Nutrition 66 (2019) 44–47

Contents lists available at ScienceDirect

Nutrition

journal homepage: www.nutritionjrnl.com

Applied nutritional investigation

Prestroke sarcopenia and functional outcomes in elderly patients who have had an acute stroke: A prospective cohort study

Masafumi Nozoe Ph.D. [a,*], Masashi Kanai P.T., Ph.D. [b], Hiroki Kubo P.T., M.Sc. [b], Miho Yamamoto M.D., Ph.D. [b], Shinichi Shimada M.D., Ph.D. [c], Kyoshi Mase P.T., Ph.D. [a]

[a] Department of Physical Therapy, Faculty of Nursing and Rehabilitation, Konan Women's University, Kobe, Japan
[b] Department of Rehabilitation, Itami Kousei Neurosurgical Hospital, Kobe, Japan
[c] Department of Neurosurgery, Itami Kousei Neurosurgical Hospital, Kobe, Japan

ARTICLE INFO

Article History:
Received 20 November 2018
Received in revised form 4 April 2019
Accepted 8 April 2019

Keywords:
Aging
Elderly
Sarcopenia
Stroke
SARC-F

ABSTRACT

Objectives: The association between prestroke sarcopenia and functional outcomes in patients who have had a stroke has not, to our knowledge, been evaluated to date. We aimed to investigate the prevalence of prestroke sarcopenia, and determine whether prestroke sarcopenia is associated with functional outcomes in elderly patients who have suffered an acute stroke.

Methods: We assessed prestroke sarcopenia in elderly patients with acute stroke using the SARC-F questionnaire. Patients were divided into two groups according to their SARC-F score: non-sarcopenia (SARC-F score <4) and prestroke sarcopenia (SARC-F score ≥ 4). The study endpoint was the modified Rankin Scale score at 3 mo after the stroke (0–3, good outcome; 4–6, poor outcome). The Mann-Whitney U-test, Pearson χ^2 test, Fisher exact test, and logistic regression were used in the statistical analyses.

Results: Of the 152 patients (81 men; median age [interquartile range]: 76 [11] y) enrolled, the prevalence rate of prestroke sarcopenia was 18% (27 patients). These 27 patients showed poor functional outcome at 3 mo after the stroke (50% versus 12%, prestroke sarcopenia versus nonsarcopenia; $P < 0.001$). After adjusting for variables, prestroke sarcopenia was an independent predictor of poor functional outcome at 3 mo after stroke (odds ratios: 7.39, 95% confidence interval: 1.47–37.21, $P = 0.02$).

Conclusions: Prestroke sarcopenia is an independent predictor of functional outcome at 3 mo after a stroke. Our findings highlight the importance of detecting prestroke sarcopenia in elderly patients with acute stroke.

Introduction

Sarcopenia is a predictor of poor outcome in elderly populations with cardiovascular disease because of its possible effect on the capacity of mobility and incidence of cardiovascular disease [1,2]. However, the association between prestroke sarcopenia and functional outcomes in patients who have suffered a stroke has not been evaluated to date.

Patients with chronic strokes have shown higher rates of sarcopenia compared with healthy individuals [3,4], and the prevalence of sarcopenia after a stroke is associated with poor functional outcomes [5,6]. The measurement of physical function (e.g., grip strength or gait speed) is crucial to determine the prevalence of stroke, and the evaluation is based preferably on the guidelines from the European Working Group on Sarcopenia in Older People or Asian Working Group for Sarcopenia [7,8]. However, acute stroke often suddenly leads to physical disability, loss of consciousness, or cognitive disorder and also causes difficulty in performing physical function. Thus, sarcopenia after a stroke makes distinguishing between prestroke and poststroke sarcopenia difficult.

SARC-F is a useful screening tool to detect sarcopenia in elderly patients and eliminates the need for a functional measurement [9–12]. We hypothesized that the detection of prestroke sarcopenia in patients with acute strokes in whom measuring physical function is difficult might also be useful.

