

Research Article

# A Study on the Correlation Between Sarcopenia and Chronic Obstructive Pulmonary Disease

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## Abstract

Chronic obstructive pulmonary disease (COPD) is a disease that affects the entire body. Sarcopenia, one of the adverse manifestations of the whole body, can lead to a variety of adverse outcomes. The worldwide studies have shown that sarcopenia was associated with COPD. This article aims to further enrich this research direction by focusing on the relationship between sarcopenia and COPD in Chinese inpatients. The subjects of this study were patients hospitalized in the Department of Respiratory and Critical Care Medicine of Rongchang People's Hospital of Chongqing from July 2022 to May 2024. After bioelectrical impedance analysis (BIA), test of 6 m walking speed, and tests for upper grip strength were accomplished, the sarcopenia can be diagnosed. According to the presence of chronic airflow limitation, which assessed by post-bronchodilator spirometry, we diagnosed COPD. COPD and sarcopenia as two variables, simple correlation analysis was adopted for them. The subjects were classified into sarcopenia group and non-sarcopenia group. And then, the correlation between sarcopenia and COPD was assessed with binary logistic regression analysis. Finally we get the results. Spearman's correlation coefficient for sarcopenia and COPD was 0.166 ( $p < 0.05$ ). While, COPD was not an independent risk factor to sarcopenia in the binary logistic regression analysis. Therefore, this study draws conclusions that COPD and sarcopenia is associated, but not linked independently.

## Keywords

Sarcopenia, COPD, Age

## 1. Introduction

Challenges are emerged with the global aging of society, as the same to China, and increasing age-related diseases, including COPD and sarcopenia, need to be managed by clinical medical workers. Sarcopenia as a term is come from Greek word, which means the loss of fresh. In 1989, sarcopenia as a medical concept was proposed by Rosenberg first [1]. Owing to a growing number of basic and clinical researches, the definition for sarcopenia has been refined. In 2019, the Asian Working Group for Sarcopenia (AWGS) reported sarcopenia

as “age-related loss of muscle mass, plus low muscle strength, and/or low physical performance” [2]. People with sarcopenia more likely suffer from physical disability, poor quality of life and even death [3].

COPD, as a frequent respiratory system disease, also a systemic inflammatory disorder and age-related disorder [4], has been one of the major health problems of worldwide concern for the high disability and mortality. Studies have found that sarcopenia secondary to COPD can lead to further

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**Received:** 23 September 2024; **Accepted:** 25 October 2024; **Published:** 29 October 2024



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deterioration of lung function and reduced ability to carry on daily life, this kind of chronic disease state can lead to disorders like inflammatory response, increased energy expenditure, reduced activity tolerance, all of them aggravate sarcopenia in return [5]. In this work, we focused on the correlation between sarcopenia and COPD in hospitalized patients, which discussed through a cross-sectional study. At present, there is still a lack of similar study in China.

## 2. Materials and Methods

**Materials.** The participants signed informed consent approved by the ethics committee of Chongqing Rongchang People's Hospital. From July 2022 to May 2024, in Chongqing Rongchang People's Hospital, inpatients at the respiratory and critical care medicine department, who were stable enough to made hospital discharge soon, can be included in the study. Patients with New York Heart Association (NYHA) class III or IV, COPD in acute exacerbation period, and stroke, would be excluded. Patients who had stage 5 chronic kidney disease, organ transplant, took immunomodulators within the last six months were also excluded. Bioelectrical impedance analysis (BIA) and pulmonary function test were performed by routine physicians. Tests for six meters usual gait speed were also conducted under the observation of routine physicians. As the American Society of Hand Therapists recommended, the right and left hands were both measured three times with Jamar digital hand dynamometer, and the peak value was adopted.

**Accompanied data.** After the participants had fasted for eight hours, their weight, height, and blood pressure were measured, and venous blood was collected and analyzed. The levels of serum biochemicals such as liver function index, renal function index, lipid and hypersensitive C-reactive protein (hs-CRP) were obtained. Additionally, body mass index (BMI) was calculated with the formula:  $BMI = \text{weight (kg)} / \text{height (m)}^2$ . After medical history of the patients were collected, we got modified Medical Research Council (mMRC) score [6].

