PREVALENCE AND ASSOCIATED FACTORS OF SARCOPENIA IN LUNG CANCER PATIENTS UNDERGOING CHEMOTHERAPY: A CROSS-SECTIONAL STUDY AT A TERTIARY HOSPITAL IN VIETNAM

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Abstract

Objectives: To evaluate the prevalence of sarcopenia and its associated factors in lung cancer patients undergoing chemotherapy at a tertiary hospital in Vietnam. ***Methods:*** A cross-sectional descriptive study was conducted on 89 lung cancer patients. Sarcopenia was assessed using the Asian Working Group for Sarcopenia (AWGS) 2019 criteria, including measurements of handgrip strength (HGS), appendicular skeletal muscle mass (ASM), and physical performance. Logistic regression analysis identified factors associated with sarcopenia. ***Results:*** The mean age of participants was 62.6 ± 9.8 years; 78.7% were male. The prevalence of sarcopenia was 39.3%, with 40.4% of patients having reduced ASM. Malnutrition (Body mass index (BMI) < 18.5) was found in 15.7% of patients. Logistic regression analysis revealed significant associations between sarcopenia and male gender (OR = 8.19), lower hemoglobin levels (OR = 0.96), and increased lymphocyte counts (OR = 1.05). Patients with normal BMI (18.5 - 23) and high BMI (≥ 23) had lower odds of sarcopenia compared to those with BMI < 18.5. ***Conclusion:*** Sarcopenia is prevalent among lung cancer patients undergoing chemotherapy. Male gender, low BMI, low HGB, and high lymphocyte counts are associated with increased sarcopenia risk in lung cancer patients, whereas normal to high BMI offers protective effects.

Keywords: Malnutrition; Sarcopenia; Lung cancer; Chemotherapy.

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INTRODUCTION

Sarcopenia is a syndrome characterized by the loss of muscle mass, strength, and function, commonly seen in older adults and patients with chronic diseases [1]. In cancer patients, it results from chronic inflammation, metabolic dysregulation, and side effects of cancer treatments. Sarcopenia often coexists with cachexia, a syndrome of chronic inflammation and increased protein breakdown, leading to muscle wasting and functional decline [2].

The prevalence of sarcopenia in cancer patients can reach 80 - 90% in advanced stages, doubling the mortality risk [3]. It is particularly common in elderly cancer patients, increasing chemotherapy toxicity, reducing treatment efficacy, raising postoperative complications, and worsening quality of life, ultimately leading to higher mortality [4].

Lung cancer is one of the most common cancers worldwide. In Vietnam, lung cancer incidence has risen significantly, with an age-standardized rate of 33.2 per 100,000, ranking second after liver cancer [5]. Although chemotherapy is effective, it also exacerbates muscle loss and sarcopenia in lung cancer patients [6]. Nutritional status plays a crucial role in lung cancer management. Some studies on sarcopenia have been published in Vietnam [7, 8]; however, there were no publications on the application of bioelectrical impedance analysis in cancer patients. At Military Hospital 103, standardized multimodal cancer treatment is provided, but further research on malnutrition and sarcopenia prevalence and risk factors is needed to enhance clinical care. Therefore, this study aims to: *Determine the prevalence and risk factors of sarcopenia in lung cancer patients at Military Hospital 103 and evaluate the role of bioelectrical impedance analysis in diagnosing sarcopenia. The findings will provide scientific evidence to improve screening, diagnosis, and nutritional interventions for lung cancer patients, contributing to better treatment outcomes.*

MATERIALS AND METHODS

1. Subjects

Including 89 lung cancer inpatients diagnosed and undergoing chemotherapy at the hospital.

* *Inclusion criteria:* Adults aged ≥ 18 years; undergoing chemotherapy; capable of responding to survey questions; voluntary participation.

* *Exclusion criteria:* Incomplete medical records; conditions affecting bioelectrical impedance (e.g., pacemakers); neurological or communication impairments.

* *Study location and duration:* The research was conducted at the Cancer Center, Military Hospital 103, from October 2023 to December 2024.

