



Analysis of the Relationship between Sarcopenia and Medical History along with Clinical Biochemistry

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Abstract

Aims: To analyze the past medical history and relevant clinical biochemical indexes of patients with sarcopenia, and then explore the correlative factors of sarcopenia. **Methods:** 200 individuals randomly selected from those undergoing body composition analysis in Linyi People's Hospital Health Examination Center between September and December 2020 were chosen as research participants. They were divided into 155 cases in the non-sarcopenia group (Group 1), 25 cases in the pre-sarcopenia group (Group 2), and 20 cases in the sarcopenia group (Group 3). A body composition analyzer was used to measure the body composition, and the grip strength, walking speed, etc. of the subjects were measured. At the same time, general data such as the age, gender, and medical history of the patients as well as routine biochemical indexes such as fasting plasma glucose (FPG), glycosylated hemoglobin (HbA1c), total cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL) were collected. **Results:** The prevalence of cardiovascular disease (CVD) in the sarcopenia group was higher than that in the non-sarcopenia group, and the difference was statistically significant ($P < 0.017$). The value of HDL in the sarcopenia group was higher than that in the non-sarcopenia group, and the difference was statistically significant ($P < 0.05$). **Conclusion:** Compared with the non-sarcopenia group, the subjects in the sarcopenia group have a higher prevalence of CVD and a higher value of HDL.

Subject Areas

Clinical Medicine

Keywords

Sarcopenia, Aging, Chronic Diseases, High-Density Lipoprotein

1. Introduction

Sarcopenia was first proposed by Rosenberg in 1989 [1]. It is a progressive and systemic skeletal muscle disease that increases the likelihood of adverse outcomes such as falls, fractures, physical disabilities, and death [2]. Currently, the diagnosis of sarcopenia mainly relies on imaging examination methods. Among them, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and dual energy X-ray absorptiometry (DXA) have relatively high accuracy in detecting muscle mass. However, these methods require professional operation and pose risks of radiation exposure. Bioelectrical impedance analysis (BIA) is non-invasive, convenient, and fast to operate, but the accuracy varies among devices from different manufacturers. The ultrasound method depends on the skills and experience of ultrasound physicians. Anthropometric measurements are used in clinical practice and screening, but their accuracy is poor. At present, DXA and BIA are the two methods commonly used in clinical settings.

Due to the deficiencies of the existing measurement methods, muscle mass detection has not become a routine examination item, resulting in the difficulty of timely detection of sarcopenia and its pre-stage. The purpose of this experiment is to compare the past medical histories and biochemical indicators of non-sarcopenia, pre-sarcopenia, and sarcopenia populations, screen out effective diagnostic indicators, combine them with clinical manifestations and physical examinations to achieve accurate diagnosis of sarcopenia and its pre-stage, and then promptly implement intervention treatments to delay or reverse the progression of sarcopenia, reduce the occurrence of adverse consequences, and improve the quality of life of patients.

2. Methods

2.1. Research Subjects

Based on the sarcopenia diagnostic criteria established by the Asian Working Group for Sarcopenia (AWGS 2019) and the pre-sarcopenia diagnostic criteria proposed by the European Working Group on Sarcopenia in Older People (EWGSOP), 200 individuals randomly selected from those undergoing body composition analysis in Linyi People's Hospital Health Examination Center between September and December 2020 were chosen as research participants. They were divided into 155 cases in the non-sarcopenia group (Group 1), 25 cases in the pre-sarcopenia group (Group 2), and 20 cases in the sarcopenia group (Group 3).

Diagnostic Criteria for Sarcopenia [3]:

1) Muscle Strength: Men have a grip strength of less than 28 kg, and women have a grip strength of less than 18 kg.

2) Physical Function: The walking speed for a distance of over 6 meters is less than 1 m/s, or it takes 12 seconds or more to stand up and sit down 5 times, or the score of the Short Physical Performance Battery (SPPB) is 9 or less.

3) Appendicular Skeletal Muscle Mass: When measured by DXA, men have a mass of less than 7.0 kg/m² and women have a mass of less than 5.4 kg/m². When measured by BIA, men have a mass of less than 7.0 kg/m² and women have a mass of less than 5.7 kg/m².

Sarcopenia is diagnosed when there is a decrease in skeletal muscle mass accompanied by a reduction in muscle strength and/or physical function.

The diagnostic criteria for pre-sarcopenia [4] state that only muscle mass is reduced, while muscle strength and physical function remain unchanged.