The purpose of this study was to investigate the prevalence of prestroke sarcopenia and determine its association with functional outcomes in elderly patients with acute stroke.

Sources of support: This study was supported by the JSPS KAKENHI (grant number 17 K13106).

* Corresponding author. Tel.: +81-78-413-3584; fax: +81-78-413-3007.
E-mail address: Masafumi.nozoe@gmail.com (M. Nozoe).

https://doi.org/10.1016/j.nut.2019.04.011
0899-9007/

Methods

Subjects

This observational cohort study enrolled elderly patients who suffered a stroke within 48 h of stroke symptom onset in Itami Kousei Neurosurgical Hospital between August 2017 and June 2018. The inclusion criteria were age ≥65 y and evidence of cerebral infarction or intracerebral hemorrhage on computed tomography or magnetic resonance imaging scans. The exclusion criteria were prestroke functional limitation (modified Rankin Scale [mRS] score ≥4); subarachnoid hemorrhage; major concurrent illness (including chronic obstructive pulmonary disease, renal failure, and active malignancy); and inability to answer questionnaires because of impaired consciousness, severe cognitive dysfunction, or language disorders such as aphasia. This study was approved by Research Ethical Committee of the Konan Women's University, and informed consent was obtained from all patients.

Data processing

Patient characteristics, including age, sex, and body mass index (BMI), and clinical details at the time of presentation (National Institutes of Health Stroke Scale [NIHSS] score, stroke type, side of stroke, comorbidities, and mRS score) were obtained from electronic medical records. The NIHSS is a valid, reliable, and reproducible scale to assess neurologic severity and is widely used in the clinical setting for acute stroke [13]. Within 3 d of admission, patients were asked to complete the SARC-F questionnaire, which was originally adapted for use in Japanese and has five components: strength, assistance in walking, rising from a chair, climbing stairs, and falls [8]. SARC-F scores range from 0 to 10, with 0 to 2 points for each component (0 = best; 10 = worst). Patients with a total score ≥4 were classified as having a risk of sarcopenia [8]. SARC-F has been shown to have good test–retest reliability [11] and high specificity (0.90–0.94), but low sensitivity (0.14–0.20) to classify sarcopenia in older adults [14].

Clinical outcomes

The main outcome was mRS score, which was assessed 3 mo after the stroke from medical records or applied telephonically. The secondary outcomes were mRS score at the time of discharge and length of hospital stay.

Statistical analysis

The results are presented as medians (interquartile range). Categorical variables are expressed as numbers and percentages. Patients were divided according to their SARC-F score. The nonsarcopenia group comprised patients with SARC-F score <4, and the prestroke sarcopenia group comprised patients with SARC-F score ≥4 [8]. The Mann-Whitney U-test, Pearson χ^2 test, and Fisher exact test were used to compare patients' baseline characteristics and clinical outcomes between the groups, as appropriate.

We derived the unadjusted and adjusted odds ratios of prestroke sarcopenia and unfavorable functional outcomes (mRS score 4–6) using logistic regression. Odds ratios were adjusted for variables that were significantly different between the two groups. All statistical analyses were performed with SPSS version 20.0 (SPSS, Inc.). Differences with $P < 0.05$ were considered significant.

Results

A total of 240 elderly patients with stroke were hospitalized during the study period. Seventy-seven patients were excluded because of admission 48 h after the onset of stroke symptoms (n = 1), prestroke functional limitation (mRS score ≥4; n = 12), major concurrent illnesses (n = 2), altered consciousness(n = 19), language disorder (n = 12), and cognitive dysfunction (n = 31). Subsequently, three patients refused to participate and eight patients did not provide informed consent. Thus, 152 patients were included in the study.

Among the 152 patients enrolled, 81 were men and the median age (interquartile range) was 76 (11) years. The prevalence rate of prestroke sarcopenia was 18% (27 patients; Table 1), and patients with a prolonged length of hospital stay showed poor functional outcomes at the time of discharge (prestroke sarcopenia group: 56% versus nonsarcopenia group: 19%; $P < 0.001$). Compared with the nonsarcopenia group, patients in the prestroke sarcopenia group were older ($P < 0.001$), predominantly female ($P = 0.01$), and had higher NIHSS scores ($P = 0.007$), higher rates of previous stroke ($P = 0.04$), and lower rates of hypercholesterolemia ($P = 0.03$).

