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Brief Report

Sarcopenia as a Risk Factor for Cognitive Deterioration in Community-Dwelling Older Adults: A 1-Year Prospective Study

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A B S T R A C T

Objective: The purpose of this 1-year prospective study was to determine whether sarcopenia is an independent risk factor of cognitive deterioration in community-dwelling older adults.
Study Design: One-year prospective study.
Setting: Japanese community.
Participants: A total of 131 community-dwelling older adults aged 65 years and older participated in this study.
Measurements: We defined sarcopenia using the diagnostic algorithm recommended by the Asian Working Group for Sarcopenia, and the participants were classified into the sarcopenia and normal groups according to this definition. The participants' cognitive functions were assessed using the Mini-Mental State Examination (MMSE) during pre- and postdata collection (after 1 year).
Results: The rate of change in pre- and post-MMSE scores during the follow-up term was significantly different between the 2 groups (normal group, −0.32 ± 8.39%; sarcopenia group, −5.86 ± 5.16%; $P = .002$). The analysis of covariance, adjusted for demographic data and the pre-MMSE scores, showed a significant change in the MMSE scores between the normal and sarcopenia group ($F = 9.30$, $P = .003$). Furthermore, in the multivariate logistic regression analysis, the cognitive function was significantly more likely to deteriorate (defined as a loss of at least 2 points of MMSE) in the sarcopenia group during the follow-up term (odds ratio: 7.86, 95% confidence interval: 1.53–40.5).
Conclusions: Sarcopenia was identified as an independent risk factor of cognitive deterioration in community-dwelling older adults during the 1-year study period.

Cognitive decline is almost universal in the general elderly population and increases with age. A systematic review of studies in the general elderly population showed a mean annual decline of cognitive functions, with the Mini-Mental State Examination (MMSE) scores ranging between −0.1 and −1.3 points per year.[1] Cognitive impairment is associated with disability[2]; therefore, approaches for preventing cognitive decline are urgently needed. Sarcopenia is the age-dependent loss of skeletal muscle mass.[3] In 2014, the Asian Working Group for Sarcopenia recommended assessing muscle function and muscle mass for the diagnosis of sarcopenia,[4] and a previous epidemiologic study showed that sarcopenia is highly prevalent and a serious problem in older adults.[5] In our previous study, we found both cognitive impairment and sarcopenia to be associated with frailty.[6] Therefore, prevention of sarcopenia is important for addressing age-related healthcare issues.

Recent studies surveyed the association between sarcopenia and cognitive impairment.[7–11] Among these, 2 studies showed a significant association between sarcopenia and cognitive impairment,[9,10]

The authors declare no conflicts of interest.

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whereas others did not.[7,8,11] Furthermore, as the sole longitudinal study to date showed no significant association,[11] the causal relationship remains unclear. In our previous study, sarcopenia was found to be associated with frailty at an earlier stage compared with cognitive impairment[6] and was depicted as a possible causal factor for cognitive decline. However, because this study was a cross-sectional study, the longitudinal association between sarcopenia and cognitive decline was unclear. Therefore, the purpose of this 1-year prospective study was to determine whether sarcopenia is an independent risk factor of cognitive deterioration in community-dwelling older adults.

Methods

Participants

Participants were recruited to this study using the local press; 210 Japanese healthy volunteers aged 65 years and older responded. Data collection was performed in September 2014 (predata collection) and September 2015 (postdata collection). We included community-dwelling older adults who were independent in daily activities. Exclusion criteria included severe cardiac, pulmonary, musculoskeletal disorders, or neurologic disorders, or participation in Japan's long-term care service. As 79 participants did not complete the follow-up survey after 1 year, this prospective cohort study finally analyzed data from 131 older adults (mean age: 74.2 ± 5.3 years). Each participant's age, body mass index (BMI), sex, educational background, and family structure were recorded as demographic data during the predata collection. Written informed consent was obtained from each participant in accordance with the guidelines approved by the Kyoto University Graduate School of Medicine and the Declaration of Human Rights, Helsinki, 1975. The ethics committee of the Kyoto University Graduate School and Faculty of Medicine approved this study protocol.

