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Feature Article

Calf circumference is associated with dysphagia in acute-care inpatients

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ABSTRACT

The aim of the study was to determine the association between decreased muscle mass and dysphagia in older acute-care patients. A cross-sectional study was performed on 103 patients aged ≥ 65 years who were consecutively admitted to acute-care wards. Muscle mass and strength were evaluated by assessing calf circumference (CC) and handgrip strength, respectively. Dysphagia and swallowing difficulty were assessed using the Dysphagia Severity Scale (DSS). Univariate and multivariate analyses were used to determine whether CC was associated with dysphagia. There were 58 women and 45 men (mean age, 80 ± 8 years) with a mean CC of 28.2 ± 4.4 cm, and a mean HG of 11.8 kg. Dysphagia was observed in eight patients (8%). Based on the multivariate analysis, CC was independently associated with DSS after adjusting for possible confounders. Future studies to evaluate dysphagia in acute-care older patients with low skeletal muscle mass (i.e., sarcopenia) are required.

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Introduction

Dysphagia is prevalent with aging. Older hospitalized patients are postulated to be at high risk of dysphagia. Therefore, dysphagia management is regarded as an important current and future public health issue in geriatric medicine because of the increased risk of malnutrition and clinical complications, such as aspiration pneumonia, choking, dehydration, and mortality. The prevalence of dysphagia in primary care patients, community-dwelling individuals, and nursing home residents has been reported to be 22.6%,¹ 11.4–38%,^{2–4} and 40–68%,^{5–7} respectively. However, research studies regarding swallowing problems among patients in acute-care hospitals are currently limited. Although dysphagia is primarily caused by either stroke or head and neck disease, dysphagia without such diseases can occur commonly in frail and sarcopenic older adults in clinical practice.

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Sarcopenia is a condition characterized by the loss of skeletal muscle mass and function. Sarcopenia has been reported to be associated with declining physical function and increased risk of fall-related injury and fractures,⁸ and the loss of skeletal muscle mass has been associated with a 1-year survival rate of 60%.⁹ In recent studies, it has been suggested that a decline in skeletal muscle mass and/or strength might be associated with dysphagia.^{10–12} Sarcopenic dysphagia has been characterized by the loss of swallowing muscle mass and function associated with generalized loss of skeletal muscle and function.^{11–14} Conversely, dysphagia can also lead to sarcopenia due to malnutrition. In addition, it was reported that swallowing muscle mass is associated with tongue strength,^{15–17} tongue thickness, and mid-arm muscle area.¹⁸

Sarcopenia is associated with dysphagia; however, literature regarding the association between calf circumference (CC) and dysphagia in older acute-care patients is limited. CC is routinely used in patients to screen for malnutrition upon admission to acute-care hospitals. Confirming an association of CC with dysphagia might promote simultaneous assessments of dysphagia and nutrition in patients, which can be useful in acute-care clinical practice. Furthermore, it can lead to improved clinical management of dysphagia in older adults. Therefore, we hypothesized that CC is associated with dysphagia in older patients in acute-care settings in this study.

Materials and methods

Participants

Consecutive patients aged ≥ 65 years who were admitted to the acute-care wards at Kagoshima Medical Association Hospital, Kagoshima, Japan, from March to June 2015 participated in this cross-sectional study. Kagoshima has a population of about 605,000 people with 23.4% of this population aged >65 years old. The hospital is a locally based hospital with 166 beds for acute care. The mean number of admissions and age of the patients is 299 per month and 65 years, respectively. The inclusion criterion for this study was dysphagia without an underlying disease condition. The exclusion criteria was a prior history of stroke and dementia, including Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, or head and neck carcinoma. Patients with a prior history of stroke and dementia, including Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, or head and neck carcinoma, were excluded, because these diseases may directly impair swallowing and cause dysphagia. Patients with edema in the lower limbs were also excluded.

Basic information was collected regarding participant characteristics, including age, sex, body mass index (BMI), reason for admission (e.g., internal medicine, emergency surgery, and elective surgery), activities of daily living (ADL), nutritional status, and handgrip strength (HG). ADL was evaluated by the Barthel Index (BI) that is often used as an indicator of ADL in acute-care clinical practice and consists of an ordinal assessment (0–100 points) where lower scores represent lower physical function. Trained registered dietitians conducted interviews upon admission and discharge to evaluate nutritional status using the Mini Nutritional Assessment-Short Form (MNA-SF).^{19–21} HG under the cut-off values of 18 kg (women) and 26 kg (men), as described by EWG-SOP,²² were classified as low handgrip strength.

