

ASSOCIATION BETWEEN RISK OF FALL AND RELATED FACTORS IN SARCOPENIA PATIENTS

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ABSTRACT

Objectives: This study aims to evaluate related factors affecting the risk of fall in older sarcopenic patients. **Methods:** A cross-sectional study was conducted in 294 participants aged ≥ 60 years old at National Geriatric Hospital in Hanoi, Vietnam, from July to October 2022. Sarcopenia was defined by the criteria proposed by Asian Working Group for Sarcopenia (AWGS 2019). Risk of fall was assessed through 21-item index. The T-test and Chi-square were used to compare groups. The relationship between sarcopenia and risk of fall was estimated by deriving odd ratios from multiple logistic regression models. **Results:** Mean age 75.68 ± 8.20 , 78.2% female. In multivariate logistic regression, age (adjusted OR=2.907, 95%CI:1.777-4.754), marital status (adjusted OR=2.352, 95%CI:1.390-3979), diabetes (adjusted OR=1994, 95%CI:1225-3246), heart failure (adjusted OR=1.947, 95%CI:1.086-3.493), depression (adjusted OR=2.298, 95%CI:1.005-5.253), hypertension (adjusted OR=1.885, 95%CI:1.166-3.046), ADL (adjusted OR=4.724, 95%CI: 2.867-7.783), IADL (adjusted OR= 8.403, 95%CI:4.689-15.061), sleep quality (adjusted OR=3.027, 95%CI: 1.837-4.987) were significantly associated with high risk of fall in sarcopenic patients defined by AWGS 2019 criteria. **Conclusion:** Patients with sarcopenia have high prevalence of fall and high risk of fall. Fall risk assessment and implementation of fall prevention should be carried out in everyday practice.

Keywords: sarcopenia, risk of fall, sarcopenic patient, AWGS 2019

1. INTRODUCTION

Sarcopenia is classified as a musculoskeletal disorder that characterized by low muscle mass, low muscle strength and low physical performance. In recent years, more and more studies have shown that sarcopenia is associated with multiple adverse health outcomes, including hospitalization multiple trauma, functional decline, poor quality of life [1] particularly higher risk of falls [2]. Falling is the second leading cause of unintentional injury death, after road traffic injuries. The majority of fall-related deaths occur in low- and middle-income countries in the Western Pacific and

Southeast Asia regions. The highest mortality rate in adults over 60 years old [3]. Some studies have been conducted the increased risk of clinical relevant outcomes among sarcopenic older adults compared to non-sarcopenic population such as the recurrent rate of fall, the incidence of falls [4], previous falls, fall-related injuries and also fall related fractures. Sarcopenia is predicting factor for falls in community-dwelling older adults [4]. A study on the prevalence of fall-related injury (2021) show higher among those with sarcopenia than in those without this condition (7.9% vs. 4.3%). In Vietnam, the rate of falls in outpatients is relatively

high, almost 1 out of every 4 outpatients experienced fall and highly concentrated in group ≥ 60 years old typically sarcopenia older patients. In Vietnam, there have not been many research papers on sarcopenia. In 2018, cross-sectional studies was performed on patients aged ≥ 60 years visiting outpatient geriatric clinics in Vietnam, sarcopenia the prevalence of sarcopenia was quite high and varied from 48.3% - 61.1% according to the criteria used [5]. Therefore, this study was conducted on sarcopenia and patterns in older adults to evaluate related factors affecting the risk of falls in older sarcopenic patients.

2. METHOD

2.1. Participants

Patients 60 years old and older were being examined and treated at National Geriatric Hospital.

Recruited criteria

- Patients who were diagnosed with sarcopenia by specialist doctor according to the AWGS criteria [6].
- Patients who had already been diagnosed with and received treatment for sarcopenia before.
- Patients and patient's family agreed to participate in the study (agree to answer questions regarding general health and disease status according to the outline proposed by the research).
- The patients are fully conscious and have the physical and cognitive abilities to do a face-to-face interview.

Exclude criteria

- Patients or families refused to participate in the study.
- Patients who do not have the physical and cognitive abilities to do a face-to-face interview.
- Patients with advanced dementia and terminal illness, acute and malignant diseases (advanced cancers, end-stage

chronic diseases, acute myocardial infarction, acute stroke, symptomatic cardiovascular disease).

2.2. Study design

The study is cross-sectional descriptive study.

Sample size and sampling

The sample size is calculated using the formula: $n = (Z_{1-\frac{\alpha}{2}})^2 \frac{p(1-p)}{d^2}$

n: study sample size;

α : statistical significance level, with $\alpha = 0,05$; $(Z_{1-\frac{\alpha}{2}}) = 1,96$

$p = 0.25$ (Sex differences in impact of sarcopenia on falls in community-dwelling Korean older adults in 2021) [7]

d = expected error ($d = 0.05$).