At 3 mo after the stroke, another eight patients were lost to follow up; thus, data from 144 patients were included in the final analysis. The rate of poor functional outcome was significantly higher in the prestroke sarcopenia group than the nonsarcopenia group (50% versus 12%; $P < 0.001$). The unadjusted odds ratio of the prestroke sarcopenia group and 3-mo unfavorable functional outcome after acute stroke was 7.43 (95% confidence interval, 2.87–19.21; $P < 0.001$). After adjusting for age, sex, previous stroke, hypercholesterolemia, and NIHSS score at the time of admission, prestroke sarcopenia was still significantly associated with an unfavorable outcome, with an odds ratio of 7.39 (95% confidence interval, 1.47–37.21; $P = 0.02$; Table 2).

Discussion

Our study investigated the prevalence of prestroke sarcopenia and its association with functional outcomes in patients who suffered an acute stroke. We found that prestroke sarcopenia is prevalent in 18% of elderly patients with an acute stroke and is an independent predictor of poor outcome.

The prevalence of sarcopenia in Japan, as determined using the algorithm suggested by the European Working Group on Sarcopenia in Older People, is 21.8% and 22.1% in men and women, respectively [15]. Sarcopenia has also been diagnosed during hospital admission in 34.7% of patients using bioelectrical impedance analysis [16]. The difference in the prevalence rate between our study and that previously reported may be due to the low sensitivity of diagnostic tools for the classification of sarcopenia [14]. Thus, our patients may have had severe sarcopenia.

In the present study, patients with prestroke sarcopenia showed a longer hospital stay, higher rates of poor outcome and previous stroke, and female predominance compared with those without sarcopenia. Compared with individuals who have not had a stroke, stroke survivors showed an increased prevalence of sarcopenia when considering age, sex, and race [3], which was similar to our findings. Generally, female patients showed poorer outcomes than men because of older age, severe stroke severity, and prestroke dependency [17]. We hypothesize that sarcopenia is also a factor for worse outcome in female patients with a stroke.

Lower BMI is also a predictor of poor functional outcome because BMI may represent the pathophysiology of malnutrition or sarcopenia [18]; however, our patients with SARC-F score ≥4 did not have a lower BMI. Hence, SARC-F score ≥4 is more important than BMI to predict poor outcomes from sarcopenia.

This study has several limitations. First, we measured functional outcome at 3 mo after a stroke, but not the long-term outcome at ≥1 y after onset. Second, we defined an mRS score of ≥4 as poor functional outcome, but an mRS score ≥3 is generally used. However, we only included elderly patients and many with a recurrent stroke (34%), and these patients often have mild disability. Therefore, our definition of poor functional outcome is valid. Third, these patients with recurrent strokes may have higher SARC-F scores because of neurologic dysfunction and not only for sarcopenia. Hence, prestroke sarcopenia was significantly associated with an unfavorable outcome, even after adjusting for the presence of a recurrent stroke. Fourth, the SARC-F questionnaire has a low sensitivity [14]. Fifth, we recruited only patients with the cognitive capacity to answer the questionnaire. Measuring muscle mass on admission with more valid methods, such as bioelectrical impedance analysis, is useful to detect prestroke sarcopenia in all patients, including those with cognitive issues. Therefore, the generalizability of our results may be limited.