2. Methods

* *Study design:* A cross-sectional descriptive study.

* *Sampling method:* All lung cancer patients admitted during the study period and meeting inclusion criteria were selected.

* *Study variables:*

Sarcopenia is diagnosed according to the AWGS 2019 criteria, based on three main criteria: Low muscle mass (mandatory criterion), low muscle strength, and low physical performance. Sarcopenia was diagnosed when low muscle mass presented along with either low muscle strength or low physical performance [1]. Measurement of muscle mass using multi-frequency bioelectrical impedance analysis (MF-BIA) with the InBody S10 (InBody Co., Ltd, Seoul, Korea), SMI = ASM (kg)*((height(m))$^{-2}$). Ensuring the subject fasts for at least 2 hours before the test. Avoiding intensive exercise, alcohol, and excessive water intake before testing. Removing metal accessories and ensuring clean, dry skin for electrode placement. The subject lies down in a supine position for at least 5 minutes before measurement. Reduced ASM was defined as SMI < 7.0 kg/m² for men and SMI < 5.7 kg/m² for women.

Muscle strength measurement by HGS using Camry EH101 (Camry, China). Reduced HGS was defined as < 28kg for men and < 18kg for women.

Physical performance: The 6-meter walk test (Gait Speed Measurement) was done on a flat, non-slip surface with a 6-meter distance clearly marked. A time of ≥ 6 seconds was considered as reduced physical performance.

* *Data collection:*

The assessed variables included patient demographics (age, sex, education), treatment method, and Eastern Cooperative Oncology group (ECOG) performance status.

Hematology and biochemical data collection: Blood samples were collected in the morning after overnight fasting. Complete blood count (CBC) analysis was performed using the UniCel DxH 600 hematology analyzer based on flow cytometry and morphological analysis utilizing laser technology. Biochemical parameters, including albumin, lymphocytes, potassium, sodium, chloride, creatinine, and hemoglobin, were analyzed using the AU5800 - Beckman Coulter, which employs the turbidimetric immunoassay method analyzed using standard laboratory techniques. All laboratory tests were

conducted in the hospital's central laboratory to ensure consistency and reliability.

The ECOG performance status scale was designed to assess the level of functioning of patients with cancer in terms of their ability to care for themselves, daily activity, and physical ability. Data were collected through surveys and processed using statistical software. Bias was minimized through investigator training and clear inclusion/ exclusion criteria.

* *Data analysis:* Data were entered and analyzed using SPSS 26.0. A p-value < 0.05 was considered statistically significant.

3. Ethics

The study was approved according to the Decision of the Research Project of the Military Medical University (Decision No. 2404/QĐ-HVQY, 25/6/2024). Military Hospital 103 granted permission for the use and publication of the research data. The authors declare to have no conflicts of interest in this study.

RESULTS

Table 1. Characteristics of study participants (n = 89).

Characteristics	Mean ± SD or n (%)
Age (years)	62.6 ± 9.8
Age ≥ 60 (n, %)	60 (67.4)
Male (n, %)	70 (78.7)
Education above high school (n, %)	57 (64)
Stable income (n, %)	39 (43.8)
Advanced-stage cancer (n, %)	75 (84.3)
Treatment method (n, %)	
Surgery - Chemotherapy	23 (25.8)
Surgery - Radiotherapy - Chemotherapy	2 (2.2)
Chemotherapy	31 (34.8)
Radiotherapy - Chemotherapy	33 (37.1)
BMI (kg/m^2)	21.5 ± 2.8
BMI < 18.5 (n, %)	14 (15.7)
BMI 18.5 - 23 (n, %)	48 (53.9)
BMI ≥ 23 (n, %)	27 (30.3)

Characteristics	Mean ± SD or n (%)
ECOG performance status (points)	0.9 ± 0.9
ECOG 0 (n, %)	32 (36.0)
ECOG 1 (n, %)	44 (49.4)
ECOG 2 (n, %)	4 (4.5)
ECOG 3 (n, %)	9 (10.1)
Hemoglobin (g/L)	122.8 ± 19.9
Lymphocytes (G/L) #	12.7 (1.5 - 26.2)
Albumin (g/L) #	40.3 (38.2 - 43.1)
Potassium (mmol/L)	3.9 ± 0.3
Sodium (mmol/L) #	139.0 (136.4 - 141.1)
Chloride (mmol/L) #	101.7 (100.1 - 104.8)
Creatinine (µmol/L) #	73.7 (87.9 - 97.4)