From the formula, the estimated sample size was 288 sarcopenic patients. The number of sarcopenic patients in our study was 294 patients.

Sampling: convenience sampling

Location and time

Inpatients and outpatients at National Geriatric Hospital excepted for Emergency and Stroke departments, Intensive care unit from July to October 2022.

2.3. Tools and data collection method

Data were collected by using designed tools included: General information, history of fall, Mini Nutrition Assessment (MNA-SF), Instrumental Activities of Daily Livings (IADLs), Activities of Daily Livings (ADLs), 21-item fall risk index. Data were collected by using research questions through interview, diagnosis test, laboratory test and medical record at National Geriatric Hospital.

2.4. Sarcopenia criteria to diagnose

Sarcopenia diagnosis by the standard of the Asian Working Group for Sarcopenia (AWGS) [6].

- Criterion 1: Low muscle mass (kg): Each patient was assessed whole-body skeletal muscle mass by using a Bioelectrical Impedance Analysis (BIA) (InBody 770, Biospace Co., Ltd.). The results show the muscle mass of each body part (kg) standardized to height²: $SMI = ALM (kg)/height^2 (m)$.

- Criterion 2: Low grip strength: The low grip strength is evaluated using JamarTM (Hydraulic Hand Dynamometer J1, USA), 2 trials were performed on both hands, the better of the two trials was used for scoring purposes.

- Criterion 3: Low physical performance is evaluated by 6m walk test, calculated by the patient's time to cover the 6m distance outline.

Based on the AWGS, diagnosis of sarcopenia required the present of low muscle mass plus low muscle strength or/and low physical performance. Sarcopenia can be separated into 2 types:

Mild sarcopenia: decreasing in muscle mass, muscle strength or physical performance.

Severe sarcopenia: decreasing in muscle mass, muscle strength and physical performance.

2.5. Falls

Include 6 questions to identify prevalence of falls in the elderly in the community.

Risk of fall

❖ 21 item fall risk index

Include 21 questions to identify possible risks of falls in the elderly in the community. The answer is one in 2 options: Yes = 1; No = 0;

- Evaluation: < 10 points:
Normal

≥ 10 points:

Risk of fall ⁴⁶

2.6. Data analysis

- The process of data coding, entry and analysis would be done using SPSS software version 22.0
- Descriptive statistics were adopted to examine data characteristic: number, %, mean, median, and minimum, maximum, range. Inferential statistics would be done to compare between groups, using χ^2 , ANOVA (if compare between more than 2 mean groups, use ANOVA and ≥ 2 groups, use χ^2).
- The correlation between lower body strength and its related factors was determined by using crosstabs method for classified variables
- The correlation between handgrip strength and factors was also analyzed by using simple binary regression and multiple binary regressions to see the relative.
- Statistical significance was defined as any p-value is less than 0.05

2.7. Ethical consideration

- The participants were explained clearly about the purposes of the study and they consented to take part in the study.

3. RESULTS

The study was conducted on patients aged 60 years and older who came to the National Geriatric Hospital for examination and treatment from July 2022 to October 2022. A total number of 294 older sarcopenic patients were selected for this study. After completing the data analysis, the demographic and baseline characteristics of the participants were shown below:

Table 1. Patient's demographic (n=294)

Characteristics		Frequency (n)	Percent (%)
Aged group	60 – 69	73	24.8
	70-79	115	39.1
	≥80	106	36.1
	Mean age ±SD	75.68±8.20	
Gender	Male	64	21.8
	Female	230	78.2
Educational level	Below high school	140	47.6
	High school	55	18.7
	Above high school	99	33.7
Occupation	Retirement	160	54.4
	Others	134	45.6
Marital status	Married	215	73.1
	Others	79	26.9
Living with	Family	273	92.9
	Alone	1	0.3
	Caregiver	20	6.8

Demographic details of patients in this study are shown in the table 1. In the total 294 participants, the age of sample ranged from 60 to 97 with the mean age was 75.68 ± 8.20 years old. The greatest distribution was generated by people aged from 70-79 years old, with percentage of 39.1%. In which, female subjects accounted for 78.2%, higher than male subjects accounted for

21.8%. The highest percentage of sarcopenic patients was below high school group, with 47.6% and the lowest was high school group with 18.7%. About half of the participants were retired (54.4%), the percentage of married participants was 73.1% and nearly three times the total percentage of the remaining groups.

