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Study on the Impact of Respiratory Function Training and Preventive Nursing Pathway on the Prognosis of Patients with Stable COPD

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Abstract: *Objective*: This study aims to explore the impact of respiratory function training and preventive nursing pathways on the prognosis of patients with stable chronic obstructive pulmonary disease (COPD), providing a scientific basis for clinical nursing. *Methods*: Eighty-six patients with stable COPD from May 6, 2022, to May 6, 2023, were selected and divided into a novel group and a traditional group, with 43 patients in each group. The novel group received respiratory function training and a preventive nursing pathway, while the traditional group received routine nursing. Observation indicators included lung function indicators (forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), FEV1/FVC ratio), dyspnea severity, 6-minute walking distance, quality of life (CAT questionnaire score), and the number of acute exacerbations and hospitalizations. SPSS 21.0 software was used for statistical analysis. *Results*: The novel group performed significantly better than the traditional group in FEV1, FVC, and FEV1/FVC ratio ($P < 0.05$). Patients in the novel group had reduced dyspnea severity, increased 6-minute walking distance, decreased quality of life scores, and reduced acute exacerbations and hospitalizations ($P < 0.05$). Conclusion: Respiratory function training and preventive nursing pathways can significantly improve lung function, dyspnea severity, exercise tolerance, and quality of life of patients with stable COPD, and reduce the number of acute exacerbations and hospitalizations, which has important clinical significance.

Keywords: Chronic obstructive pulmonary disease (COPD); Respiratory function training; Preventive nursing pathway; Lung function; Quality of life

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1. Introduction

Chronic obstructive pulmonary disease (COPD) can severely affect patients' quality of life and prognosis. Currently, drug therapy, oxygen therapy, rehabilitation therapy, and so on are the main treatment methods for

COPD. However, these treatments can only provide symptomatic relief and cannot effectively halt the progression of the disease. Nursing care is crucial for patients with stable COPD to delay disease progression, reduce acute exacerbations, and improve quality of life. Studies have shown that respiratory function training can enhance respiratory muscle strength, improve lung function, and increase patients' exercise tolerance and quality of life [1]. Through measures such as establishing patient profiles, health education, environmental management, and exercise guidance, preventive nursing can improve patients' self-management abilities, reduce risk factors for the disease, and lower the risk of acute exacerbations. However, research on the impact of respiratory function training and preventive nursing pathways on the prognosis of patients with stable COPD still has some gaps. This study aims to delve into the effects of respiratory function training and preventive nursing pathways on the prognosis of patients with stable COPD, providing a scientific basis for clinical nursing.

2. Materials and methods

2.1. Baseline information

Eighty-six patients with stable chronic obstructive pulmonary disease (COPD) from May 6, 2022, to May 6, 2023, were selected as study subjects and divided into a new-style group and a traditional group, with 43 patients in each group.

In the new-style group, there were 25 males and 18 females, with an age range of 52.25 to 78.47 years and a mean age of 64.23 ± 1.29 years. The disease duration ranged from 5.26 to 15.58 years, with a mean duration of 8.65 ± 1.28 years.

In the traditional group, there were 23 males and 20 females, with an age range of 50.26 to 76.25 years and a mean age of 63.82 ± 1.58 years. The disease duration ranged from 4.96 to 16.58 years, with a mean duration of 8.52 ± 1.39 years.

Inclusion criteria: Meet the diagnostic criteria for stable COPD; aged 50 years or older; able to cooperate and complete respiratory function training and nursing intervention; signed informed consent.

Exclusion criteria: Combined severe cardiac, liver, kidney, and other important organ dysfunction; suffering from mental illness or cognitive impairment; COPD patients in acute exacerbation stage; patients unable to cooperate and complete the study.

Upon comparison, there were no significant differences in baseline data between the two groups ($P > 0.05$).

2.2. Methods

Patients in the traditional group received routine nursing care, including detailed condition observation, medication guidance, and dietary nursing.

Patients in the new-style group received respiratory function training and preventive nursing pathways.