Definition of Sarcopenia

We defined sarcopenia using the diagnostic algorithm recommended by the Asian Working Group for Sarcopenia, which assesses the presence of both low muscle function (low physical performance or low muscle strength) and low muscle mass.[4] A bioelectrical impedance data acquisition system (Inbody 430; Biospace Co, Ltd, Seoul, Korea) was used to determine bioelectrical impedance. This system uses electrical current at different frequencies (5, 50, and 250 kHz) to directly measure the amount of extracellular and intracellular water in the body. Participants stood on 2 metallic electrodes and held metallic grip electrodes. Using segmental body composition and muscle mass, a value for the appendicular skeletal muscle mass was determined and used for further analysis. Skeletal muscle mass index was calculated by dividing the muscle mass by height in squared meters (kg/m^2). If a participant had both low muscle function (slow walking speed, ≤0.8 m/s; low grip strength for men and women, <26 kg and <18 kg, respectively) and low skeletal muscle mass index (low muscle mass for men and women, <7.0 kg/m^2 and <5.7 kg/m^2, respectively), they were diagnosed with sarcopenia.[4]

Measurement of Cognitive Function

The participants' cognitive function was assessed using the MMSE,[12] which is a standard test in cognitive aging research to assess mental status. The MMSE is a short screening test that consists of the following 5 areas for detecting cognitive impairment: orientation, registration, attention and calculation, memory, and language. It contains 11 questions with a maximum possible score of 30; higher scores indicating better cognitive performance. The MMSE was assessed at both pre- and postdata collection (after 1 year).

Statistical Analysis

Prior to the analysis, we classified participants into 2 groups, sarcopenia and normal, based on the description of sarcopenia. Differences in the demographic variables, and the pre- and post-MMSE scores between the 2 groups were analyzed using the unpaired *t*-test and χ^2 test. Furthermore, we statistically analyzed the differences in the rate of change of pre- and post-MMSE scores between the 2 groups by using the Mann Whitney U-test. The rate of change of pre- and post-MMSE scores was calculated using the following equation: (post-MMSE − pre-MMSE)/pre-MMSE × 100. Moreover, a repeated measures 2-way analyses of covariance (ANCOVA) adjusted for age, sex, BMI, educational background, family structure, and the pre-MMSE scores was used to analyze whether the degree of cognitive decline determined according to the pre-and post-MMSE scores differed significantly between the groups. In addition, we also classified participants into 2 groups according to their cognitive deterioration during the 1-year study period. A loss of at least 2 MMSE points between pre- and postdata collection was determined as meeting the criteria of cognitive deterioration as it was previously established that reliable changes in the MMSE scores for short intervals correspond to a loss of at least 2 points.[13] In order to determine whether sarcopenia was associated with cognitive deterioration during the follow-up term, multivariate logistic regression analysis adjusted for age, sex, BMI, educational background, family structure, and the pre-MMSE scores was performed. For this analysis, the presence or absence of cognitive deterioration was used as a dependent variable, whereas the presence or absence of sarcopenia was used as an independent variable. Data was quantified using odds ratios with 95% confidence intervals. The threshold for statistical significance was set at $P < .05$. All statistical analyses were performed using SPSS Statistics for Mac OS, v 22.0 (IBM Corporation, Armonk, NY).

Results

Demographic data concerning the participants in both groups are shown in Table 1. There were 121 participants (92.4%) in the normal group and 10 participants (7.6%) in the sarcopenia group. Although no significant differences in sex, educational background, and family structure were identified, significant differences in age ($P = .028$) and BMI ($P = .003$) were observed. In addition, the sarcopenia group had significantly lower pre-MMSE scores (normal group: 27.3 ± 2.3,

Table 1
Baseline Characteristics and Post-MMSE Scores of the Participants With and Without Sarcopenia

	All (n = 131)		
	Normal Group (n = 121)	Sarcopenia Group (n = 10)	*P* Value
Age, (y)	73.9 ± 4.7	77.3 ± 4.7	.028*
Female, n (%)	76 (62.8%)	6 (66.7%)	1.000
BMI, (kg/m^2)	22.9 ± 2.8	20.2 ± 2.3	.003†
Educational background			.849
Less than 9 years, n (%)	46 (38.0%)	5 (50.0%)	
10–12 years, n (%)	50 (41.3%)	3 (30.0%)	
More than 12 years, n (%)	24 (19.8%)	2 (20.0%)	
Family structure			.765
Single, n (%)	20 (16.5%)	1 (10.0%)	
Elderly household, n (%)	65 (53.7%)	5 (50.0%)	
Other, n (%)	37 (30.6%)	4 (40.0%)	
Pre-MMSE scores	27.3 ± 2.3	25.4 ± 1.65	.012*
Post-MMSE scores	27.2 ± 2.2	23.9 ± 1.9	<.001†

Sarcopenia was identified using the diagnostic algorithm recommended by the Asian Working Group for Sarcopenia.
*$P < .05$.
†$P < .01$.