LOWER LIMB STRENGTH AND ASSOCIATED FACTORS AMONG OLDER PATIENTS WITH DEMENTIA

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This cross-sectional study was conducted to assess lower limb strength and related factors among older people with dementia examined and treated at the National Geriatric Hospital. Lower limb strength was assessed using the 30-Second Chair Stand Test. The proportion of participants with impaired lower limb strength was 78.2%. There were significant associations between impaired lower limb strength and diabetic patients. There were significant associations between impaired lower limb strength and geriatric syndromes: malnutrition, high risk of falls, and dependence or partial dependence according to the Barthel Index. There was no significant difference between the type of dementia and the level of dementia with impaired lower limb strength. In conclusion: Three-quarters of older dementia patients have impaired lower limb strength. Our results highlighted that diabetes, and geriatric syndromes such as malnutrition, high fall risk, dependence, and partial dependence were significantly associated with lower limb strength in older patients with dementia.

Keywords: Lower limb strength, older adults, dementia.

I. INTRODUCTION

Dementia is a disorder that is characterized by cognitive decline involving memory and at least one of other domains, including personality, praxis, abstract thinking, language, executive functioning, complex attention, and social and visuospatial skills.[1] It is often a progressive disorder, and individuals often do not have insight into their deficits. Dementia is a significant public health burden and significantly increases the costs of care, both to the individual and society.[2]

Physical function is often characterized by muscle strength, muscle endurance, body composition, and flexibility.[3] However, as older adults become less physically active during the aging process, their physical function is negatively affected.[4] Hence, physical performance measurements are critical tools that identify a decline in physical function and provide the implementation of preventive measures.[5,6]

Several factors play roles in the physical function of the elderly with dementia. Besides non-modifiable factors (genetics, aging, gender), around one-third of all dementia cases are likely to be caused by modifiable risk factors such as comorbidities, and physical inactivity.[7] Although various risks for dementia have been identified, it has not been adequately disseminated and recognized as any of those factors affect physical function among the older with dementia. In addition, lower limb strength has been predicated as a mediating variable influencing optimal cognitive performance.8 Lower limb strength likely enhances the ability to maintain faster walking speeds, which may

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attenuate the rate of dementia and prospective cognitive decline.[9]

The 30-second Chair Stand (30SCT) test is a commonly used method of assessing lower limb strength among older adults in geriatric clinics. In addition, 30CST detects muscle weakness in general, and community-residing older adults.[10] 30SCT performance is a functional task, that is of high relevance for everyday life and is recommended to assess lower limb strength in dementia patients.[11,12] Compared to the Five Times Sit-to-Stand Test, which records the time required to perform five repetitions, the modified 30SCT counts the number of repetitions within 30 seconds and fulfills the criteria of a sequential approach by allowing each participant to be rated independently of the number of sit to stand repetitions. Exploring the limitations and factors that affect lower limb strength among older patients with dementia can develop interventions to promote muscle strength as much as possible. However, data about lower limb strength are lacking regarding the older population with dementia. Thus, this study aimed to assess lower limb strength and some related factors among older people with dementia examined and treated at the National Geriatric Hospital.

II. SUBJECTS AND METHODS

1. Subjects

Older patients aged 60 years and older, were being examined and treated at National Geriatric Hospital.

Inclusion Criteria:

Patients aged 60 years and older were diagnosed with dementia according to DSM-5 criteria by neurologists at National Geriatric Hospital. Patients have a caregiver who either lives with the participant or visits for at least four hours per week.

Exclusion criteria:

(1) Patients have any diagnosis or self-reported acute and malignant diseases (advanced cancers, end-stage chronic diseases, acute myocardial infarction, stroke, symptomatic cardiovascular disease, coronary revascularization within 1 year);

(2) Clinical evidence of schizophrenia, psychiatric or bipolar disorder according to DSM-4 TR criteria);

(3) Alcoholism or substance dependence (according to DSM-5 criteria), currently, or within the past 2 years;

(4) Severe loss of vision, hearing, or communicative ability (according to interRAI Community Health Assessment).