### 2.1. Clinical and Laboratory Measurements

The participants who had completed BIA, six meters usual gait speed, and tests for upper grip strength were chose. According to the recommendations of AWGS, we divided the participants into sarcopenia group and non-sarcopenia group by using cutoff values for appendicular skeletal muscle mass/height<sup>2</sup> (7.0 kg/m<sup>2</sup> for male and 5.7 kg/m<sup>2</sup> for female by BIA), six meters usual gait speed (<1 m/s) and handgrip strength (<28 kg for male and <18 kg for female). According to the 2021 global strategy for prevention, diagnosis and management of COPD, reported by Global Initiative for Chronic Obstructive Lung Disease (GOLD), COPD should be considered in any patient with dyspnea, chronic cough or expectoration, recurrent lower respiratory tract infections, and/or a history of exposure to risk factors for this disease. Patients

with chronic bronchitis and pulmonary emphysema, who show a ratio of forced expiratory volume in first one second (FEV1) to forced vital capacity (FVC) less than 0.7 as assessed by spirometry after bronchodilator use, can be diagnosed as COPD. According to the decline degree of FEV1, the Chronic Obstructive Lung Disease (GOLD) classification were obtained, which reflect the severity of airflow restriction.

### 2.2. Statistical Analysis

The Statistical Program for Social Sciences (version 20, IBM Corp, Armonk, NY, USA) was used for all data analysis. The tables show the mean  $\pm$  standard deviation as descriptive statistics of the continuous variables. Chi-squared test was performed to compare the categorical data and independent samples t-test was used for quantitative data to assess significance of differences between two groups. Ranked data were analyzed by Spearman correlation test. Multiple binary logistic regression analysis was used to assess the relation between sarcopenia and COPD, age, BMI, creatinine, sex, and hs-CRP. The outcomes were evaluated with a confidence interval of 95%, and  $P < 0.05$  was considered significant.

## 3. Results

460 patients (303 COPD, 157 non-COPD) were enrolled in this study (Table 1). There were 159 subjects (91 men, 68 women) in the sarcopenia group and 301 subjects (108 men and 193 women) in the non-sarcopenia group. The mean age, the incidence of COPD, the proportion of male, creatinine level and exceeding hs-CRP in the sarcopenia group were higher than the non-sarcopenia group, while the mean BMI were lower (Table 2). Sarcopenia were positively associated with COPD (Table 3). Furthermore, data from 303 patients with COPD were analyzed. The GOLD classification was positively associated with sarcopenia (Table 4). The mMRC score was positively associated with sarcopenia (Table 5).

In the multiple binary logistic regression analysis, BMI, gender, age, hs-CRP, COPD and creatinine, were Included as independent variables and sarcopenia was Included as dependent variable. The protective factor of sarcopenia was BMI, while the risk factors were age, male, and exceeding hs-CRP (Table 6). COPD was not an independent factor to sarcopenia.

**Table 1.** Diagnostic table of sarcopenia and COPD.

	sarcopenia	non-sarcopenia	total
COPD	122	181	303
non-COPD	37	120	157
total	159	301	

**Table 2.** Clinical characteristics of subjects.

	sarcopenia	non-sarcopenia
Cases	159	301
men/women	91/68*	108/193
COPD (%)	76.73%*	60.13%
exceeding hs-CRP (%)	42.14%*	27.91%
Age (year)	72.96±9.80*	69.62±7.57
BMI (kg/m <sup>2</sup> )	22.26±3.07*	25.18±3.37
creatinine	94.42±67.16*	81.96±39.20
Uric acid	312.7±105.66	315.07±98.49
Alanine aminotransferase (U/L)	23.58±21.96	21.97±16.32
Aspartate aminotransferase (U/L)	22.99±14.36	22.25±15.52
total cholesterol (mmol/L)	4.34 ±2.77	4.22 ±1.21
triglyceride (mmol/L)	1.47 ±1.11	1.71 ±1.69
high-density lipoprotein (mmol/L)	1.25 ±0.38	1.21 ±0.38
low density lipoprotein (mmol/L)	2.47 ±0.91	2.54 ±0.93
Diabetes (%)	26.42%	22.92%
Hypertension (%)	58.49%	56.48%

\*P&lt;0.05

**Table 3.** Spearman's correlation coefficient for sarcopenia and COPD.

COPD		
	R	P
sarcopenia	0.166	<0.001

**Table 4.** Spearman's correlation coefficient for sarcopenia and GOLD classification.

GOLD		
	R	P
sarcopenia	0.320	<0.001

**Table 5.** Spearman's correlation coefficient for sarcopenia and mMRC score.

mMRC	R	P
sarcopenia	0.229	<0.001

**Table 6.** Multiple binary logistic regression results (variables in the equation).

	OR	95%CI
BMI (<18.5)	1	
BMI (18.5~)	0.123	0.033-0.464
BMI (≥24)	0.021	0.005-0.082
age (<70 y)	1	
age (70~y)	1.557	0.941-2.576
age (≥80 y)	4.007	2.117-7.587
men	1	
women	0.286	0.179-0.458
hs-CRP (normal)	1	
hs-CRP (exceeding)	2.190	1.355-3.538

