

## Original Article

# Effect of cardiopulmonary rehabilitation nursing on exercise endurance and quality of life of stable COPD patients

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**Abstract:** Objective: To investigate the effect of cardiopulmonary rehabilitation nursing on exercise endurance and quality of life (QOL) of patients with stable chronic obstructive pulmonary disease (COPD). Methods: This randomized trial was conducted on 84 subjects with stable COPD recruited in our hospital from March 2018 to December 2019 and they were divided into the observation group (n=42) and the control group (n=42) based on nursing methods. The control group adopted conventional nursing, and the observation group received cardiopulmonary rehabilitation nursing in addition to conventional method. The exercise endurance, cardiopulmonary function, psychological state, QOL and nursing satisfaction were compared at pre- and post-nursing care. Results: Before nursing, no notable difference was observed in 6 min walking distance (6MWD), deep inspiratory volume (IC), left ventricular ejection fraction (LVEF), forced vital capacity (FVC), Forced expiratory volume in one second (FEV1), FEV1/FVC, Self-Rating Anxiety Scale (SAS), Self-rating Depression Scale (SDS) score, QOL, scores of symptoms, activities and impact in these two groups ( $P>0.05$ ). After nursing, 6MWD and IC of observation group were remarkably higher ( $P<0.05$ ); LVEF, FVC, FEV1 and FEV1/FVC in the observation group were remarkably higher ( $P<0.05$ ); SAS and SDS scores of two groups decreased, and the observation group was notably lower ( $P<0.05$ ); the QOL scores of symptoms, activities and effects of two groups were notably reduced, and the observation group was remarkably lower ( $P<0.05$ ). The nursing satisfaction of the observation group was considerably higher than the control group (95.23% vs 76.19%) ( $P<0.05$ ). Conclusion: Cardiopulmonary rehabilitation nursing has a remarkable effect on COPD patients in stable stage, which can enhance patients' exercise endurance and lung function, reduce adverse emotions, and improve patients' QOL and nursing satisfaction.

**Keywords:** Cardiopulmonary rehabilitation nursing, COPD, exercise endurance, QOL

## Introduction

Chronic obstructive pulmonary disease (COPD) is a common and destructive chronic airway disease in clinic. The main cause of COPD is long-term inhalation of particles, gas or dust harmful to human body, which leads to abnormal chronic inflammatory reaction [1]. Due to the high incidence, high mortality and heavy social and economic burden, COPD has now become a critical public health problem [2]. At present, the general clinical treatment for COPD is to relieve symptoms and control airway inflammation [3]. Although it plays a positive role in the treatment of acute exacerbation period, it still needs further improvement in the management of prognosis and rehabilitation in stable period of COPD. Therefore, the single

concept of inflammation control in stable period is required to transform to the overall rehabilitation of lung function and systemic multiple organ function. It has been reported that cardiopulmonary rehabilitation nursing can enhance lung function, exercise endurance and QOL of stable COPD patients [4]. However, there is a lack of standardized and unified methods. Therefore, this randomized trial was carried out to further validate the impact of cardiopulmonary rehabilitation nursing on exercise endurance and QOL.

## Materials and methods

### General information

84 participants with stable COPD who were treated in our hospital from March 2018 to

## Cardiopulmonary rehabilitation nursing on stable COPD patients

December 2019 were recruited. Inclusion criteria: (1) patients diagnosed as COPD by clinical diagnosis; (2) patients with stable disease condition; (3) patients with complete clinical data; (4) patients and their families signed informed consent. Exclusion criteria: (1) patients with pulmonary bullae, bronchial asthma, pneumonia, pulmonary hypertension and other related respiratory diseases; (2) immobile patients; (3) patients with mental illness or cognitive impairment.

They were into observation group (n=42) and control group (n=42) according to different nursing methods. The control group aged 45 to 72 years old; the course of disease was 3~12 years. The observation group aged 46 to 75 years old; the course of the disease was 3~13 years. This study has obtained the approval from the ethic committee prior to the commencement.

