (2.00)	0 (0.00)	0 (0.00)	1 (2.00)*

In relation to the control category, \* P<0.05.

## DISCUSSION

COPD in the breathing department is a serious chronic condition. The airflow restriction of CPD patients in the acute period would not be reversible absolutely. Cough, shallow breath and dyspnea are clinical signs of COPD. If the condition becomes stronger, dyspnea eventually becomes worse and also progresses into respiratory collapse, inducing blood pressure and arterial hypoxemia and thereby endangering the patient's life and wellbeing [6,7]. For patients with acute exacerbation of COPD, then aggressive care is needed.

However, it is not yet fully apparent if COPD is a therapeutic pathogene. COPD regular treatments usually include expectorant injection, anti-infection injection and supplementary oxygen inhalation, which may to some degree relieve the effects of patients and regulate the disease 's development. Inhalation by supplementary oxygen is intended for COPD patients with airflow and dyspnea obstruction. Patients also require intrusive artificial ventilation during severe exacerbation. They are linked by an artificial airway to an infiltrated ventilator and provide patients with a great deal of oxygen[8,9]. However, once the patient has weaning signs, artificial ventilation must be stopped. It is advised to administer concurrent auxiliary oxygen therapy for patients following weaning from intrusive mechanical ventilation to ensure that adequate blood oxyge is given for patients with COPD.

Non-invasive mechanical breathing and HFNC therapy are also utilized in the concurrent management of auxiliary oxygen inhalation. Non-invasive mechanical ventilation, which does not involve tracheotomy or endotracheal intubation, is non-invasively attached to the ventilator in the nose to supply patients with oxygen and adequately satisfy patients' oxygen requirements, thus decreasing hypoxia in bodies and allowing patients to regain voluntary respiration. However, a high degree of patient support is required where mechanical ventilation is not invasive. Moreover, since there is no heating system during care, the humidifying impact is limited; during the inhalation of oxygen, patients are vulnerable to dry nose / mouth, thereby reducing oxygen efficiency[10,11]. HFNC care primarily delivers continuous oxygen injection via nasal catheters, which will completely satisfy patients' oxygen requirements and reduce hypoxia. The HFNC therapy can completely humidify oxygen in contrast with non-invasive mechanical ventilation, preserve the airway mucosa system of patients, stably convey oxygen, and aid patients in smooth spontaneous breathing. In the

meanwhile, it will improve airways and heroic resistance to anatomical mortal movement, raise the motivation movement rate and decrease respiratory muscles oxygen intake by increasing patients' oxygenation state [12,13]. The research shows three findings, (1) The average efficacy of observation group is higher (96.00% vs. 80.00%), and symptom relief period, the supplementary oxygen inhalation period and patient hospital stay was less of observation group than in control groups. The analysis results indicate the following three items. The observed community became more experienced after treatment with FEV1, FEV1 / FVC, PaO2 and SpO2, and PaCO2 in observer group was lower than in control group with  $P < 0.05$ . The findings above demonstrate that the usage of concurrent care for HFNC therapy will entirely satisfy the patients' need for auxiliary oxygen inhalation, correct patients ' blood smoothness and enhance their pulmonary ventilation, which is useful in enhancing the regulation of their disease and has a remarkable curative impact ... (2) After therapy, CRP, IL-6 and PCT levels were lower in the research groups than in the control group ( $P < 0.05$ ), indicating that, as compared to non-invasive mechanical air ventilation, HFNC treatment may help to suppress inflammatory reactions in COPD patients... It is primarily attributed to the improved impact of HFNC therapy on drying out deep sputum and the potential to eliminate deep sputum and suppress inflammatory secretions. (3) Complication outcomes in the observation community were smaller than that in the control group, which implies that HFNC treatment will reduce problems for patients (2.00 per cent vs. 14.00 per cent,  $P < 0.05$ ). This is primarily because HFNC therapy completely humidifies the oxygen, allowing the quality of airway mucosa to be preserved and pain reduced.

In brief, the usage of HFNC therapy in series care will efficiently enhance the curative results of COPD patients following weaning from intrusive mechanical ventilation, shortening the symptoms' time to heal, decrease the body's inflammatory reaction, increase the lung ventilation and blood gas level, and reduce the toxicity of the blood gasses.

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