ORIGINAL RESEARCH

Individualized Nursing Interventions in Patients with Comorbid Chronic Obstructive Pulmonary Disease and Chronic Heart Failure

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ABSTRACT

Objective • Individuals with chronic obstructive pulmonary disease (COPD) are more likely to develop heart failure (HF) compared with the general population, and the presence of HF may contribute to reduced quality of life (QoL), increased hospitalizations and worse survival rates in patients with COPD. Our study examined the exercise capacity, QoL, mental health, family burden and rehospitalization rate of patients with comorbid COPD and chronic heart failure (CHF) after individualized inpatient and outpatient nursing care.

Methods • A total of 100 patients with comorbid COPD and CHF admitted to Affiliated Hospital of Jiangnan University January 2021 to July 2022 were enrolled in our study and then randomly assigned to one of two groups of 50 patients: patients receiving traditional nursing care and patients receiving individualized nursing care. Exercise capacity, mental health, QoL and family burden were assessed by means of the 6-minute walk test (6MWT), Zung's Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS), the short-form health survey (SF-36) and the Perceived Family Burden Scale (PFBS).

Results • The patients receiving individualized nursing care had notable differences regarding distance walked in the 6MWT, the scores in all domains of both the physical and mental composites, SAS and SDS scores and PFBS scores of patients at on admission (T0), at discharge (T1) and at 2 months after discharge (T2) ($P<.05$). The patients receiving individualized nursing care walked longer distances on the 6MWT, more scores reflecting improved QoL and reduced SAS and SDS scores at both T1 and T2 compared with patients receiving traditional nursing care ($P < .05$). The patients receiving individualized nursing care exhibited decreased PFBS scores at T2 compared with patients receiving traditional nursing care ($P<.05$). None of the patients receiving individualized nursing care were rehospitalized, but 2 patients receiving traditional nursing care were rehospitalized due to acute exacerbation of chronic obstructive pulmonary disease (AECOPD) and acute HF, respectively.

Conclusion • Our study demonstrates that individualized inpatient and outpatient nursing care can enhance exercise capacity and improve QoL and mental health in patients with comorbid COPD and CHF. (*Altern Ther Health Med.* 2023;29(8):329-333).

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD), characterized by sustained airflow limitation concurrent with excessive inflammatory response, is a leading cause of morbidity, mortality and the most significant public healthcare burden worldwide.[1] COPD is traditionally viewed as a self-inflicted disease resulting from tobacco smoking (active or passive).[2] Approximately 20% of cigarette smokers have COPD resulting from persistent inflammation and irreversible damage to the airway epithelium induced by tobacco smoke.[3] However, up to 50% of all patients with COPD worldwide are never-smokers, creating a critical need for identification of non-smoking-related risk factors, including but not limited to exposure to air pollution.[4,5] Inhaler therapy, which allows direct conveyance of medication into the airways, represents the backbone of pharmacological treatment in patients with COPD, often followed by multiple nonpharmacologic interventions, such as smoking cessation programs and pulmonary rehabilitation.[8]

The overwhelming healthcare burden due to COPD is mainly attributed to the management of other comorbid conditions such as cardiovascular disease and pulmonary exacerbations.[9,10] Patients with COPD are likely to experience

cardiovascular events, and cardiovascular disease causes approximately 30% of COPD-associated deaths.[11] The COPD patient population has an increased risk of developing HF compared with the general population, and the presence of HF may contribute to reduced QoL, increased hospitalizations and worse survival rates in patients with COPD.[12] The sustained low-grade systemic inflammation pathophysiologically links COPD and HF. On one hand, increased C-reactive protein (CRP) and tumor necrosis factor α (TNF-α) levels in patients with stable COPD favors the development of systemic atherosclerosis and ischemic heart disease.[13] On the other hand, acute inflammation contributes to higher neutrophil counts and increased fibrinogen contents, further resulting in a procoagulant status that favors arrhythmias.[14] COPD is commonly followed by pulmonary arterial hypertension, causing right HF and, in time, left HF.[15] COPD and CHF as a combined syndrome have a significant impact on all-cause hospitalization and HF hospitalization,[16] presenting a significant challenge for nursing care to improve patient functional ability and QoL and to reduce psychological distress.[17]

The aim of this study was to evaluate the feasibility and efficacy of inpatient individualized nursing care followed by an outpatient health-education program integrated with nursing telesurveillance in patients with coexistent COPD and CHF, focusing on (1) exercise capacity as the primary outcome, and (2) mental health, QoL and time-to-event (hospitalization for any reason, or death) as the secondary outcomes.

