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Original article

Prevalence of stroke-related sarcopenia and its association with poor oral status in post-acute stroke patients: Implications for oral sarcopenia

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SUMMARY

Background & aims: The aim of the study was to investigate the prevalence of stroke-related sarcopenia and its association with poor oral status in post-acute stroke patients.
Methods: This cross-sectional study included 202 consecutive stroke patients who were admitted to convalescent rehabilitation wards in Japan. The Revised Oral Assessment Guide (ROAG) was used to assess oral status. Sarcopenia was defined as a loss of skeletal muscle mass index (SMI) with bioelectrical impedance and decreased muscle strength as measured by handgrip strength; cut-off values were adopted from the Asian Working Group for Sarcopenia. Univariate and multivariate analyses were applied to examine the associations between oral status, SMI, and HG.
Results: Study participants included 107 males and 95 females with a mean age of 72 ± 12 years. According to the ROAG, 82.2% of participants had slight to severe oral problems (median score: 11 [9–14]). The prevalence of stroke-related sarcopenia was 53.5%. Both SMI (mean: 6.1 ± 1.3) and handgrip strength (median: 15 [7–25]) were significantly lower in the group with oral problems (SMI = 5.8 ± 1.2, handgrip strength = 12 [6–20]) compared to individuals without oral problems (SMI = 7.4 ± .8, handgrip strength = 27 [23–34]) ($p < .001$). The ROAG score was independently associated with SMI and handgrip strength, after adjusting for sex, age, stroke severity, activities of daily living, cognitive level, nutritional status, comorbidities, and time from stroke onset.
Conclusions: Poor oral status was associated with sarcopenia, reduced muscle mass and strength in post-acute stroke patients. Poor oral status and stroke-related sarcopenia were very common among the patients in this study, suggesting that healthcare providers should monitor for oral sarcopenia in post-acute stroke patients.

1. Introduction

Poor oral status is common and associated with malnutrition, dysphagia, and reduced activities of daily living (ADL) in older people. The prevalence of poor oral status is reported to be 71% among patients in rehabilitation care [1] and 91% among individuals in an acute-care hospital [2]. This is significant because poor oral status may lead to malnutrition [3–8] and dysphagia [7–9] in older people. Furthermore, poor oral status has been associated with worse rehabilitation outcomes in older hospitalized patients [10]. Therefore, managing oral status in older adults is becoming an important public health issue.

Sarcopenia is associated with malnutrition, physical dysfunction, and dysphagia. Secondary sarcopenia includes malnutrition caused by nutrition-related sarcopenia [11]. Approximately 50% of older people in post-acute care and rehabilitation settings experience sarcopenia [12]. Sarcopenia can cause sarcopenic dysphagia due to loss of generalized muscle mass and strength, as well as deterioration in those muscles directly related to swallowing [13]. As such, treatment for sarcopenia is very important in rehabilitation wards, because sarcopenia is common and one of the major causes of disability among older patients.

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Malnutrition and dysphagia are common in post-acute stroke patients. After a stroke, malnutrition occurs in 8.2–49.0% of patients and dysphagia occurs in 24.3–52.6% of patients [14]. These conditions may impact overall recovery, and a study found that overweight stroke patients had better rehabilitation outcomes than underweight stroke patients [13]. Stroke rehabilitation is important, because stroke is a major cause of disability among patients in developed countries. However, few articles have reported on stroke-related sarcopenia [15–17]. Furthermore, the association between poor oral status and sarcopenia in post-acute stroke patients remains unclear. Therefore, we investigated the sarcopenia prevalence and its association with poor oral status in post-acute stroke patients.

2. Materials and methods

2.1. Participants

The present study examined data from 235 consecutive stroke patients admitted to convalescent rehabilitation wards in Kumamoto Rehabilitation Hospital between June 2014 and August 2015. Of these patients, those with missing data, disturbances of consciousness, and pacemaker implantations were excluded. In Japan, treatment in a convalescent rehabilitation ward is covered by national health insurance and includes multidisciplinary post-acute rehabilitation programs [18]. The hospital was located in a city with a population of about 750,000, and 30% of these residents were over 65 years old. More so, the hospital was a local base rehabilitation hospital with three convalescent rehabilitation wards, each consisting of 45 beds.