Muscle mass assessment

CC, a surrogate marker of skeletal muscle mass, was assessed by anthropometric measurement. To measure CC, the patients' dominant foot was measured by trained nurses within 3 days of admission. Participants were asked to sit with their knee at an angle of 90° and their soles placed flat on the ground. The thickest part of the calf was measured with a measuring tape. CC values under the cut-off values of 33 cm (women) and 34 cm (men), as described by Kawakami et al.²³ for the Japanese elderly individuals, were classified as low muscle mass.

Swallowing assessment

Swallowing status was evaluated using the Dysphagia Severity Scale (DSS),²⁴ (Table 1). The severity was graded as follows: 7, normal; 6, minimal problem; 5, oral problem; 4, chance aspiration; 3, water aspiration; 2, food aspiration; 1, saliva aspiration. Each item was scored from 1 to 7. A DSS score of ≥ 4 was clinically regarded as abnormal and indicated the presence of swallowing difficulty (i.e., dysphagia with aspiration). The interclass reliability and validity of the DSS have been previously established.^{24,25} The DSS was assessed through elaborative interviews by trained nurses with the patient, observing the patients during eating, and by administering various bedside tests for dysphagia, such as water or food swallowing tests, pulse oximetry, or cervical auscultation. Cervical auscultation is not considered a valid or reliable assessment; however, it can be helpful when used in conjunction with multiple other measurements.

Table 1
Dysphagia severity scale.

Classification	Definition
7 normal	No clinical problem
6 minimal problem	There are some mild problems including subjective problems
5 oral problem	There is no aspiration, but there is a problem in eating due to oral stage disorder
4 chance aspiration	Sometimes aspirate, Or pharyngeal remission is remarkable and suspected to be aspiration
3 water aspiration	Although moisture is aspirated, devised food is not aspirated
2 food aspiration	Aspiration of everything can be swallowed, but respiratory conditions are stable
1 saliva aspiration	All aspirated, including saliva, bad respiratory condition. Or swallowing reflex is not caused at all and respiratory condition is poor

Statistical analyses

Sample size was calculated using data from our previous study.²⁶ According to the current study data, the CC score of older patients admitted to the hospital was normally distributed with a standard deviation of 4.5. If the true difference in means between participants with and without dysphagia was 5.0, we would need a sample size of at least 14 participants in each group to reject the null hypothesis with a power of 0.8 and an α -error of 0.005.

IBM SPSS Version 23 (Armonk, NY: IBM Corp) statistical software was used to perform all statistical analyses for this study. Parametric data were expressed as the mean \pm standard deviation, and nonparametric data were reported as the median and 25–75 percentiles (interquartile range). The chi-square test, Mann-Whitney U test, and *t*-test were used to analyze the between-group differences for patient groups with or without dysphagia and with or without low muscle mass or strength. A multivariate logistic regression analysis was used to determine whether muscle mass upon admission was independently associated with dysphagia. Covariates selected to adjust for bias were sex, age, HG, CC, BI, BMI, and MNA-SF scores. P-values <0.05 were considered statistically significant.

Ethics

The current study was performed according to the ethical recommendations outlined in the Declaration of Helsinki. The ethics committee of the Kagoshima Medical Association Hospital approved this study, and informed consent was obtained from patients or their legal guardians.

Results

Data from 103 patients with a mean age of 80 ± 8 years who participated in this study were analyzed. The patients were admitted to internal medicine (52 patients, 50%), elective surgery (37 patients, 36%), and emergency surgery (14 patients, 14%). The hemodynamic status and general condition of the study patients were relatively stable, and intensive care was not required for all participants. The mean CC was 28.2 ± 4.4 cm (men, 30 cm; women, 27 cm) and the mean HG was 11.8 kg (men, 15.6 kg; women, 8.9 kg). Low muscle mass and strength were found in 96 (93.2%) and 90 (87.4%) patients, respectively. The median DSS was 7 (6–7) and dysphagia, as assessed by the DSS, was observed in 8 patients (8%).

The characteristics of the participants and the between-group difference of those with or without dysphagia, as assessed by the DSS, is shown in Table 2. Patients with dysphagia had significantly

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