2. Study design

- A cross-sectional descriptive study

- The sample was selected according to the entire sampling method

- Time: July to November 2021

3. Variables

- General information: age, gender, weight, height, body mass index (BMI).

- Comorbidities characteristics, Charlson Comorbidity Index

- Characteristics of dementia: classification of dementia (vascular dementia, Alzheimer's disease, mixed dementia, others) and level of dementia (mild, moderate, severe).

- Lower limb strength: 30-Second Chair Stand Test (30CST)

- Performing: the 30-Second Chair Stand Test is administered using a folding chair without arms, with a seat height of 45cm, and a stopwatch. Participants were asked to sit and stand as many times as possible for 30 seconds. . Evaluation: the number of times the patient comes to a full standing position in 30

seconds as a result. The patient's results are evaluated according to age group (table 1): if the result is below the cut-off point, patients were considered reduced lower limb strength[10]:

Table 1. Low 30 seconds Chair Stand test, adjusted for gender and age

	30-second Chair Stand Test: the number of times the patient comes to a full standing position in 30 seconds	
Age	**Male**	**Female**
60-64	<14	<12
65-69	<12	<11
70-74	<12	<10
75-79	<11	<10
80-84	<10	<9
85-89	<8	<8
90-94	<7	<4

- Characteristics of some geriatric syndromes:

+ Polypharmacy was assessed by asking patients and families/ caregivers, viewing prescriptions, and referring to medical records, the patient was defined as having regular use of at least 5 medications. Nutrition status was evaluated using the Mini Nutritional Assessment - Short Form (MNA-SF). Depression was performed using the Patient Health Questionnaire-9 (PHQ-9). Sleep disturbance was screened by the Pittsburgh Sleep Quality Index (PSQI). The risk of falls was assessed by asking the 21-item fall risk index. The 3 Incontinence Question (3IQ) assesses urinary incontinence. Activities of daily living were assessed using the Barthel index which includes 10 personal activities and Instrumental Activities of Daily Living (IADLs).

4. Tools and data collection method

Data were collected by using a research questionnaire through interviews, diagnosis tests, and medical records at the National Geriatric Hospital.

5. Data processing and data analysis

The process of data coding, entry into REDCap, and analysis was done by using Statistical Package for Social Science (SPSS) software (version 22.0). Descriptive statistics were adopted to examine characteristic data: frequency, percentage, and mean with standard deviation. T-test and Chi-square were performed to evaluate the factors associated with lower limb strength in dementia patients. Statistical significance was accepted at the 95% confidence level ($p < 0.05$).

6. Ethical consideration

Study subjects were explained clearly about the purpose of the study, and they were willing to participate in the study. Collected data was used for research. The results of the study were proposed for improving the health of the community, not for other purposes.

III. RESULTS

1. General characteristics

A total of 87 participants were recruited, female patients accounted for 65.5% (n=57). The male/female ratio was 0.53. The mean age of the patients was 76.8 ± 8.4 years with a minimum of 60 and a maximum of 96. The prevalence of participants aged 60-69, 70-79, and ≥ 80 were 20.7%, 41.4%, and 37.9%, respectively. The mean BMI of the patients was 21.95 ± 2.82 kg/m^2 with a minimum of 13.8 and a maximum of 29.3. The majority of patients (51.7%) had normal BMI.

2. Lower limb strength in older patients with dementia

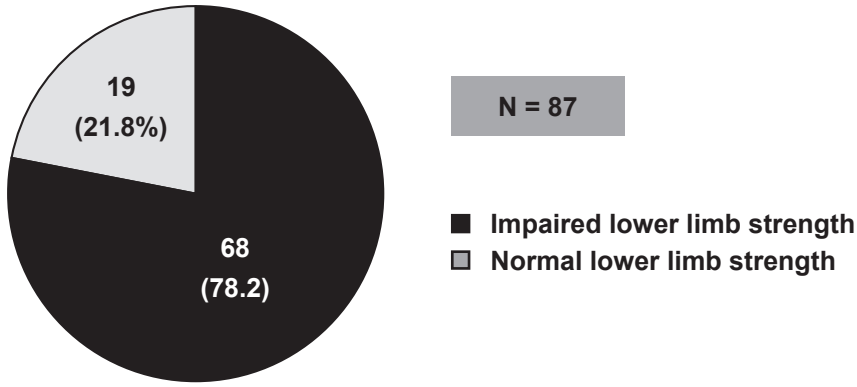

Figure 1. Assessment of lower limb strength using the 30 seconds Chair Stand test

The proportion of participants with impaired lower limb strength by the 30-second Chair Stand test accounted for 78.2%.