METHODS

Participant Selection

Patients with COPD coexisting with CHF who were hospitalized at the Affiliated Hospital of Jiangnan University in China from January 2021 to July 2022 due to worsening COPD were consecutively recruited into this trial.

Inclusion criteria. Patients who: (1) fulfilled the diagnostic criteria of acute exacerbation of COPD (AECOPD) according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD Identifier 28128970): a recent worsening of respiratory symptoms, such as dyspnea and cough, that required a change in their medication; (2) had a history of CHF and occurrence of HF decompensation in the previous 6 months before recruitment; (3) were New York Heart Association (NYHA) functional class II-IV; and (4) aged >60 years.

Exclusion criteria. Patients who (1) had physical activity limitations because of non-pulmonary/cardiac conditions; (2) had a survival expectancy <12 months; (3) had severe hearing impairment or cognitive impairment; (4) had alcohol dependence and alcohol abuse; (5) had uncontrolled diabetes and hypertension; and (6) were participants in another ongoing trial.

Patients were informed regarding the study and asked to sign a written informed consent form before their participation in the study. The study protocol was performed in accordance with the Declaration of Helsinki and approved by the Ethics Committee of our hospital.

Treatment Protocols

Eligible participants were randomly assigned on a 1:1 basis to traditional nursing care or individualized nursing care. After admission, the participants scheduled to receive traditional nursing were instructed to take a semi-recumbent position and received much more rest, minimal physical activities, less oxygen consumption, more fresh air, sufficient calorie intake,and more water. In addition, they were instructed to follow a low-sugar, high-fiber diet, including luffa, milk, yams, hawthorn, etc. The vitamin-deficient participants were recommended to take a multivitamin supplement, avoid consumption of high-fat foods, have more meals per day but less food at each meal and improve their body quality. Patients with evident breathing difficulties were given low-flow oxygen inhalation according to medical advice.

The patients scheduled to receive individualized nursing care received a set of nursing interventions:

1. Patients were nursed in the ward in a comfortable, relaxed, quiet and harmonious environment; the ward was clean and tidy, well-controlled with regard to temperature and humidity; the nursing staff disinfected the ward twice a day, opened the windows in the morning and evening for ventilation, and adjusted the light at different times every day according to patients' requests; daily family visits were limited to ensure better rest.
2. The patients received counseling and health education; elderly patients with AECOPD and HF were usually worried about their medical condition and prognosis, and felt a greater disease burden due to limited understanding of the disease pathogenesis; the nursing staff provided psychological counseling based on the patient's clinical manifestations, psychological characteristics, educational background and personality; the nursing staff provided one-on-one answers to the patient's questions, explained the causes of AECOPD and HF and treatment outcomes, gave examples of successful treatment and reduced the psychological pressure on patients.
3. Elderly patients with AECOPD and HF often have complications such as dyspnea, arrhythmia, infection and greater disease pain; the nursing staff evaluated the patient's physiological condition and promptly handle it, guide the patient to actively cooperate with the attending physician for treatment; patients with abnormal respiratory symptoms were given oxygen inhalation, back tapping and, if necessary, negative pressure drainage to discharge sputum; urine volume and water inflow were monitored in patients with water and sodium retention; the patients were instructed to consume a low-salt diet and have more meals a day but consuming less food at each meal; patients with trouble sleeping were instructed to quit smoking and not drink alcohol, sleep in a high pillow position and maintain a good mood.
4. The patients were instructed to follow their rehabilitation regimens, such as walking and breathing exercises—like contraction lip breathing and abdominal breathing—in a bid to improve cardiopulmonary function.
5. A home-nursing group consisting of 5 experienced nurses with high-level professional titles and trained in communication skills implemented family nursing interventions for 2 months; before discharge, the nursing staff communicated with the patient about the advantages, timing, process and home care nursing methods. According to the patient's condition,

medication status and lifestyle, home-based nursing interventions were developed; after discharge, the home-nursing group visited the patients in their homes every week for family care guidance, including how to maintain a good mood, improve pulmonary function, follow a healthy diet, comply with medication regimens and address adverse reactions from medications.

6. The patients were invited to attend nursing lectures about AECOPD and HF on a regular basis to share their experiences and address their concerns.

Outcome Measurements

All patients were evaluated at admission (T0), at discharge (T1) and after 2 months (T2). The primary outcome of this study was exercise capacity as assessed by the distance walked in the 6-minute walk test (6MWT). The secondary outcomes were mental health assessed by the Zung's Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS), QoL assessed by the short-form health survey (SF-36), family burden assessed by the Perceived Family Burden Scale (PFBS) and the rehospitalization rate.