### Methods

The control group received routine nursing, including disease-related knowledge, diet, medication knowledge and family oxygen therapy. The observation group received cardiopulmonary rehabilitation nursing in addition to conventional method. The specifics were as follows. (1) Admission assessment. Upon admission, the nursing staff evaluated the comprehensive condition of the patient according to the clinical characteristics, medical history data, test results and other information of the patient, and formulated a cardiopulmonary rehabilitation nursing plan. (2) Breathing training. Nursing staff guided patients to carry out respiratory exercises, assisted patients learn lip contraction breathing, instructed patients to breathe and inhale through nose, exhale through circular lip contraction, and guided patients to whistle to increase the pressure in bronchus and to prevent patients from bronchial atrophy and improve vital capacity. The training for inhaling and exhaling should continue about 2 seconds and 10 seconds respectively each time, twice a day for a total of 30 min each time. (3) Breathing exercise. Nursing staff instructed the patient to perform lying, sitting and standing gymnastics, and to bend down, lower down and take deep breaths, so as to improve their cardiopulmonary respiratory function, twice a day for a total of 30 min each

time. (4) Home oxygen therapy. Nursing staff explained the role of oxygen therapy on improving clinical symptoms, and guided patients how to use the home oxygen therapy machine. The home oxygen therapy should be implemented for over 15 h every day, and the oxygen flow is set at 1~2 L/min. (5) Follow-up. A WeChat group was established to encourage patients or their families to upload their training videos. In this way, patients can encourage each other. Nursing staff could give them a timely credit to improve patients' compliance. The patient should be followed up by telephone on the first day after discharge, once every 2 weeks.

### Observing indicators

(1) Comparison of exercise endurance between two groups at pre-and post-nursing. The exercise endurance was evaluated by 6 min walking distance (6MWD) and deep inspiratory volume (IC). 6MWD is a commonly used sub-maximum test for COPD patients, which can be completed in corridors. (2) Comparison of cardiopulmonary function between two groups at pre-and post-nursing. ① Cardiac function: Echocardiography was used to detect the cardiac function. The main detection index was left ventricular ejection fraction (LVEF). During the detection, the patient was instructed to take the lateral position and breathe calmly. ② The changes of airflow restriction of patients were monitored by lung function tester before and after intervention. The main indexes included forced vital capacity (FVC), Forced expiratory volume in one second (FEV1). During the detection, the patients were in a sitting position and in a quiet state. The patients were continuously measured for 3 times and the maximum value was taken. (3) Comparison of negative emotions between two groups at pre-and post-nursing. Self-rating Anxiety Scale (SAS) and Self-rating Depression Scale (SDS) were used to evaluate patients' emotions, with a total of 40 items, 20 items for SAS and 20 items for SDS, each item being 1~4 points. SAS scoring criteria [5]: ① <60: normal; ② 60~69: mild anxiety; ③ 70~80 points: moderate anxiety; ④ ≥ 80 points: severe anxiety. SDS scoring criteria [6]: ① <60: normal; ② 60~69: mild depression; ③ 70~79: moderate depression; ④ ≥80 points: severe depression. (4) Comparison of QOL. St. George's Questionnaire (SGRQ) [7] was used to investigate and evaluate the QOL,

## Cardiopulmonary rehabilitation nursing on stable COPD patients

**Table 1.** Baseline information

Index	control group (n=42)	observation group (n=42)	X <sup>2</sup> /t	P
gender			0.774	0.963
male	23	24		
female	19	18		
age (years)	61.72±9.05	61.69±9.1	1.365	0.935
course of disease (years)	7.88±1.42	7.88±1.50	1.415	0.865

including three functional scores of symptoms, activities and impacts. Each area is weighted by weighted average method. The total score is 100 points, and score is inversely proportional to QOL. (5) Comparison of nursing satisfaction.

### Statistical method

The present trial was carried out using SPSS 19.0 software. Quantitative data were expressed as ( $\bar{x} \pm s$ ), and t-test was performed for the comparison between the groups; counting data were described as n (%), and run by Chi-square  $\chi^2$ . Studies were considered heterogeneous when P assumed a value of <0.05.

### Results

#### General data

No notable difference was observed in general data between the two groups ( $P>0.05$ , **Table 1**).

#### Exercise endurance

Prior nursing, the 6MWD and IC of these two groups did not statistically differ ( $P>0.05$ ). After nursing, the observation group reported a notably higher level in 6MWD and IC ( $P<0.05$ , **Table 2**).

#### Cardiopulmonary function

Considering the cardiopulmonary function, we observed no notable difference in LVEF, FVC, FEV1 and FEV1/FVC in these two groups prior nursing ( $P>0.05$ ). After nursing, remarkably higher levels in LVEF, FVC, FEV1 and FEV1/FVC were noted in observation group ( $P<0.05$ , **Table 3**).

