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Self Reported Dysphagia is not Associated with Sarcopenia Defined by the Revised EWGSOP2 Criteria and Regional Thresholds at the Hospital Among Ambulatory Older Patients

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ABSTRACT

Introduction: Dysphagia and sarcopenia are geriatric syndromes, and they are shown to be related. There is no study on dysphagia and sarcopenia with the revised European Working Group on Sarcopenia in Older People (EWGSOP)2 criteria. **Aim:** We aimed to evaluate dysphagia and sarcopenia with the revised criteria implementing regional thresholds for skeletal muscle mass (SMM) in hospitalized older patients. **Methods:** Ambulatory patients ⩾60 years of age from the Internal Medicine Department of our hospital were taken into the study. Grip strength, SMM via bioelectrical impedance analysis, nutritional status, dysphagia screening with Eating Assessment Tool-10, prior hospitalizations and diet were evaluated. Sarcopenia was defined by EWGSOP2 criteria using regional SMM thresholds adjusted to body mass index (BMI) (SMMI (BMI)). **Results:** Out of 112, 61 patients were enrolled. Sarcopenia, nutritional risk, and dysphagia were shown in 36.1%, 88.5%, and 14.8% of the patients. The risk of dysphagia was not associated with sarcopenia (p=0.263). Hospitalizations (⩾1) in one year with pneumonia, modified diet, malnutrition, and low SMMI (BMI) were more common in patients with dysphagia risk than in the patients without (p=0.001, p<0.01, p=0.011, p=0.008, respectively). The median age and BMI were higher where SMMI (BMI) was lower in the group with dysphagia risk than in the group without (p=0.016, p=0.034, p=0.032), respectively. **Conclusion:** We found that self-reported dysphagia was not associated with sarcopenia defined by the EWGSOP2 criteria in ambulatory hospitalized patients over 60 years of age. Further studies using revised criteria, different adjustments and thresholds are needed to reveal possible differences.

Keywords: Self Reported Dysphagia, Sarcopenia, Revised EWGSOP2 Criteria.

1. INTRODUCTION

Dysphagia is a substantial problem for older patients (1, 2). Oropharyngeal dysphagia (OD) is inclined to show higher prevalences in patients with functional declines, higher comorbidity and frailty, and it is associated with poor outcomes (3-5). Despite the high prevalence; awareness on OD, screening and proper management is inadequate in the clinical setting (3). There are several methods to be used in the presence of suspicion for dysphagia in the elderly. However, implementing further studies in the older patients with low functional status and multiple comorbidities might not always be feasible and safe. So, bedside screening methods may be used to define dysphagia in the elderly, to reveal the individuals with swallowing disorder and/or at risk of OD, rather than missing out the pathology (2), Among those screening methods Eating Assessment Tool (EAT-10) is a self-reported questionnaire (2, 6).

Since "sarcopenia" was described initially as an age-dependent decline in muscle mass, numerous research groups published various consensus papers worldwide for sarcopenia to

date (7, 8). Recently, extended group of European Working Group on Sarcopenia in Older People (EWGSOP) has proposed a new consensus on sarcopenia in 2018 (EWGSOP2) and defined sarcopenia as a muscle disease occurring because of changes in the muscle across a lifetime (9).

Various pathologies such as aging and neurological diseases can cause OD. Swallowing action is a complex event that involves many phases. Some of the causes for impaired efficacy of swallow in the elderly with dysphagia are; lower oropharyngeal sensitivity, prolonged duration of swallow, delayed hyoid movement and impaired bolus propulsion primarily because of sarcopenia (3, 10-12). The possibility of a swallowing disorder may increase concerning the deteriorations in muscles used in swallowing action. The association of dysphagia and sarcopenia is a very hot topic (13). Studies on the relationship between dysphagia and sarcopenia have been conducted using different definitions of sarcopenia, but mainly with EWGSOP 2010 criteria. By the implementation of the new EWGSOP2 criteria, the prevalence of sarcopenia and the relation with dysphagia might differentiate. Besides, the use of regional thresholds and the method used for the adjustment of muscle mass might also have an impact.

2. AIM

So, we aimed to evaluate dysphagia and sarcopenia with the revised criteria, and also the associations between them in hospitalized older patients. To the best of our knowledge, our study is the first in the literature about the association of dysphagia with sarcopenia using the new EWGSOP2 criteria in older patients.

3. METHODS

The patients over 60 years of age from the Department of Internal Medicine of our hospital were taken into the study. Those patients admitted to the department in two weeks were enrolled. Inclusion criteria were; ambulatory patients who can feed per orally with water, juicy food or normal food, and adequate cognitive ability. The patient was excluded if the patient was with enteral tube feeding or tracheostomy tube, and, nil per os by physician order. Out of 112 patients, 12 of them rejected to complete dysphagia assessment and nutritional assessment, and 21 patients could not maintain the evaluations for one or more parameters essential for sarcopenia diagnosis, so they were excluded. After excluding the patients who were not eligible, 61 patients were enrolled. The number of hospitalizations and hospitalizations because of pneumonia in the past year, the type of the meal at the hospital (normal, diet, thickener use, oral supplements, juicy food), and the other parameters were noted.