Statistical Analysis

The outcomes were evaluated using mean ± standard deviation (SD) for measurement variables and counts and percentages for categorical variables. Fisher's exact test, Student's *t* test and one-way analysis of variance (ANOVA) were used for statistical analysis. The significant difference was set at $P < .05$ for all tests, which were performed by GraphPad Prism 8.0 (GraphPad Software, San Diego, California USA).

RESULTS

Baseline Patient Characteristics

Patient recruitment started in January 2021 and ended in July 2022. In total, 100 patients were enrolled and then randomly assigned to one of two groups of 50 patients each: patients receiving traditional nursing care and patients receiving individualized nursing care. Demographic and clinical characteristics of patients with coexisting COPD and CHF are presented in Table 1. The 2 groups were comparable in the following analysis.

Improved Exercise Capacity in Patients with Comorbid COPD and CHF After Individualized Nursing Care

The 2 groups of patients showed no significant difference in the distance walked in the 6MWT at T0 ($P > .05$). The 6MWT distance did not differ between T0, T1 and T2 in the patients receiving traditional nursing care ($F = 1.410$; $P = .244$). However, the patients receiving individualized nursing care had notable differences in the 6MWT at T0, T1 and T2 ($F = 34.07$; $P < .001$). The distance walked on the 6MWT at T1 was longer than at T0 ($P < .001$) and at T2 was longer than at T1 ($P < .01$). The patients receiving individualized nursing care walked longer distances on the 6MWT at both T1 and T2 than the patients receiving traditional nursing care ($P < .001$; see Table 2).

Table 1. Patient Characteristics in Both Groups at Baseline

Characteristics	Individualized nursing care (n = 50)	Traditional nursing care (n=50)	*P* value
Age (yrs)	72.10 ± 6.00	72.56 ± 5.33	.686
Sex/male (n/%)	45 (90%)	42 (84%)	.554
BMI (kg/m^2)	23.33 ± 3.48	22.60 ± 3.26	.282
GOLD class (n/%)			.458
• IB	16 (32%)	14 (28%)	
• IIB	25 (50%)	23 (46%)	
• IIIC	2 (4%)	3 (6%)	
• IVD	7 (14%)	10 (20%)	
NYHA class (n/%)			.725
• II	22 (44%)	26 (52%)	
• III	20 (40%)	17 (34%)	
• IV	8 (16%)	7 (14%)	
EF% pred	40.24 ± 7.70	39.72 ± 7.30	.730
FEV1% pred	65.66 ± 20.57	63.70 ± 22.91	.654
FEV1/FVC	58.90 ± 5.67	59.10 ± 7.68	.883
Drug therapy (n/%)			
LAMA	15 (30%)	13 (26%)	.824
LAMA + LABA + ICS	20 (40%)	23 (46%)	.687
Beta-blocker	34 (68%)	31 (62%)	.675
ACE inhibitors/ARB	22 (44%)	19 (38%)	.685
Diuretics	38 (76%)	40 (80%)	.801
Aldosterone antagonists	13 (26%)	16 (32%)	.660

Abbreviations: 6MWT, 6-minute walk test; ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; EF, ejection fraction; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; ICS, inhaled corticosteroid; LABA, long-acting beta2-agonist; LAMA, long-acting muscarinic antagonist; NYHA, New York Heart Association.

Table 2. Exercise Capacity Evaluated by the Distance Walked on the 6-Minute Walk Test in Patients Receiving Individualized Nursing Care vs Patients Receiving Traditional Nursing Care

Nursing care	T0	T1	T2
Individualized	326.80 ± 58.02	385.08 ± 58.93[a]	429.02 ± 64.45[a,b]
Traditional	339.62 ± 82.98	357.34 ± 73.13[a]	359.74 ± 73.59
P value	.373	<.001	<.001

[*] $P < .001$ compared with T0
[#] $P < .001$ compared with T1

Abbreviations: T0, at admission; T1, at discharge; T2, 2 months after discharge.