(#: Presented with interquartile ranges (25^{th} - 75^{th} percentile))

Characteristics of the study population are shown in table 1. The mean age was 62.6 years, with a predominance of males (78.7%). Most participants had advanced-stage cancer (84.3%) and a BMI in the range of 18.5 - 23 (53.9%), while 15.7% were malnourished (BMI < 18.5). Radiotherapy - Chemotherapy is the most common treatment method (37.1%).

Table 2. Sarcopenia characteristics in patients (n = 89).

AWGS 2019 criteria	n	%
Reduced HGS	81	91.0
Reduced physical performance	83	93.3
Reduced ASM	36	40.4
Sarcopenia	35	39.3

Data on sarcopenia characteristics in table 2 showed that 39.3% of patients were diagnosed with sarcopenia according to AWGS 2019 criteria, and 40.4% had reduced ASM. The percentages of reduced HGS (91.0%) and physical performance (93.3%) were notably high.

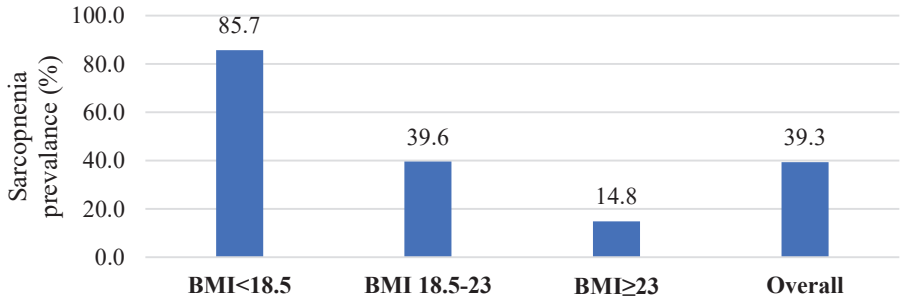

Chart 1. The prevalence of sarcopenia according to BMI categories (n = 89).

Chart 1 shows the prevalence of sarcopenia according to BMI categories. The data presented that with BMI < 18.5, sarcopenia accounted for the highest prevalence at 85.7%. As for the BMI 18.5 - 23 group, the prevalence drops to 39.6%. Finally, when BMI ≥ 23, the lowest prevalence is witnessed at 14.8%.

Table 3. Logistic regression model: Sarcopenia and associated factors (n = 89).

Characteristics	Sig.	OR	95%CI
Model 1			
Age (years)	0.96	1.00	0.92 - 1.09
Male gender	0.074	7.77	0.82 - 73.51
Education above high school	0.902	1.10	0.24 - 4.95
Stable income	0.718	0.77	0.18 - 3.23
Advanced-stage cancer	0.09	9.76	0.70 - 135.92
Surgery - Chemotherapy (reference)		1.00	
Surgery - Radiotherapy - Chemotherapy	0.91	1.27	0.02 - 81.14
Chemotherapy	0.235	0.30	0.04 - 2.18
Radiotherapy - Chemotherapy	0.351	0.39	0.05 - 2.84
BMI < 18.5 (reference)		1.00	
BMI 18.5 - 23	0.00	0.03	0.00 - 0.27
BMI ≥ 23	0.00	0.01	0.00 - 0.16
ECOG score (points)	0.07	2.00	0.95 - 4.20
Albumin (g/L)	0.37	1.05	0.94 - 1.17
Creatinine (mcrmol/L)	0.38	1.02	0.98 - 1.05