#### Negative emotions and QOL score

The SAS and SDS scores exhibited no statistical difference between two groups before nursing

( $P>0.05$ ). While SAS and SDS scores of two groups decreased after nursing, and the observation group demonstrated a notably lower level compared to the control group ( $P<0.05$ , **Table 4**). When comparing QOL scores of symptoms, activities and impact scores, we found no notable difference between the two groups ( $P>0.05$ ). After nursing, these scores of two groups decreased considerably, and the observation group was remarkably lower ( $P<0.05$ , **Table 4**).

#### Nursing satisfaction

Regarding the nursing satisfaction, the observation group was higher than the control group (95.23% vs 76.19%) ( $P<0.05$ , **Table 5**).

### Discussion

In recent years, with the aggravation of environmental pollution, the incidence of COPD is on the rise. It is reported that the incidence of COPD in the elderly population over 60 years old in China reaches 14%. COPD is characterized by chronic inflammatory changes in respiratory tract, lung blood and lung parenchyma [8, 9]. The pathology of COPD patients is mainly squamous metaplasia, airway mucosal epithelial hyperplasia and granuloma formation, which is connected to the inflammatory reaction caused by harmful substances that damage airway wall and make the structure reconstructed [10]. With the progression of the disease, some COPD patients may develop pulmonary hypertension, muscle dysfunction, malnutrition and other symptoms [11]. Generally, routine nursing pays less attention on the nursing of patients' respiratory function, psychological state and rehabilitation, and thus the treatment outcome is not satisfactory [12]. A previous study has shown that [13] cardiopulmonary rehabilitation exercise can enhance respiratory function, the exercise endurance and QOL of COPD patients after entering a stable period. Lung rehabilitation, proposed by the *American Cardiovascular and Lung Rehabilitation Association and the American College of Chest Doctors* is a low-cost intervention measure [14], including exercise rehabilitation exercise, respiratory function exercise and health educa-

## Cardiopulmonary rehabilitation nursing on stable COPD patients

**Table 2.** Comparison of exercise endurance between two groups

Group	6MWD (m)		IC (L)	
	Before nursing	After nursing	Before nursing	After nursing
Observation Group (n=42)	320.87±45.26	488.95±65.74 <sup>a</sup>	1.40±0.32	2.56±0.45 <sup>a</sup>
Control group (n=42)	321.02±45.30	356.44±48.65 <sup>a</sup>	1.42±0.34	1.64±0.38 <sup>a</sup>
<i>t</i>	0.015	10.500	0.278	10.120
<i>P</i>	0.987	<0.001	0.782	<0.001

Note: a indicates compared with before nursing ( $P < 0.05$ ).

tion, etc. Because COPD patients in stable phase progresses slowly and remain stable, timely and effective lung rehabilitation nursing is of vital significance to reduce acute attacks and promote the prognosis. Of note, psychological intervention is crucial in nursing work. To undertake scientific and reasonable psychological nursing for patients is a realization of humanistic service concept, thus boosting treatment compliance and maintaining a favorable doctor-patient relationship [15]. As a symptom of COPD, exercise restriction seriously threatens patients' daily life [16]. COPD is not only connected to respiratory systemic diseases, it can also influence the structure of skeletal muscle due to the extensive inflammatory reaction in the body, resulting in systemic muscle dysfunction [17]. Respiratory muscle dysfunction is characterized by endurance decline and respiratory muscle strength decline. However, due to the increase of ventilation load and respiratory muscle dysfunction, COPD patients' exercise is generally restricted, and the ventilation reserve during exercise cannot meet the requirements. And the elastic load of respiratory system increases due to excessive dynamic inflation of lung [18, 19].

Our study demonstrated that after cardiopulmonary rehabilitation nursing, the observation group reported a notably higher level in 6MWD and IC, which suggests that cardiopulmonary rehabilitation nursing is helpful to improve exercise endurance of COPD patients. Dyspnea is also a common symptom of COPD, and effective nursing methods play an important role in relieving dyspnea. What's more, remarkably higher levels in LVEF, FVC, FEV1 and FEV1/FVC were noted in observation group after nursing, and it is assumed that nursing can promote respiratory function of stable COPD patients. In stable COPD patients, the expiratory flow rate is constantly restricted and irreversible,