The screening of dysphagia was performed using EAT-10 questionnaire, a valid self-assessment instrument commonly used to measure the risk of dysphagia. The EAT-10 involves ten queries which score from zero (no problem) to four (high level of problem) with a point ⩾3 indicating the swallowing problems. Each item describes a specific risk condition such as "Swallowing liquids necessitates additional striving" (6, 14). The EAT-10 is reliable and validated in adult Turkish patients (15). The presence of malnutrition and risk of malnutrition was determined by Mini Nutritional Assessment Short Form (MNA-SF). Tanita SC-330 was used for the analysis of skeletal muscle mass (SMM). The measures were executed with fasting of overnight and with light clothes after urination in a standardized protocol for our department. Total SMM was calculated from fat-free mass (FFM) using a validated formulation (SMM (kg) = 0.566 × FFM) (16). The cutpoints for low muscle mass have been defined in a previous study for Turkish population (17, 18). Those thresholds are for whole-body SMM measurements. The SMM adjusted to body mass index (BMI) was presented as SMMI (BMI) in this study, and the thresholds were 1.049 kg/BMI/0.823 kg/BMI for men and women. Cutpoints of SMMI (height) were 9.2/7.4 (kg/m2) for men and women, respectively (17, 18). We used grip strength measurement for low muscle strength in this study. Grip strength was measured by Takei T.K.K. 5401 digital dynamometer (Takei Scientific Instruments Co. Ltd, Tokyo, Japan) using a standardized protocol. Three trials with the dominant hand at one-minute intervals were performed. The patients were standing, arms extended 30° to the trunk. The mean of the three performances was taken for each case and recorded. The thresholds for low muscle strength are values below 27 for men and 16 for women in EWGSOP2 (9). According to EWGSOP2 consensus; sarcopenia is determined by the use of both low muscle strength and quantity or quality (9). In this study, sarcopenia was diagnosed by low muscle strength and muscle mass according to EWGSOP2 criteria using regional thresholds of SMM adjusted to BMI

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Statistical analysis

Normality was tested by Shapiro–Wilk test. Numerical variables were analysed by Mann Whitney-U, and categorical variables were analysed with Chi-square. Data were noted as ± standard deviations and medians (interquartile ranges) or as percentages where available. A P value less than 0.05 was deemed as significant. The Statistical Package for Social Sciences (SPSS/Windows version 25.0, SPSS Inc., Chicago, IL, USA) was used for the analyses.

4. RESULTS

Total population consisted of 61 (⩾60 years of age) patients. As the patients were taken from an Internal Medicine Department, the patients showed a wide range of comorbidities. Other than diabetes mellitus and hypertension, 24.6% of the patients had renal diseases, 18% had collagen diseases, 26.2% were with hematological problems. The patients with Parkinson disease, dementia, coronary artery disease, thyroidal, urological, and other problems constituted a minor group, so, those were not mentioned. Out of all, 24.6% of the patients were on modified food, 52.5% of them were hospitalized at least two or more times in last year, and the ratio of hospitalization with pneumonia one or more times in one year was 18%. Patients with BMI <18.5, between and ⩾30 were 3.5%, 61.4% and 35.1% of the study group, respectively. Dysphagia with EAT-10 and undernutrition (malnutrition or malnutrition risk) were present in 14.8%, and 88.5 of the patients. Patients found to have low grip strength and low SMMI (BMI) were 79.7%, and 40% of the total group (78%/83.3% and 48.6%/22.2% for females/

males, respectively). Sarcopenia was identified in 36.1 of the patients implemented with SMMI (BMI). Height squared adjustment was also performed for SMMI. However, we could identify no patient as having low muscle mass with regional SMMI (height) thresholds in both sexes among our group of inpatients. So, there was no sarcopenic patient with regional SMMI (height) thresholds. The features of the participants are shown in Table 1.

Parameters	Female (*n* = 43, 70.5%)	Male (*n* = 18, 29.5%)	Total (*n* = 61)
Age (year)[a]	70.65 ± 9.08	67.72 ± 8.16	69.78 ± 8.86 (60-90)
Diabetes mellitus (n, %)	20 (46.5)	12 (66.7)	32 (52.5)
Hypertension (n, %)	12 (27.9)	1 (5.6)	13 (21.3)
BMI (kg/m^2)[a]	27.91 ± 6.97	26.81 ± 6.43	27.57 ± 6.77 (17.2 -46.3)
FFM (kg)[a]	42.88 ± 7.31	58.29 ± 10.24	47.92 ± 11.04 (33.6-86.5)
SMM (kg)[a]	24.27 ± 4.13	32.99 ± 5.79	27.12 ± 6.25 (19.02-48.96)
SMM/BMI (kg/BMI)[a]	0.903 ± 0.19	1.27 ± 0.24	1.02 ± 0.27 (0.66-1.63)
SMM/height (kg/m^2)[a]	9.93 ± 1.61	11.21 ± 1.70	10.35 ± 1.73 (7.91-15.80)
Hand grip strength (kg)[a]	12.34 ± 4.68	22.52 ± 9.08	15.45 ± 7.85 (4.50-41)
MNA-SF score[a]	8.39 ± 2.38	7.94 ± 2.66	8.26 ± 2.45 (3-12)
EAT-10 score[a]	1.41 ± 3.95	0.44 ± 1.04	1.13 ± 3.38 (0-24)
Sarcopenia (n, %)	18 (41.9)	4 (22.2)	22 (36.1)