Characteristics	Sig.	OR	95%CI
Hemoglobin (g/L)	0.02	0.95	0.92 - 0.99
Lymphocyte (G/L)	0.04	1.05	1.00 - 1.10
Kali (mmol/L)	0.51	2.03	0.25 - 16.58
Natri (mmol/L)	0.44	0.91	0.71 - 1.16
Clo (mmol/L)	0.833	1.026	0.81 - 1.31
Constant	0.489	8442.76	
Model 2			
Male gender	0.023	8.19	1.34 - 50.17
BMI 18.5 - 23	0.002	0.06	0.01 - 0.35
BMI ≥ 23	0	0.02	0.00 - 0.17
ECOG score (points)	0.083	1.75	0.93 - 3.28
Hemoglobin (g/L)	0.013	0.96	0.93 - 0.99
Lymphocyte (G/L)	0.024	1.05	1.01 - 1.10
Constant	0.038	82.063	

(Model 1: Full logistic multivariate model; Model 2: Adjusted logistic multivariate model)

Table 3 analyzes factors associated with sarcopenia. The significant predictors of sarcopenia include male gender (OR = 8.19), BMI (BMI 18.5 - 23: OR = 0.06; BMI ≥ 23: OR = 0.02), Hemoglobin levels (OR = 0.96), and Lymphocyte count (OR = 1.05).

DISCUSSION

1. The prevalence of sarcopenia

This study found that 39.3% of patients met the AWGS 2019 criteria for sarcopenia, consistent with global estimates of 30 - 60% in lung cancer patients, especially in advanced stages. Reduced muscle mass (40.4%) and impaired functional performance (93.3%) highlight the impact of chronic inflammation, tumor burden, and cancer treatments [2, 6]. Sarcopenia was most prevalent (85.7%) in undernourished patients (BMI < 18.5), confirming low BMI as a major risk factor. Notably, 39.6% of patients with normal BMI (18.5 - 23) also had sarcopenia, indicating muscle loss can occur despite normal weight. In overweight/obese

patients (BMI ≥ 23), sarcopenia was the lowest (14.8%), suggesting a protective effect of higher BMI.

2. Risk factors for sarcopenia

Significant factors associated with sarcopenia included male gender, low hemoglobin levels, and increased lymphocyte count. For instance, a study published in the Journal of Parenteral and Enteral Nutrition found that the prevalence of sarcopenia in lung cancer patients varies between 35% and 50%, with a higher prevalence observed in males [9]. This may result from a combination of biological factors, lifestyle choices, and disease-related influences. However, it is important to note that the prevalence and risk factors can vary across populations, and further studies are needed to understand the gender-specific mechanisms underlying sarcopenia.

Anemia, as reflected by reduced hemoglobin, compromises oxygen delivery to muscles, further impairing their function [10]. Elevated lymphocyte counts may reflect an underlying inflammatory response, a hallmark of cancer-associated sarcopenia [2]. Interestingly, BMI is a protective factor, higher BMI significantly reduced the risk of sarcopenia. This supports the importance of maintaining or improving nutritional status to mitigate muscle loss. The association between sarcopenia and poor clinical outcomes, such as higher treatment toxicity, reduced treatment tolerance, and increased mortality, is well-documented [5]. The high prevalence of sarcopenia in this study underscores the urgent need for early identification and interventions targeting nutritional and physical rehabilitation to improve patient outcomes. This study emphasizes the importance of integrating sarcopenia assessments, such as HGS and muscle mass measurements, into routine oncology care. Early nutritional support, tailored physical activity programs, and anti-inflammatory strategies may help mitigate sarcopenia's progression and improve the quality of life for lung cancer patients [10].

However, this study has some limitations. Its cross-sectional design prevents causal conclusions, highlighting the need for longitudinal research on sarcopenia in lung cancer patients. The small sample size may limit generalizability. Additionally, the impact of specific treatments and co-morbidities on sarcopenia was not explored. Future studies should address these gaps for better understanding.

CONCLUSION

Sarcopenia is a prevalent and serious condition among lung cancer patients. The study identified key predictors of sarcopenia, including male gender, low hemoglobin levels, and increased lymphocyte count, reinforcing the role of systemic inflammation and anemia in muscle deterioration. Notably, BMI was found to be a protective factor, highlighting the importance of maintaining adequate nutritional status.

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