thus the air in the lungs cannot fully emptied while exhaling. As a result, the residual air volume in the lung keeps increasing, resulting in excessive dynamic inflation of the lung, which leads to an increase in end expiratory lung volume. Cardiopulmonary rehabilitation training increases the pressure in the bronchus of the patient by training patients lip contraction breathing method, prevents the atrophy of the bronchus, and improves the vital capacity [20]. Additionally, the present study revealed that SAS and SDS scores of two groups decreased after nursing, and the observation group demonstrated a notably lower level compared to the control group. It suggests that cardiopulmonary rehabilitation nursing can considerably reduce negative emotions. What's critical to note that when comparing QOL scores of symptoms, activities and impact scores, and nursing satisfaction, we found that these scores of the observation group was remarkably better. It has also been indicated that the implementation of lung rehabilitation nursing can improve QOL as well. However, there is not a long-term follow-up in this study, and cardiopulmonary rehabilitation interventions in patients with stable COPD can slow the progression of the disease. Yet, the data in this study are not available. Therefore, the population and the time will be expanded in the future to obtain more reliable conclusions.

To sum up, cardiopulmonary rehabilitation nursing plays a significant role in COPD patients in stable stage. It can remarkably enhance patients' exercise endurance, improve lung function, reduce adverse emotions, boost patients' QOL and nursing satisfaction, and is of significant clinical relevance.

### Disclosure of conflict of interest

None.

## Cardiopulmonary rehabilitation nursing on stable COPD patients

**Table 3.** Comparison of cardiopulmonary function of two groups at pre-and post-nursing

Group	LVEF (%)		FVC (L)		FEV1 (L)		FEV1/FVC (%)	
	Pre-nursing	Post-nursing	Pre-nursing	Post-nursing	Pre-nursing	Post-nursing	Pre-nursing	Post-nursing
Observation Group (n=42)	51.66±4.25	61.05±4.46 <sup>b</sup>	1.81±0.26	2.47±0.35 <sup>b</sup>	1.04±0.060	1.45±0.019 <sup>b</sup>	43.58±5.72	64.02±6.75 <sup>b</sup>
Control group (n=42)	51.70±4.24	56.78±4.35 <sup>b</sup>	1.82±0.27	2.09±0.30 <sup>b</sup>	1.05±0.080	1.24±0.014 <sup>b</sup>	43.60±5.70	56.22±6.10 <sup>b</sup>
<i>t</i>	0.043	4.442	0.173	5.342	0.703	57.670	0.016	5.556
<i>P</i>	0.966	<0.001	0.863	<0.001	0.484	<0.001	0.987	<0.001

Note: b indicates compared with that before nursing ( $P < 0.05$ ).

## Cardiopulmonary rehabilitation nursing on stable COPD patients

**Table 4.** Comparison of SAS, SDS and QOL scores of two groups before and after intervention ( $\bar{x} \pm s$ )

Group	Time	Observation Group (n=42)	Control group (n=42)	t	P
SAS score	Before nursing	69.93±12.59	69.89±12.66	0.015	0.988
	After nursing	41.44±7.85 <sup>c</sup>	50.68±9.02 <sup>c</sup>	9.395	<0.001
SDS score	Before nursing	68.58±11.25	68.46±11.33	0.049	0.961
	After nursing	39.28±9.02 <sup>c</sup>	45.78±9.78 <sup>c</sup>	3.166	<0.001
QOL					
Symptom	Before nursing	61.22±12.24	60.98±12.33	0.089	0.929
	After nursing	44.60±10.11 <sup>c</sup>	52.76±10.52 <sup>c</sup>	3.624	<0.001
Activity	Before nursing	43.82±11.25	43.78±11.28	0.016	0.987
	After nursing	30.64±9.20 <sup>c</sup>	37.23±9.88 <sup>c</sup>	3.164	0.002
Impact	Before nursing	68.13±16.30	67.92±16.24	0.059	0.953
	After nursing	46.38±10.27 <sup>c</sup>	54.31±11.19 <sup>c</sup>	3.384	0.001

Note: c indicates comparison with that before nursing ( $P < 0.05$ ).

**Table 5.** Comparison of nursing satisfaction between two groups

Group	Satisfied	General	Dissatisfied	Satisfaction
Observation group (n=42)	26 (61.90)	14 (33.33)	2 (4.76)	40 (95.23)
Control group (n=42)	15 (35.71)	17 (40.48)	10 (23.81)	32 (76.19)
$\chi^2$				6.222
P				0.013

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## Cardiopulmonary rehabilitation nursing on stable COPD patients

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