2.2. Research Methods

- Collection of Basic Information: Collect and record the basic information of the subjects, including age, gender, and past medical history, such as Type 2 Diabetes Mellitus (T2DM) and cardiovascular diseases (CVD).
- Measurement of Muscle Strength: Use grip strength to represent muscle strength. Employ an electronic grip dynamometer and calibrate it before use. Instruct the subjects to stand with their arms hanging down naturally to avoid touching their bodies. Measure the maximum strength of each hand at least twice and take the maximum value as the grip strength.
- Assessment of Physical Function: Use the time taken for 5 sit-to-stand repetitions to represent physical function. According to the AWGS 2019 diagnostic criteria, if the time for 5 sit-to-stand repetitions is equal to or greater than 12 seconds, it indicates a decline in physical function. This indicator can replace the 6-meter walking speed to reflect the physical function.
- Determination of Human Body Parameters: Apply the InBody 770 combined with a height measuring instrument to measure multiple indicators of the subjects, including height, weight, skeletal muscle mass, skeletal muscle mass of the limbs and trunk, body mass index (BMI), skeletal muscle index (SMI), visceral fat area, total body water, protein, inorganic salts, body fat content, and segmental circumferences.
- Detection of Biochemical Indexes: All subjects were required to fast overnight for more than 8 hours. In the early morning, 5 milliliters of venous blood was drawn from the elbow to test routine biochemical indexes, such as fasting blood glucose (FBG), glycosylated hemoglobin (HbA1c), total cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL).
- Data Statistical: Using SPSS 25.0 software. For enumeration data, the constituent ratio was used for representation. Differences were compared by the chi-square test or the exact probability method. When making comparisons between each pair of groups, chi-square partitioning was adopted, and $P < 0.017$ in chi-square partitioning was considered statistically significant. For measurement data, it was

expressed as ($x \pm s$), and analysis of variance was used to compare differences.

3. Results

3.1. The Relationship between Sarcopenia, Pre-Sarcopenia and T2DM, CVD

There was no statistically significant difference in the prevalence of T2DM among the three groups ($P > 0.05$). However, differences were observed in the prevalence of CVD among the three groups. Through further pairwise comparisons, it was found that the prevalence of CVD in the sarcopenia group was higher than that in the non-sarcopenia group, and the difference was statistically significant ($P < 0.017$) (See **Table 1** and **Table 2**).

Table 1. Distribution of T2DM and CVD among the three groups.

		Group 1	Group 2	Group 3	χ^2	P
T2DM	No	113 (72.9)	21 (84)	15 (75)	1.398	0.497
	Yes	42 (27.1)	4 (16)	5 (25)		
CVD	No	130 (83.87)	16 (64)	11 (55)	---	0.002
	Yes	25 (16.13)	9 (36)	9 (45)		

Table 2. Comparison of CVD between Groups.

			χ^2	P
CVD	Group 1	Group 2	----	0.027
	Group 1	Group 3	----	0.005
	Group 2	Group 3	0.375	0.540

3.2. Relationship between Sarcopenia, Pre-Sarcopenia and Some Biochemical Indicators

The average HDL level in the non-sarcopenia group was (1.34 ± 0.41), that in the pre-sarcopenia group was (1.42 ± 0.29), and that in the sarcopenia group was (1.58 ± 0.36). The distribution of the average HDL levels among the three groups was different, and the difference was statistically significant ($P < 0.05$). Specifically, the HDL value in the sarcopenia group was higher than that in the non-sarcopenia group, and the difference was statistically significant ($P < 0.05$). There was no statistically significant difference in HDL between the non-sarcopenia group and the pre-sarcopenia group ($P > 0.05$), nor was there a statistically significant difference in HDL between the sarcopenia group and the pre-sarcopenia group ($P > 0.05$). Meanwhile, there was no statistical significance in the mean values of fasting blood glucose, HbA1c%, TC, TG, and LDL ($P > 0.05$) (See **Table 3** and **Table 4**).

4. Discussion

The meta-analysis by Pacifico *et al.* showed that the prevalence of sarcopenia in

Table 3. Distribution of Some Biochemical Indicators among the three groups.

	Group 1	Group 2	Group 3	F	P
FPG (mmol/L)	6.73 ± 1.97	6.59 ± 2.67	6.67 ± 3.19	0.044	0.957
HbA1c (%)	6.65 ± 2.1	6.26 ± 1.92	6.63 ± 2.58	0.374	0.689
TC (mmol/L)	4.9 ± 1.07	5.19 ± 1.19	4.85 ± 0.77	0.852	0.428
TG (mmol/L)	1.87 ± 1.76	1.33 ± 0.74	1.14 ± 0.61	2.775	0.065
HDL (mmol/L)	1.34 ± 0.41	1.42 ± 0.29	1.58 ± 0.36	3.375	0.036
LDL (mmol/L)	3.25 ± 0.9	3.4 ± 0.85	3.15 ± 0.9	0.490	0.614

Table 4. Comparison of HDL between groups.