Table 1
Characteristics of patients with acute stroke according to SARC-F score

Characteristics	Total cohort (N = 152)	Prestroke sarcopenia cohort (n = 27)	Nonsarcopenia cohort (n = 125)	*P*-value
Age (y)	76 (11)	85 (8)	74 (11)	< 0.001[a]
Sex (male/female)	81/71	8/19	73/52	0.01[b]
Body mass index (kg /m^2)	22 (14)	21 (5)	23 (4)	0.09[a]
NIHSS score	2 (3)	4 (6)	2 (3)	0.007[a]
Stroke type (infarct/hemorrhage)	123/29	24/3	99/26	0.29[b]
Comorbidity (%)				
Hypertension	70 (46)	14 (52)	56 (45)	0.53[b]
Diabetes	39 (26)	8 (30)	31 (25)	0.63[b]
Previous stroke	52 (34)	14 (52)	38 (30)	0.04[b]
Hypercholesterolemia	44 (29)	3 (11)	41 (33)	0.03[b]
Ischemic heart disease	17 (11)	3 (11)	14 (11)	0.99[c]
Atrial fibrillation	15 (10)	2 (7)	13 (10)	0.99[c]
Side of lesion (right/left/both)	73/75/4	11/16/0	62/59/4	0.38[c]
mRS on admission (%)				
0	3 (3)	0 (0)	3 (2)	0.002[c]
1	33 (22)	0 (0)	33 (26)	
2	19 (12)	2 (7)	17 (14)	
3	22 (14)	2 (7)	20 (16)	
4	56 (37)	16 (60)	40 (32)	
5	19 (12)	7 (26)	12 (10)	
mRS ≥4 at discharge (%)	39 (26)	15 (56)	24 (19)	< 0.001[b]
Length of hospital stay (d)	15 (15)	23 (19)	14 (13)	< 0.001[a]
SARC-F				
Strength				< 0.001[c]
None (0)	100 (66)	2 (7)	98 (78)	
Some (1)	16 (10)	1 (4)	15 (12)	
A lot or unable (2)	36 (24)	24 (89)	12 (10)	
Assistance in walking				< 0.001[c]
None (0)	133 (88)	9 (33)	124 (99)	
Some (1)	17 (11)	16 (59)	1 (1)	
A lot, use aids, or unable (2)	2 (1)	2 (8)	0 (0)	
Rise from a chair				< 0.001[c]
None (0)	133 (87)	14 (52)	119 (95)	
Some (1)	17 (11)	11 (41)	6 (5)	
A lot or unable without help (2)	2 (2)	2 (7)	0 (0)	
Climb stairs				< 0.001[c]
None (0)	88 (58)	1 (4)	87 (70)	
Some (1)	42 (28)	9 (33)	33 (26)	
A lot or unable (2)	22 (14)	17 (63)	5 (4)	
Falls				< 0.001[c]
None (0)	116 (76)	10 (37)	106 (85)	
1 to 3 falls (1)	25 (17)	9 (33)	16 (13)	
≥4 falls (2)	11 (7)	8 (30)	3 (2)	

[a]Mann-Whitney U-test.
[b]Pearson χ^2 test.
[c]Fisher's exact test.
mRS, modified Rankin scale; NIHSS, National Institute of Health stroke scale.

Table 2
Logistic regression analyses for functional outcome at 3 mo after stroke

	Unadjusted		Adjusted	
Independent variable	Odds ratio (95% CI)	*P*-value	Odds ratio (95% CI)	*P*-value
Age	1.09 (1.03-1.16)	0.005	0.94 (0.86-1.03)	0.20
Sex	0.74 (0.32-1.72)	0.49	0.41 (0.10-1.72)	0.22
Previous stroke	2.52 (1.08-5.92)	0.03	3.68 (0.98-13.76)	0.053
Hypercholesterolaemia	0.85 (0.33-2.21)	0.75	0.25 (0.05-1.13)	0.07
NIHSS	1.60 (1.35-1.91)	< 0.001	1.68 (1.36-2.08)	< 0.001
Prestroke sarcopenia	7.43 (2.87-19.21)	< 0.001	7.39 (1.47-37.21)	0.02

CI, confidence interval; NIHSS, National Institute of Health stroke scale.

Conclusions

Prestroke sarcopenia is an independent predictor of functional outcomes at 3 mo after stroke onset. Our findings highlight the importance of detecting prestroke sarcopenia in elderly patients with acute stroke.