2.2.1. Respiratory function training

Pursed-lip breathing: Patients close their mouths, inhale through their noses, and then exhale slowly through pursed lips. The inhalation to exhalation time ratio is 1:2 or 1:3. Each training session lasts for 10–15 minutes, 3–4 times per day. Abdominal breathing: Patients take a comfortable position, relax their whole body, and place their hands on their abdomen and chest. During inhalation through the nose, the abdomen rises, and during exhalation, the abdomen falls. They try to make the exhalation time longer than the inhalation time. Each training session lasts for 10–15 minutes, 3–4 times per day.

2.2.2. Preventive nursing pathway

Establish individual patient files to record detailed patient conditions, treatment status, and nursing needs. Regularly conduct health education to explain the causes, symptoms, treatment methods, and preventive measures of COPD to patients and their families, improving patients' self-management abilities. Strengthen environmental management to maintain fresh air and suitable temperature in the ward, avoiding patients' exposure to harmful gases and dust. Guide patients to perform moderate exercise such as walking and Tai Chi to enhance their physical fitness. Closely monitor changes in patients' conditions and promptly detect and manage complications.

2.3. Observation indicators

Analyze and compare the lung function indicators of the two groups of patients before and after intervention. Details include: forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio.

Analyze and compare the degree of dyspnea and 6-minute walking distance before and after intervention in both groups. The modified British Medical Research Council (mMRC) dyspnea scale is used for evaluation, which is divided into 0–4 levels. The higher the level, the more severe the dyspnea. Patients are asked to walk as fast as possible on a flat surface for 6 minutes, and the walking distance is measured.

Analyze and compare the quality of life before and after intervention in both groups. The Chronic Obstructive Pulmonary Disease Assessment Test (CAT) questionnaire is used for evaluation, including details such as coughing, expectoration, chest tightness, and mobility. The total score ranges from 0–40, with a higher score indicating a poorer quality of life.

Analyze and compare the number of acute exacerbations and hospitalizations in both groups.

2.4. Statistical principles

This experiment uses the SPSS 21.0 software package. *t*-values are used to calculate measurement data, and chi-square values are used to calculate count data. Statistical differences are considered significant when $P < 0.05$.

3. Results

3.1. Detailed comparison of lung function indicators before and after intervention in both groups

The comparison of lung function indicators before and after intervention in both groups is shown in **Table 1**.

Table 1. Detailed comparison of lung function indicators before and after intervention in both groups (Mean ± SD)

Group	Time period	FEV_1(L)	FVC(L)	FEV_1/FVC(%)
New group (n = 43)	Before intervention	1.25 ± 0.21	2.56 ± 0.32	48.85 ± 5.23
	After intervention	1.68 ± 0.25	2.98 ± 0.35	55.21 ± 5.45
t		4.228	6.396	9.638
P		<0.05	<0.05	<0.05
Traditional group (n = 43)	Before intervention	1.23 ± 0.20	2.54 ± 0.31	48.52 ± 5.18
	After intervention	1.42 ± 0.23	2.75 ± 0.33	51.36 ± 5.32
t		3.936	5.025	7.118
P		<0.05	<0.05	<0.05

3.2. Comparison of the degree of dyspnea and 6-minute walking distance before and after intervention in two groups of patients

The comparison of the degree of dyspnea and 6-minute walking distance before and after intervention in two groups of patients is shown in **Table 2**.

Table 2. Comparison of the degree of dyspnea and 6-minute walking distance before and after intervention in two groups of patients (Mean ± SD)

Group	Degree of dyspnea (mMRC grade)	Degree of dyspnea (mMRC grade)
New group (n = 43)	2.56 ± 0.35	350.25 ± 25.68
	1.23 ± 0.22	450.56 ± 30.25
t	5.693	23.695
P	<0.05	<0.05
Conventional group (n = 43)	2.58 ± 0.34	348.52 ± 24.85
	1.85 ± 0.28	400.23 ± 28.56
t	4.025	15.227
P	<0.05	<0.05

3.3. Comparison of quality of life before and after intervention in two groups of patients

The comparison of quality of life before and after intervention in two groups of patients is shown in **Table 3**.