Table 3. Quality of Life Evaluated by the SF-36 Scale in Patients Receiving Individualized Nursing Care vs Patients Receiving Traditional Nursing Care

SF-36	Nursing care	T0	T1	T2
Physical	Individualized	450.62 ± 27.01	527.56 ± 27.19[a]	552.88 ± 32.16[a,b]
	Traditional	449.94 ± 29.66	464.22 ± 27.63	456.08 ± 30.80
	P value	.905	<.001	<.001
Mental	Individualized	19.02 ± 1.53	20.60 ± 1.65[a]	21.84 ± 2.27[a,b]
	Traditional	18.92 ± 1.50	19.36 ± 2.01	18.62 ± 1.65
	P value	.742	.001	<.001

[a] $P < .001$ compared with T0
[b] $P < .001$ compared with T1

Abbreviations: T0, at admission; T1, at discharge; T2, 2 months after discharge.

Better Quality of Life in Patients with Comorbid COPD and CHF After Receiving Individualized Nursing Care

As shown in Table 3, the 2 groups of patients showed no significant difference in any physical or mental composite domains at T0 ($P > .05$). The physical ($F = 2.834$; $P > .05$) and mental ($F = 2.476$; $P > .05$) composite scores did not differ at T0, T1 or T2 in the patients receiving traditional nursing care. The patients receiving individualized nursing care had

Table 4. Mental Health Evaluated by Zung's Self-Rating Anxiety Scale and Self-Rating Depression Scale Questionnaires in Patients Receiving Individualized Nursing Care vs Patients Receiving Traditional Nursing Care

	Nursing care	T0	T1	T2
SAS	Individualized	9.42 ± 1.50	8.12 ± 1·47[a]	7.74 ± 1.63[a,b]
	Traditional	9.56 ± 2.36	8.86 ± 2.09[a]	8.76 ± 2.34
	P value	.724	.043	.013
SDS	Individualized	8.94 ± 1.27	7.94 ± 1.49[a]	7.54 ± 1.64[a,b]
	Traditional	9.14 ± 1.54	8.62 ± 1.71[a]	9.02 ± 0.77
	P value	.480	.037	<.001

[a]$P < .05$ compared with T0
[b]$P < .01$ compared with T1

Abbreviations: SAS, Self-Rating Anxiety Scale; SDA, Self-Rating Depression Scale; T0, at admission; T1, at discharge; T2, 2 months after discharge

Table 5. Family Burden Evaluated by the Perceived Family Burden Scale Scores in Patients Receiving Individualized Nursing Care vs Patients Receiving Traditional Nursing Care

Nursing care	T0	T1	T2
Individualized	22.94 ± 4.68	20.14 ± 4.32[a]	18.40 ± 4.62[a,b]
Traditional	22.86 ± 4.78	21.30 ± 3.88	21.96 ± 3.67
P value	.933	.161	<.001

[*]$P < .001$ compared with T0
[#]$P < .001$ compared with T1

Abbreviations: SAS, Self-Rating Anxiety Scale; SDA, Self-Rating Depression Scale; T0, on admission; T1, at discharge; T2, 2 months after discharge.

notable differences in the physical (F =v63.60; $P < .001$) and mental (F = 30.70; $P < .001$) composite scores at T0, T1 and T2. However, the scores at T1 were higher than at T0 ($P < .001$) and the scores at T2 were higher than at T1 ($P < .001$). The patients receiving individualized nursing care had higher physical and mental composite scores at both T1 and T2 than patients receiving traditional nursing care ($P < .001$).

Better Mental Health in Patients with Comorbid COPD and CHF After Individualized Nursing Care

Next, we determined the presence of anxiety symptoms and depressive disorders in patients with comorbid COPD and CHF using Zung's SAS and SDS questionnaires. The 2 groups showed no significant difference in SAS or SDS scores ($P > .05$). The patients receiving traditional nursing care also showed no significant difference in SAS (F = 2.406; $P > .05$) or SDS (F = 2.916; $P > .05$) scores at T0, T1 or T2. The patients receiving individualized nursing care displayed remarkable differences in the SAS (F = 77.53; $P < .001$) or SDS (F = 15.93; $P < .001$) scores in the T0, T1 or T2. The SAS and SDS scores at T1 were lower than at T0 ($P < .05$) and the SAS and SDS scores at T2 were lower than at T1 ($P < .05$). The patients receiving individualized nursing care had reduced SAS and SDS scores at both T1 and T2 compared with patients receiving traditional nursing care ($P < .05$; see Table 4).