Dependent variable	(I) Group	(J) Group	Mean difference (I-J)	Standard Error	P	95% Confidence Interval	
HDL (mmol/L)	1	2	-0.076	0.085	0.372	-0.240	0.090
	1	3	-0.238	0.094	0.012	-0.420	-0.050
	2	3	-0.161	0.119	0.175	-0.400	0.070

patients with CVD, dementia, diabetes, and respiratory diseases was 31.4%, 26.4%, 31.1%, and 26.8%, respectively [5], which indicates the commonality of the coexistence of sarcopenia with multiple chronic diseases. There are numerous common risk factors between sarcopenia and chronic non-communicable diseases, such as sedentary lifestyle, lack of exercise, malnutrition, and inflammation [5], which can account for the relatively high prevalence of sarcopenia in patients with related diseases. In this study, no significant direct association was observed between sarcopenia and T2DM, and this result differs from some previous studies. The possible reason lies in the differences in sample characteristics, research methods, or inclusion and exclusion criteria between this study and other studies. Notably, the prevalence of CVD is relatively high in the sarcopenia group. Sarcopenia may lead to metabolic disorders in the body and affect the normal functions of the cardiovascular system, specifically in aspects such as vascular endothelial function, lipid metabolism, and inflammatory response, thereby promoting the occurrence and development of CVD. A study by Sasaki *et al.*, Japanese scholars, also showed that CVD can reduce motor function and accelerate the occurrence of sarcopenia [6].

In the analysis of sarcopenia and clinical biochemical indicators, the average value of HDL increased successively in the non-sarcopenia group, the pre-sarcopenia group, and the sarcopenia group. However, only the difference between the non-sarcopenia group and the pre-sarcopenia group was statistically significant ($P < 0.05$). A meta-analysis published by Du *et al.* pointed out that the levels of serum TG and HDL-C were positively correlated with sarcopenia [7]. The research by Wang *et al.* shows that in community-dwelling Chinese residents, a

higher level of high-density lipoprotein cholesterol (HDL-C) will increase the incidence of sarcopenia [8]. Serum lipid determination has the advantages of low cost and simple operation. Discovering its correlation with sarcopenia is helpful for the early detection and treatment of sarcopenia. In this study, the value of high-density lipoprotein (HDL) in the sarcopenia group was higher than that in the non-sarcopenia group. Although HDL is a cardiovascular protective factor that can participate in reverse cholesterol transport, thereby reducing blood cholesterol levels and the risk of atherosclerosis, the increase in HDL in the sarcopenia group contradicts the traditional perception. This may imply that under the special pathological state of sarcopenia, the structure and function of HDL have changed. Even though its level has increased, due to the presence of interfering factors such as chronic inflammation, insulin resistance, and oxidative stress in the patient's body, it cannot effectively play a cardiovascular protective role. Although no correlation between sarcopenia and other clinical indicators was found in this study, previous studies have shown that FBG, TG, TC, etc. were closely associated with sarcopenia [7].

5. Conclusion

In this study, a comparative analysis was carried out for the non-sarcopenia group, the pre-sarcopenia group, and the sarcopenia group. The results showed that the sarcopenia group had a significantly higher prevalence of CVD and a higher HDL value compared to the non-sarcopenia group. These findings have uncovered the close association between sarcopenia and the prevalence of CVD, as well as the particular complexity of HDL changes in the state of sarcopenia. It provides essential clues for a profound understanding of the pathogenesis of sarcopenia and its complications, and also offers novel perspectives and a foundation for clinicians in formulating prevention and treatment strategies for cardiovascular diseases in patients with sarcopenia. Nevertheless, currently, the in-depth pathophysiological link between sarcopenia and CVD, as well as the precise mechanism of action of HDL therein, remain incompletely elucidated. Hence, it is imperative for further research to delve deeper into the intrinsic correlation between sarcopenia and CVD and to meticulously dissect the mechanism of action of HDL, thereby laying a solid theoretical groundwork and providing practical guidance for attaining more accurate and effective health management of patients with sarcopenia.

Conflicts of Interest

The authors declare no conflicts of interest.

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