References

[1] Srikanthan P, Horwich TB, Tseng CH. Relation of muscle mass and fat mass to cardiovascular disease mortality. Am J Cardiol 2016;117:1355–60.

[2] Atkins JL, Whincup PH, Morris RW, Lennon LT, Papacosta O, Wannamethee SG. Sarcopenic obesity and risk of cardiovascular disease and mortality: A population-based cohort study of older men. J Am Geriatr Soc 2014;62:253–60.

[3] Ryan AS, Ivey FM, Serra MC, Hartstein J, Hafer-Macko CE. Sarcopenia and physical function in middle-aged and older stroke survivors. Arch Phys Med Rehabil 2017;98:495–9.

[4] Scherbakov N, Sandek A, Doehner W. Stroke-related sarcopenia: Specific characteristics. J Am Med Dir Assoc 2015;16:272–6.

[5] Yoshimura Y, Wakabayashi H, Bise T, Tanoue M. Prevalence of sarcopenia and its association with activities of daily living and dysphagia in convalescent rehabilitation ward inpatients. Clin Nutr 2018;37:2022–8.

[6] Yoshimura Y, Wakabayashi H, Bise T, Nagano F, Shimazu S, Shiraishi A, et al. Sarcopenia is associated with worse recovery of physical function and dysphagia and a lower rate of home discharge in Japanese hospitalized adults undergoing convalescent rehabilitation. Nutrition 2018;61:111–8.

[7] Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: Revised European consensus on definition and diagnosis. Age Ageing 2019;48:16–31.

[8] Chen LK, Liu LK, Woo J, Assantachai P, Auyeung TW, Bahyah KS, et al. Sarcopenia in Asia: Consensus report of the Asian Working Group for Sarcopenia. J Am Med Dir Assoc 2014;15:95–101.

[9] Tanaka S, Kamiya K, Hamazaki N, Matsuzawa R, Nozaki K, Maekawa E, et al. Utility of SARC-F for assessing physical function in elderly patients with cardiovascular disease. J Am Med Dir Assoc 2017;18:176–81.

[10] Malmstrom TK, Morley JE. SARC-F. A simple questionnaire to rapidly diagnose sarcopenia. J Am Med Dir Assoc 2013;14:531–2.

[11] Woo J, Leung J, Morley JE. Validating the SARC-F: A suitable community screening tool for sarcopenia? J Am Med Dir Assoc 2014;15:630–4.

[12] Ida S, Murata K, Nakadachi D, Ishihara Y, Imataka K, Uchida A, et al. Development of a Japanese version of the SARC-F for diabetic patients: An examination of reliability and validity. Aging Clin Exp Res 2017;29:935–42.

[13] Sato S, Toyoda K, Uehara T, Toratani N, Yokota C, Moriwaki H, et al. Baseline NIH Stroke Scale Score predicting outcome in anterior and posterior circulation strokes. Neurology 2008;70:2371–7.

[14] Ida S, Kaneko R, Murata K. SARC-F for screening of sarcopenia among older adults: A meta-analysis of screening test accuracy. J Am Med Dir Assoc 2018;19:685–9.

[15] Yamada M, Nishiguchi S, Fukutani N, Tanigawa T, Yukutake T, Kayama H, et al. Prevalence of sarcopenia in community-dwelling Japanese older adults. J Am Med Dir Assoc 2013;14:911–5.

[16] Martone AM, Bianchi L, Abete P, Bellelli G, Bo M, Cherubini A, et al. The incidence of sarcopenia among hospitalized older patients: Results from the Glisten study. J Cachexia Sarcopenia Muscle 2017;8:907–14.

[17] Phan HT, Blizzard CL, Reeves MJ, Thrift AG, Cadilhac DA, Sturm J, et al. Factors contributing to sex differences in functional outcomes and participation after stroke. Neurology 2018;90:e1945–53.

[18] Kawase S, Kowa H, Suto Y, Fukuda H, Kusumi M, Nakayasu H, et al. Association between body mass index and outcome in Japanese ischemic stroke patients. Geriatr Gerontol Int 2017;17:369–74.