Table 2: Geriatric characteristics (n=294)

Characteristics	Classification	Frequency (n)	Percentage (%)
Nutritional status	Malnourished	33	11.2
	Risk of malnutrition	138	46.9
	Normal nutritional status	123	41.8
ADL	Independent	173	58.8
	Dependent	121	41.2
IADL	Independent	207	70.4
	Dependent	87	29.6
Sleep quality	Good sleep	120	40.8
	Poor sleep	174	59.2
Charlson index score (Mean ± SD)		1.80±1.59	

In nutritional status, average core of MNASF was 10.73 ± 2.49 . 46.9% participants were identified as “at risk of malnutrition” and only 11.2% were malnourished. The proportion of normal

nutritional status closely followed the proportion of malnourished patients with 41.8%.

In this study, 41.2% of study subjects were dependent on functional

activity and 58.8% of subjects were completely independent. Dependent in daily activities were also reported in 87 subjects (29.6%) of participants. There was 174 patients (59.2%) suffering from

poor sleep. The mean value of sleep quality was 7.25 ± 5.42 . The total number of comorbidities was calculated according to the Charlson scale with mean value of 1.80 ± 1.59 .

Table 3. Association between demographic and risk of fall (n=294)

		Low risk of fall		High risk of fall		p
		n	%	n	%	
Gender	Male	38	22.6	26	20.6	0.68
	Female	130	77.4	100	79.4	
Age	60-69	57	33.9	16	12.7	<0.001
	70-79	68	40.5	47	37.3	
	≥ 80	43	25.6	63	50.0	
Living area	Urban	95	56.5	74	58.7	0.71
	Rural	73	43.5	52	41.3	
Marital status	Married	135	80.4	80	63.5	0.001
	The other	32	19.6	46	36.5	
Living status	Family	154	91.7	119	94.4	0.36
	The other	14	8.3	7	5.6	
Occupation	Retired	93	55.4	67	53.3	0.71
	The other	75	44.6	59	46.8	
Education	Below high school	77	45.8	63	45.0	0.38
	High school	36	21.4	19	15.1	
	Above high school	55	32.7	44	34.9	
BMI (kg/m ²)	Underweight	18	10.7	25	19.8	0.09
	Normal	94	56.0	62	49.2	
	Overweight + Obesity	56	33.3	39	31.0	
		Mean ± SD		Mean ± SD		
Mean age		73.61±7.7		78.44± 8.08		0.04
Mean BMI		21.75± 2.68		21.08± 2.92		<0.001

The table 3 showed association between demographic and fall risk in elderly. The mean age and mean BMI in the group of patients at high risk of falling was higher than the group with low risk of falling with $p < 0.05$. Age group and marital status were associated with risk of fall in older

sarcopenic patients. The risk of falls increased with age group ($p < 0.05$).

The differences were not statistical significance between gender, living status, living area, education level and body mass index and risk of falls in the older sarcopenic patients ($p > 0.05$).

Table 4: Association between of falls and geriatric characteristics

Factor	Classification	Low risk of fall		High risk of fall		p
		n	%	n	%	
Nutritional status (MNA-	Normal	86	51.2	37	29.4	0.001
	Risk of	65	38.7	73	57.9	

SF)	malnutrition					
	Malnourished	17	10.1	16	12.7	
ADL	Independent	125	74.4	48	38.1	<0.001
	Dependent	43	25.6	78	61.9	
IADL	Normal	148	88.1	59	46.8	<0.001
	Impaired	20	11.9	67	53.2	
Quality of sleep (PSQI)	Good sleep	87	51.8	33	26.2	<0.001
	Poor sleep	81	48.2	93	73.8	

The results showed that patients with impairment in instrumental activities daily living and daily activities had higher of falls than those without impairment in instrumental activities daily living and activities daily living. The differences

were statistically significant ($p < 0.05$).

The MNA-SF scale and PSQI showed that there was a significant association between level of malnutrition, sleep quality and risk of fall ($p < 0.05$).

Table 5: Multivariable regression models on some factors related to risk of fall in older sarcopenic patients.

Factors	High risk of fall			p
	OR	95% confident interval		
		Lower	Upper	
Age (≥80 years old)	2.907	1.777	4.754	0.001
Marital status (Other)	2.352	1.390	3.979	0.001
Diabetes (Yes)	1.994	1.225	3.246	0.005
Heart failure (Yes)	1.947	1.086	3.493	0.024
Depression (Yes)	2.298	1.005	5.253	0.044
Hypertension (Yes)	1.885	1.166	3.046	0.009
Nutrition (Malnourished)	1.292	0.625	2.669	0.488
ADL (Dependent)	4.724	2.867	7.783	<0.0010
IADL (Dependent)	8.403	4.689	15.061	<0.001
Quality of sleep (Poor sleep)	3.027	1.837	4.987	<0.001

The table 5 showed the factors associated with risk of fall in older sarcopenic patients were age increasing (OR=2.907, 95%CI: 1.777-4.754), patients with dependent in activities daily living (OR=4.724, CI95%: 2.867-7.783), dependent in instrumental activities daily living (OR=8.403, CI95%: 4.689-15.061), decreasing in sleep quality (OR =3.027, CI95%:1.837-4.987). Risk of fall also increased in patients suffering from depression, diabetes, heart failure, depression, hypertension. But risk of fall in lower in married group (OR=2.352, CI95%:1.390-3.979).