P&lt;0.05

## 4. Discussion

Current international epidemiological studies had shown that the prevalence rate of sarcopenia in patients with COPD were 15%~40% [7-11]. However, studies on the prevalence rate of sarcopenia in patients with COPD was still lacking in Chinese people. In this study, the prevalence rate of sarcopenia in patients with COPD was 40.3%, calculated from the diagnostic table of sarcopenia and COPD (Table 1), which was roughly consistent with the international epidemiological studies and enriched those. Patients with COPD suffer from impaired lung function, limited gas exchange, and skeletal muscle dysfunction, which results in decreased exercise endurance and daily life affected. The above process eventually leads to muscle atrophy. Based on human composition analysis, patients with COPD have a relative increase in adipose tissue while a decrease in non-adipose tissue, promoting systemic inflammatory response and insulin resistance, which could lead to sarcopenia [12]. In this study, Spearman's correlation analysis between COPD and sarcopenia showed a positive relation (R 0.166, P<0.001). In the 303 patients with COPD, correlation analysis between GOLD classification and sarcopenia showed a positive relation (R 0.320, P<0.001),

correlation analysis between mMRC score and sarcopenia showed a positive relation (R 0.229, P<0.001) too, indicated that the worse the lung function was, the higher the probability of suffer from sarcopenia was. However, COPD was not a risk or protector for sarcopenia, according to the outcomes of multiple binary logistic regression. COPD and sarcopenia may had a common background, such as age inflammatory response, insulin resistance, etc., so patients with sarcopenia were often complicated with COPD, and positive findings were found when only the two disease were included in the correlation analysis. But there was no direct causal relationship between the two diseases, as showed in the multiple binary logistic regression when other factors were included.

In this study, multiple binary logistic regression indicated that four factors Independently influenced sarcopenia. As we knew aging was a risk for sarcopenia. The risk of suffering sarcopenia in group (70~y) was 1.557 times higher than group (<70 y) (OR=1.557, 95%CI: 0.941-2.576). The risk of suffering sarcopenia in group (≥80 y) was 4.007 times higher than that group (<70 y) (OR=4.007, 95%CI:2.117-7.587). Chronic inflammation was one underlying pathophysiological mechanism of sarcopenia. Patients with an exceeding hs-CRP had a higher risk of sarcopenia than normal hs-CRP group (OR=2.190, 95%CI:1.355-3.538). Moreover, women have a lower risk of sarcopenia than men (OR=0.286;

95%CI:0.179-0.458). Androgen may be an important role in improving muscle mass maintenance. The decrease of androgen in men with aging may lead to an increased risk of sarcopenia. Additionally, women take part in physical activity more than men, such as go shopping, do housework, and square dance. Exercise increases muscle mass after all. Compared with group (BMI < 18.5 kg/m<sup>2</sup>), there was a decrease of sarcopenia in group (BMI 18.5~kg/m<sup>2</sup>) (OR=0.123; 95%CI:0.033-0.464). Compared with group (BMI < 18.5 kg/m<sup>2</sup>), there was a decrease of sarcopenia in group (BMI≥24 kg/m<sup>2</sup>) (OR =0.021; 95%CI: 0.005-0.082). Increased muscle mass as one of the important components of human body can lead to an increase in BMI. People with more muscle mass may have less chance of sarcopenia.

This is a cross-sectional study, it has its own limitations. Sampling error may exist, which may affect the selection of subjects. What's more, the final outcome may be affected by the coexistence of multiple diseases and long-term hospitalization. Therefore, further multi-centered studies which explore in different ways may be needed to evaluate the exact relationship between COPD and sarcopenia in larger patient groups.

## Abbreviations

COPD	Chronic Obstructive Pulmonary Disease
FEV1	Forced Expiratory Volume in First One Second
FVC	Forced Vital Capacity
BIA	Bioelectrical Impedance Analysis
AWGS	Asian Working Group for Sarcopenia
NYHA	New York Heart Association
hs-CRP	hypersensitive C-reactive protein
BMI	Body Mass Index
mMRC	modified Medical Research Council
GOLD	Global Initiative for Chronic Obstructive Lung Disease

## Acknowledgments

This work was not supported by any Project.

## Author Contributions

Yu Zhai is the sole author. The author read and approved the final manuscript.

## Conflicts of Interest

There are no conflicts of interest relevant to this article.

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