Perceived Family Burden Scale and Rehospitalization After Individualized Nursing Care

The 2 groups showed no significant difference with regard to PFBS scores ($P > .05$). The PFBS scores did not differ in patients receiving traditional nursing care at T0, T1 or T2 (F = 1.790; $P = .174$). The patients receiving individualized nursing care showed remarkable differences in PFBS scores at T0, T1 and T2 (F=18.81; $P < .001$). PFBS scores at T1 were lower than at T0 ($P = .005$), and at T2 were lower than at T1 ($P = .007$; see Table 5). The patients receiving individualized nursing care exhibited reduced PFBS scores at T2 compared to patients receiving traditional nursing care ($P < .001$; see Table 5). None of the patients receiving individualized nursing care were rehospitalized, but 2 patients receiving traditional nursing care were rehospitalized due to AECOPD and acute HF, respectively.

DISCUSSION

Pulmonary disease is common in patients with HF due to shared pathophysiological mechanisms and risk factors, and the combination represents a significant therapeutic challenge.[18] Our study examined the exercise capacity, QoL, mental health and family burden of patients with COPD/CHF receiving individualized inpatient and outpatient nursing care compared with traditional nursing care. Our main findings demonstrated individualized inpatient and outpatient nursing care could enhance exercise capacity, improve QoL and reduce anxiety symptoms and depressive disorders in patients with comorbid COPD and CHF.

Patients with COPD/CHF usually experience exertional symptoms of breathlessness and fatigue,[19] and increasing their aerobic exercise capacity is regarded as a crucial component of standard care.[20] The purpose of aerobic training is to condition the muscles by walking and improve cardiorespiratory fitness in patients with COPD/CHF.[21] In addition, aerobic exercise can not only reduce limiting symptoms including skeletal and respiratory muscle dysfunction, but also minimize dyspnea and fatigue.[22] These symptoms weaken the patients' ability to exercise and impair their cardiac fitness, which gradually destroys exercise tolerance and ultimately results in exercise limitation and functional disability.[23]

Interval training is more appropriate for patients with COPD/CHF who cannot tolerate continuous high-intensity aerobic training.[24] Walking and the cycle ergometer are considered the best training modalities.[25] In addition, nutrition support including vitamin and polyunsaturated fatty acid supplementation promote muscle strength, exercise capacity, pulmonary function and QoL in patients with COPD/CHF.[26] In this study, we found that patients with COPD/CHF exhibited better exercise capacity, as evidenced by a longer 6MWT distance and better QoL in patients receiving individualized inpatient and outpatient nursing care such as walking and pulmonary rehabilitation (breathing exercises) at T2 than patients receiving traditional nursing care.

Related common chronic comorbidities were depression and poor self-care, which contributed significantly to rehospitalization and mortality.[27] A previous study showed that depression was persistently associated with shorter survival rates over 12 years of follow-up and depression was

regarded as an independent risk factor of patients with CHF.[28] It is critical to identify effective management strategies for reducing depression in patients with CHF. For example, a prospective, multicenter, parallel, randomized, controlled trial involving 236 patients with CHF and related depression demonstrated that telephone-delivered psycho-behavioral interventions could significantly improve cardiac function, QoL and severity of depressive symptoms.[29] Koehler, et al. demonstrated telemedical care attenuated depressive symptoms and improved QoL in patients with CHF with moderate depression.[30] The reported incidence rate of depression in patients with COPD was 23.1% and 35.0%, respectively, in 2 previous studies.[31,32] Patients with CHF without comorbidities had a better QoL than patients with comorbidities, and COPD was found to enhance anxiety and depression, which affected the QoL of patients with comorbidities.[33]

The high prevalence of psychological distress, mainly depression and anxiety, in patients with COPD/CHF creates a critical need for multi-faceted interventions such as pulmonary and cardiac rehabilitation, psychological counseling and health education to improve outcomes for depression and anxiety.[34] Concurring with previous studies, we found that when patients with COPD/CHF were given individualized inpatient and outpatient nursing care, they had better mental health, showing lower depression and anxiety scores and fewer rehospitalization compared with patients receiving traditional nursing care.

Family caregivers play an important role in the daily care of patients with COPD/CHF, and healthcare providers should regularly pay attention to family caregivers.[35] Our study also that the disease burden of the families of patients with COPD/CHF was notably reduced when patients received individualized inpatient and outpatient nursing care rather than traditional nursing care.

CONCLUSION

In conclusion, our study provides evidence that individualized inpatient and outpatient nursing care can enhance exercise tolerance and QoL, improve mental health, promote respiratory and peripheral muscle strength, reduce rehospitalization and the family burden in patients with coexistent COPD and CHF. However, further large-scale randomized clinical trials are warranted to investigate more convenient nursing interventions such as electronic communication as adjunct therapy in the rehabilitation of patients with chronic comorbidities.

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