3. Some related factors with lower limb strength

Table 2. Association between lower limb strength and general characteristics

Characteristics		Impaired lower limb strength (n=68)		Normal lower limb strength (n=19)		p-value
		n	%	n	%	
Age group	60 – 69	15	21.1	4	21.1	0.598
	70 – 79	29	42.6	6	31.6	
	≥ 80	24	35.3	9	47.4	
Gender	Male	24	35.3	6	31.6	0.763
	Female	44	64.7	13	68.4	
Hypertension	Yes	43	63.2	10	52.6	0.402
	No	25	36.8	9	47.4	
Diabetes	Yes	24	35.3	1	5.3	**0.011**
	No	44	64.7	18	94.7	

Characteristics		Impaired lower limb strength (n=68)		Normal lower limb strength (n=19)		p-value
		n	%	n	%	
Lipid disorder	Yes	14	20.6	5	26.3	0.593
	No	54	79.4	14	73.7	
Stroke	Yes	15	22.1	4	21.1	0.925
	No	53	77.9	15	78.9	
Heart failure	Yes	6	8.8	1	5.3	0.614
	No	62	91.2	18	94.7	
		Mean ± SD				
Age (year)		76.7±8.4		77.4±8.7		0.764
BMI (kg/m^2)		21.87±2.89		22.22±2.6		0.614
Charlson index		3.34±1.44		2.89±1.29		0.205

Data analysis showed that older dementia patients with diabetes had a higher prevalence of impaired lower limb strength than those in patients without diabetes. The differences were statistically significant ($p<0.05$).

Table 3. The association between lower limb strength and characteristics of dementia

Characteristics		Impaired lower limb strength (n=68)		Normal lower limb strength (n=19)		p-value
		n	%	n	%	
Type of dementia	VaD	11	16.2	1	5.3	0.386
	Mixed	14	20.6	4	21.1	
	Alzheimer	34	50	13	68.4	
	Others	9	13.2	1	5.3	
Level of dementia	Mild	23	33.8	8	42.1	0.761
	Moderate	31	45.6	7	36.8	
	Severe	14	20.6	4	21.1	

Data analysis showed that no significant difference between the type of dementia and level of dementia with impaired lower limb strength in older with dementia.

Table 4. The association between lower limb strength and geriatric syndromes

Characteristics		Impaired lower limb strength (n=68)		Normal lower limb strength (n=19)		p-value
		n	%	n	%	
Polypharmacy	Yes	36	52.9	8	42.1	0.404
	No	32	47.1	11	57.9	
Depression	Yes	57	83.3	16	84.2	0.968
	No	11	16.2	3	15.8	
Malnutrition	Yes	16	23.5	0	0	0.019
	No	52	76.5	19	100	
Sleep disturbance	Yes	59	86.8	14	73.7	0.17
	No	9	13.2	5	26.3	
Fall risk	High	54	79.4	10	52.6	**0.019**
	Low	14	20.6	9	47.4	
Urinary incontinence	Yes	27	39.7	5	26.3	0.285
	No	41	60.3	14	73.7	
Barthel	Dependence	9	13.2	0	0	**< 0.001**
	Partially dependence	31	45.6	1	5.3	
	Independence	28	41.2	18	94.7	
IADL	Dependence	66	97.1	19	100	0.449
	Independence	2	2.9	0	0	

The table showed that there was a significant in statistics between impaired lower limb strength in older patients with dementia and malnutrition ($p < 0.05$). Older dementia patients with high fall risk had a significantly higher prevalence of impaired lower limb strength than those in patients with lower fall risk. The differences were statistically significant ($p < 0.05$). In the Barthel index, there was a statistically significant difference between lower limb strength decline and dependence status. The proportion of participants with dependence, and partial dependence in the group with impaired lower limb strength was significantly higher than those in the group with normal lower limb strength ($p < 0.05$).