Table 3. Comparison of quality of life before and after intervention in two groups of patients (Mean ± SD)

Group	Symptoms	Activity ability	Psychological state	Total score
New group (n = 43)	15.25 ± 2.32	12.56 ± 1.85	8.52 ± 1.23	36.33 ± 4.21
	8.23 ± 1.56	7.52 ± 1.25	4.21 ± 0.85	20.06 ± 2.52
t	7.859	6.339	5.294	18.557
P	<0.05	<0.05	<0.05	<0.05
Conventional group (n = 43)	15.31 ± 2.28	12.48 ± 1.82	8.48 ± 1.21	36.27 ± 4.18
	10.56 ± 1.85	9.23 ± 1.52	5.85 ± 1.02	25.64 ± 3.21
t	5.142	4.228	4.154	14.226
P	<0.05	<0.05	<0.05	<0.05

3.4. Comparison of acute exacerbation frequency and hospitalization frequency between the two groups of patients

The comparison of acute exacerbation frequency and hospitalization frequency between the two groups of patients is shown in **Table 4**.

Table 4. Comparison of acute exacerbation frequency and hospitalization frequency between the two groups of patients (Mean ± SD)

Group	Acute exacerbation frequency	Hospitalization frequency
New group (n = 43)	1.25 ± 0.32	0.52 ± 0.21
Traditional group (n = 43)	2.15 ± 0.45	1.23 ± 0.35
t	4.582	5.036
P	<0.05	<0.05

4. Discussion

In this study, patients in the new-style group underwent an intervention combining respiratory function training and a preventive nursing pathway. The results showed that their FEV1, FVC, and FEV1/FVC ratios were significantly better than those in the traditional group, which has important clinical implications. The pursed-lip breathing and abdominal breathing in respiratory function training specifically exercise the respiratory muscles through specific breathing patterns. Pursed-lip breathing allows the exhaled air to flow out slowly, increasing airway pressure and preventing small airways from collapsing too early, thereby improving ventilatory function. Abdominal breathing, on the other hand, fully engages respiratory muscles such as the diaphragm, increases the range of motion of the thoracic cage, and enhances lung ventilation and gas exchange efficiency. The synergistic effect of these two breathing training methods effectively strengthens the respiratory muscles, laying a foundation for improving lung function.

The establishment of patient files in the preventive nursing pathway provides a basis for personalized care. By carefully documenting patients' conditions, treatment status, and nursing needs, healthcare professionals can more precisely develop nursing plans that meet the specific needs of patients [2]. Health education empowers patients with a correct understanding of the disease, allowing them to understand the pathogenesis, treatment methods, and self-management essentials of COPD, thus actively participating in disease management. Environmental management measures reduce the stimulation of harmful factors on the lungs, such as maintaining air freshness and avoiding exposure to harmful gases and dust, creating a relatively good external environment for the lungs. These measures collectively improve patients' self-management abilities, enabling them to better cooperate with treatment and nursing, thereby promoting the improvement of lung function.

In clinical practice, traditional nursing methods for stable COPD patients often focus on symptom relief and basic medical care, with limited long-term improvement in lung function. The new nursing method, however, offers a more comprehensive and systematic approach for healthcare professionals. Through respiratory function training, patients can perform standardized self-exercise under the guidance of healthcare professionals, improving the endurance and strength of respiratory muscles. This not only helps improve current lung function but also enhances patients' physical fitness and resistance to disease, reducing the risk of acute exacerbations. The preventive nursing pathway provides patients with comprehensive nursing services from multiple aspects, from establishing files to health education and environmental management. Each link is closely related to patients' needs and disease characteristics. The integrated nursing method can improve patients' satisfaction with nursing and enhance their treatment compliance. Simultaneously, due to its significant improvement in lung function indicators, it also helps reduce medical costs and resource consumption. In long-term clinical applications, the new nursing method is expected to become the standard mode of care for stable COPD patients, making a greater

contribution to improving their quality of life and prognosis [3].