Basic information regarding study participant characteristics were recorded on admission, including age, sex, stroke type, body mass index (BMI), nutritional status (the Mini Nutritional Assessment-Short Form [MNA-SF]) [19,20], comorbidity severity (the Charlson's Comorbidity Index [CCI]) [21], premorbid ADL (the modified Rankin scale [mRS]) [22], time from stroke onset, stroke severity score (the National Institute of Health Stroke Scale [NIHSS]) [23], and stroke history. Within three days of admission, we assessed skeletal muscle mass by using bioelectrical impedance analysis (BIA), physical and cognitive function using the Functional Independence Measure (FIM) [24], and handgrip strength. Trained nurses evaluated BMI, and trained physical and occupational therapists assessed BIA, handgrip strength, and FIM. We measured handgrip strength by the hand-grip test using the Smedley hand-dynamometer (TTM, Tokyo, Japan) in the non-dominant hand (or in case of hemiparesis, in the non-paralyzed hand), with the patient in a standing or seated position, depending on ability and with arms straight at their side; the higher value from two measurements was recorded.

2.2. Oral status assessment

Our study evaluated oral status using the Revised Oral Assessment Guide (ROAG), a standardized tool for the assessment of oral health and function [1,25,26]. The Oral Assessment Guide (OAG) for use among patients undergoing bone marrow transplantation and who were receiving radiation therapy and/or chemotherapy [27] was revised for use with older people. The reliability and validity of the ROAG has been reported [25,26]. The ROAG includes eight categories: voice, lips, mucous membranes, tongue, gums, teeth/dentures, saliva, and swallowing. Each category is described and rated from normal (scored as 1) to severe oral problems (scored as 3). The sum of each score from the numerical and descriptive ratings results in a total score range of 8–24. We classified a score of 8 as “normal oral status”, scores of 9–12 as “slight to moderate oral problems”, and scores of 13–24 as “severe oral problems” [1,25,26]. In this study, two experienced dental hygienists performed the oral assessments using the ROAG on the day of admission.

2.3. Sarcopenia definition

Sarcopenia was defined as low skeletal muscle mass index (SMI) with BIA and decreased muscle strength (handgrip strength) [11] using cut-off values specific to the Asian older people [28]. A multi-frequency validated BIA instrument (InBody S10; InBody, Tokyo, Japan) was used for the patients in the present study, many of whom were unable to stand independently. The body composition was measured with patients in the supine position. The measurements were performed by four experienced physical therapists in the evening 1 h before dinner, with rest of more than 1 h after rehabilitation and with correction of dehydration caused by exercise, when applicable. The SMI was calculated as the measured skeletal muscle mass divided by the squared body height in meters. Fat mass index was calculated as the measured fat mass divided by the squared body height in meters. The cut-off values of SMI in men and women were <7.0 kg/m^2 and <5.7 kg/m^2, respectively. The cut-off values of handgrip strength in men and women were <26 kg and <18 kg, respectively [28].

2.4. Sample size calculation

Sample size was calculated using data from a pilot study of 50 consecutive patients collected during the first three months of the study. The results showed that the SMI of the patients admitted to our hospital was normally distributed with a standard deviation of 1.25 kg/m^2. If the true difference in means between those with and without oral problems was .5 kg/m^2, the sample size needed to consist of at least 99 participants in each group to reject the null hypothesis with a power of .8 and an alpha error of .05. Therefore, in the present study, we collected data for over one year to obtain at least 99 participants in each group.

2.5. Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics (version 21, Armonk, New York). Continuous variables were reported as the mean (standard deviation; SD) for parametric data or medians (25th, 75th percentiles; IQR) for non-parametric data. The *t*-test, chi-squared test, and the Mann–Whitney *U* test were used to examine between group differences with or without oral problems. Multiple linear regression analysis was used to examine which variables were independently associated with SMI and HG. Covariates selected to adjust for bias were age, sex, ROAG, MNA-SF, CCI, premorbid mRS, time from stroke onset, FIM-M, FIM-C, and NIHSS. Values of $p < .05$ were used to determine statistical significance.

2.6. Ethics

We conducted the study in accordance with the Declaration of Helsinki and the study was approved by the ethics committee of Kumamoto Rehabilitation Hospital. We supplied information regarding the study to all patients and patients were informed that withdrawal from the study is always possible.

3. Results

The present study included 202 patients (mean age: 72.2 years; 107 men and 95 women). Patients with missing data (n = 20), disturbances of consciousness (n = 11), and pacemaker implantations (n = 2) were excluded. Stroke types included lacunar infarction (n = 41, 20.3%), atherothrombotic brain infarction (n = 41, 20.3%),

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