IV. DISCUSSION

Our results highlighted the high prevalence of impaired lower limb strength and its associated factors among older patients with dementia at the National Geriatric Hospital.

The total number of standing was classified follow to gender and age group, in which, the

greatest distribution was generated by reduced 30s sit-to-stand accounted for 78.2%. t Nineteen individuals (21.8%) got normal 30 seconds Chair Stand Test. The study about the effect of a sit-to-stand activity on mobility outcomes among Canadian Continuing Care residents with and without dementia also showed that patients completing the sit-to-stand activity with high intensity were less likely to lose repetitions in the mobility test compared to those completing the activity with low intensity.[13] There have not been many studies in the world and Vietnam specifically evaluating lower limb strength in elderly people with dementia using the 30CST test. Previous study showed a positive association between elevated lower extremity muscular strength and cognitive functioning.[14]

Results showed no significant difference between impaired lower limb strength with gender. There was no significant between impaired lower limb strength and mean age, and mean BMI ($p > 0.05$). However, another study found that chair–stand performance decreased significantly across age groups in decades from the 60s to the 70s to the 80s and was significantly lower for low-activate participants than for high-active participants.[10] This difference may be due to differences between study populations and sample sizes. Studies with larger and more representative numbers of people with dementia should be performed to evaluate the relationship between age, gender, and lower limb strength.

Our study showed that older dementia patients with diabetes had more impaired lower limb strength than those in patients without diabetes. The differences were statistically significant. Peripheral neuropathy and diabetic foot complications can reduce lower limb muscle strength. Other comorbidities such as hypertension, lipid disorder, stroke, heart failure, and Charlson index, were not significantly associated with impaired lower limb strength of the elderly with dementia. Another view, association with 30CST is influenced by body functions (such as cardiovascular and neural systems) beyond skeletal muscle.

The results showed that older dementia patients with malnutrition had more impaired lower limb strength than those in patients without malnutrition ($p < 0.05$). Differences between impaired lower limb strength and fall risk were clear. The older dementia patients with high fall risk had a higher prevalence of impaired lower limb strength than those in patients with lower fall risk. The differences were statistically significant ($p < 0.05$). The relationship between fall risk and various physiological and cognitive factors such as spatial orientation, reaction time, and lower limb strength is of great importance in understanding the mechanisms that increase the risk of falls in patients with dementia. Weak muscles in the lower limbs reduce the ability to respond effectively to sudden changes in balance and increase the risk of falls.[6,15]

Patients who more depend on activity daily raised the incidence of impaired lower limb strength in elderly dementia patients. The proportion of participants who had impaired lower limb strength in group dependence, partial dependence, and independence were 13.2%, 45.6%, and 41.2%, respectively. The differences were statistically significant ($p < 0.05$). Another study also indicated that a decreased ability to rise from a chair can limit independence.[16] Data analysis also showed no significant difference between polypharmacy, depression, sleep disorder, urinary incontinence, IADL, and low 30CST in older people with dementia ($p > 0.05$).

Data analysis showed no significant difference between the type of dementia, level of dementia, and duration of memory

impairment with impaired lower limb strength in older patients with dementia ($p > 0.05$).

This study may be the first published study on lower limb strength in older people with dementia in Vietnam and provides initial data for subsequent intervention studies. However, this study has some limitations. This was a cross-sectional study, and the sample size was not large enough so it could not be representative of the general population of older people with dementia. The association between lower limb strength decline and other factors needs to be considered with caution. Future studies with larger sample sizes and longitudinal follow-up studies need to be done to understand these issues.

V. CONCLUSIONS

Three-quarters of older dementia patients have impaired lower limb strength. Our results highlighted that diabetes, and geriatric syndromes such as malnutrition, high fall risk, dependence, and partial dependence were significantly associated with lower limb strength in older patients with dementia.

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