4. DISCUSSION

The average age of participants in this study was 75.68 years old (SD=8.20). According to Nguyen et al., average age of sarcopenic participants was 72.2 ± 8 . However in the research conducted by Landi et al in 2012 evaluated sarcopenia as a risk of fall in older population, the average age of participants was 86.7 years old (SD=5.4) and the same as sarcopenic group in this study [8]. Another research was conducted in Chinese participants with the age range was 80–99 years in which mean age of sarcopenic group was 87.9 ± 3.7 years old. The reasons can be

explained by the research area was different research subjects or sample size.

The majority of patients in the study were married with rate of 73.1%. This large disparity in percentage was explained by the elderly population and research location of our study. The similar result was found in the research of Nguyen et al. with 75% sarcopenic participants reported married [9]. However, in the research of Landi et al., the group of married participants was diagnosed with sarcopenia only 25% [8]. This difference may be explained by different research location.

The Mini Nutritional Assessment Short Form (MNA-SF) scale was used assess the nutritional status of the patients and normal nutritional status in our study accounted for a high rate. The group of normal nutritional status had 123 people, accounting for 41.8%. The group of risk of malnutrition had 138 people, accounting for 46.9%. Meanwhile, the malnourished group with 33 people, accounting for 11.3%. In Nguyen et al.'s study, the group of malnourished rate was 13.7% [9]. The different sample sizes and time of study were also the reasons for the difference.

With ADL, mainly patients in the dependent group had 121 people, accounting for 41.2%, meanwhile were 173 independent people (58.8%). According to Xu et al.'s research in 2020, the percentage of patients with daily independent activities based on ADLs was 34.5% and dependent was 65.5% [10].

Based on IADLs scale, mainly patients in the normal group had 207 people, accounting for 70.4%, meanwhile there was 29.6% of the people experienced impairment in daily functional activities with one or more items in the instrument activities of daily

living. According to research of Tanimoto et al. in 2012, the percentage of disability for IADL was 33.3% with sarcopenia and normal group accounted for 66.7% [11]. Because sarcopenia is a common condition in older adults that contributes to functional decline, disability, frailty, and falls. It affects to declines in activity and make patients dependent and impaired daily activity.

The significantly association between age and risk of fall in the research of Nguyen Trung Anh in hypertension patients. Aged ≥ 80 was accounted for the highest proportion in high risk of fall group in the research of Nguyen Trung Anh [12]. However, in research of Smith in 2017, there was no association between age increasing and risk of fall in elderly living at home. The difference in result could be from difference of sample size between study and difference subject study.

With ADL of independent group high risk of fall sleep is 38.1%, independent of low risk of fall is 74.4%. With IADLs of normal group having high risk of fall is 46.8%, normal group of low risk of fall is 88.1%. Thus, with $p < 0.001$, we found a correlation between activity of daily living and high risk of fall. In Yamazaki et al. research in 2017 in older adults showed reduced in functional status was associated with a greater risk of falls ($p < 0.01$) [13].

Our results show that the group of older sarcopenic patients with comorbidity including diabetes, heart failure, depression and hypertension increased the risk of falling, 1.994 times with diabetes (95% CI:1.225-3.2466), 1.947 times with heart failure (95% CI:1.086-3.493), 2.298 times with depression (95% CI: 1.005-5.253) and 1.885 times with hypertension (95% CI:1.166-3.046). Therefore, assessing the comorbidities in sarcopenic patients

is necessary. It helps us to come with more effective fall prevention measures. Our results also show that patients with poor sleep quality and dependent in activities of daily living and instrumental activities of daily living increased the risk of falling in sarcopenic older patients. Sarcopenic patients with poor sleep increased 3.027 times higher risk of fall than those with good sleep quality with 95%CI: 1.837-4.987. The risk of falls in patients with dependent in dependent in activities of daily living increased 4.724 times higher risk of fall with 95%CI: 2.867-7.783 and patients with dependent in instrumental activities of daily living increased 8.403 times risk of fall with 95%CI: 4.689-15.061 the risk of fall. Therefore, we should further assess the level of disability in older sarcopenic patients.

5. CONCLUSION

Patients with sarcopenia have high prevalence of fall and high risk of fall. Fall risk assessment and implementation of fall prevention should be carried out in everyday practice.

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