In this study, the novel nursing approach significantly improved stable COPD patients in terms of dyspnea severity and 6-minute walking distance. After receiving respiratory function training and preventive nursing pathways, patients in the novel group experienced a notable reduction in dyspnea severity and a remarkable increase in the 6-minute walking distance. This fully demonstrates the effectiveness of this nursing approach in improving patients' exercise tolerance and alleviating dyspnea symptoms. By strengthening the strength and endurance of respiratory muscles, respiratory function training provides strong support for patients' respiratory regulation during exercise. Through pursed-lip breathing and abdominal breathing training, patients can more effectively control their breathing rhythm and depth, reducing respiratory work and thereby alleviating the sensation of dyspnea. Strong respiratory muscles ensure an adequate oxygen supply during exercise, reducing movement restrictions caused by shortness of breath. Based on the specific conditions of the patients, professional exercise guidance will develop personalized exercise programs, gradually increasing exercise intensity and duration to help patients improve exercise tolerance. Meanwhile, psychological support is also indispensable. Due to dyspnea, stable COPD patients often experience negative emotions such as anxiety and fear, which can further exacerbate dyspnea symptoms. Through psychological counseling, relaxation training, and other methods, psychological support can help patients alleviate negative emotions, enhance their confidence in overcoming the disease, and thus make them more actively participate in exercise, thereby improving their athletic ability [4].

Upon further analysis, the novel nursing approach has achieved remarkable results in improving the quality of life for patients with stable COPD. The scores of patients in the novel group were significantly lower than those in the traditional group in terms of symptoms, activity level, and psychological state, indicating a significant improvement in their quality of life. This improvement is mainly attributed to the synergistic effect of respiratory function training and preventive nursing pathways. Pursed-lip breathing and abdominal breathing can enhance the strength and endurance of respiratory muscles, making it easier for patients to breathe in their daily lives and greatly improving their physical comfort. The improvement in patient's physical comfort not only reduces their physical pain but also provides the basic conditions for them to participate in various activities. After systematic and comprehensive health education, patients can have a deeper understanding of COPD, including its development process, treatment methods, and self-management essentials. This enables patients to more actively cooperate with treatment and nursing, and adopt correct lifestyles and self-management measures to better cope with the disease. Psychological support plays a crucial role in enhancing patients' self-confidence and resilience. Professional psychological counseling and support help patients overcome negative emotions such as anxiety and fear caused by the disease, build confidence in overcoming the disease, and face life with a more optimistic attitude. A scientific and reasonable exercise program is tailored to the patient's physical condition, gradually improving their physical fitness and athletic ability. Nutrition management provides adequate nutritional support for patients through reasonable dietary combinations, enhancing their immunity and improving their body's resistance. These measures work together to improve patients' quality of life from multiple perspectives [5].

Patients with COPD in acute exacerbation often face severe symptoms such as dyspnea, coughing, and expectoration, causing great discomfort to the body. At the same time, reducing the frequency of acute exacerbations can also alleviate the economic burden. Frequent acute exacerbations can lead to multiple hospitalizations for patients, increasing medical expenses and causing significant financial pressure on families. Reducing the number of acute exacerbations and hospitalizations can improve patient's quality of life, allowing them to better participate in daily activities and enjoy life. Typically, patients with acute exacerbations of COPD

require a significant amount of medical resources, including hospital beds, time and effort from medical staff, and so on. Reducing the occurrence of acute exacerbations through preventive nursing pathways and respiratory function training allows for a more reasonable allocation of limited medical resources, thereby improving the efficiency of the healthcare system. Strengthening disease monitoring can detect changes in patients' conditions in a timely manner, allowing for early intervention measures to prevent acute exacerbations. Prompt treatment of complications can prevent their further deterioration, thereby reducing the risk of acute exacerbations. Respiratory function training can improve patients' lung function and immunity, making their bodies healthier, reducing the risk of infection, and ultimately decreasing the occurrence of acute exacerbations.

Preventing acute exacerbations of COPD can be approached from multiple angles. Patients should quit smoking and avoid secondhand smoke, maintain clean air, avoid respiratory infections, and receive flu and pneumonia vaccines. Respiratory function training, such as pursed-lip breathing and diaphragmatic breathing, should be performed. A balanced diet and appropriate body weight should be maintained to provide nutritional support. Patients should strictly follow doctors' advice on medication, have regular check-ups, and self-monitor their condition. Additionally, maintaining a positive attitude and receiving support from family members is important.

Disclosure statement

The authors declare no conflict of interest.

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