Table 1. Characteristics of the patients. BMI body mass index, FFM fat free mass, SMM skeletal muscle mass, MNA-SF Mini Nutritional Assessment-Short Form, EAT-10 Eating Assessment Tool-10, SMMI skeletal muscle mass index. aValues are given as mean ± standard deviations (plus minimum- maximum values for the total polulation).

The patients with dysphagia risk and no risk were similar in terms of the presence of sarcopenia (55.6% vs. 32.7%, p=0.263). One or more hospitalizations in one year because of pneumonia, modified diet, malnutrition (MNA-SF<8), and the presence of low SMMI (BMI) were more common in patients with dysphagia risk than the individuals with no dysphagia risk (66.7% vs. 9.6%, p=0.001; 77.8% vs. 15.4%, p<0.01; 77.8% vs. 26.9%, p=0.011, 100% vs. 34%, p=0.008, respectively). The median age and BMI were significantly higher (80 (11) vs. 63 (14), p=0.016; 30.7 (3.6) vs. 25.5 (8.7), p=0.034), and median SMMI (BMI), and MNA-SF score were lower (0.735 (0.16) vs. 0.982 (0.49), p=0.032; 6 (3) vs. 8 (3), p=0.008) in the group with dysphagia risk than the group without dysphagia risk. No significant difference was shown among the patients with dysphagia risk and no risk with respect to gender, presence of DM, HT, and other diseases, malnutrition and undernutrition (MNA-SF<12), hospitalizations in one year, median and low grip strength, SMM (height), and SMM values (data not shown).

5. DISCUSSION

Self-reported dysphagia in older inpatients was not associated with the presence of sarcopenia identified by EWGSOP2 criteria in this study.

Both dysphagia and sarcopenia are common in older individuals. Sarcopenia prevalence varied widely from 7.5% to 77.6% according to the setting, age, sex, ethnicity, the sarcopenia criteria used in a recent systematic review examining various definitions including the EWGSOP criteria (19). In a recent study, the prevalence of sarcopenia was 7.4% with EWGSOP2 criteria, 18.1% in inpatients in another study, and 8.1% among Japanese community-dwelling older adults with height adjusted muscle mass values (20-22). Those studies comprised of height adjusted muscle mass measurements. Sarcopenia prevalence was found to be 36.1% in our study among older patients at the hospital. In this study, we used regional thresholds of muscle mass adjusted to BMI. Though there are several methods for adjustment of muscle mass, it has been reported that the adjustments might be performed if there is data for the related population in EWGSOP2 consensus (9). As we have used regional thresholds and BMI adjustments, those factors might have resulted in an elevated prevalence of sarcopenia in our study. In a previous study, the associations of diverse bioimpedance calculations of muscle mass with functional measurements recruited from the geriatric outpatient clinic reporting that BMI adjusted SMM for low muscle mass outperformed in relation to functionality and disability (23). However, there is no study investigating the prevalence of sarcopenia implementing the muscle mass adjusted to BMI, and also the regional thresholds among inpatients. Besides, we were not able to locate studies evaluating the impact of different adjustments in relation with body size on the prevalence of sarcopenia in the same study, so far. Further studies on the prevalence of sarcopenia using various adjustments and thresholds with the revised criteria are needed to reveal the possible differences.

The prevalence of OD in the elderly varies according to the setting, comorbidities, and the methods; varying from 27% in the community and 47.5% in an acute geriatric unit up to 91% in inpatients with community-acquired pneumonia (24-27). By the implementation of EAT-10 to older outpatients, 57.2% of men and 66.6% of women were at risk for dysphagia in a recent study from Turkey (4). Dysphagia was present in 14.8% of the participants via EAT-10, in this study. The lower OD prevalence in our study might have occurred because of the inclusion criteria which include ambulatory patients and who are able to feed per orally with adequate cognitive ability. Sarcopenia defined by low SMMI and grip strength at the hospital, physical frailty, frailty, advancing age, history of clinical disease, loss of SMM, and handgrip strength have been found to be associated with dysphagia among older individuals in several settings (1, 4, 28-32). Besides, tongue pressure was related to grip strength and gait speed in males, and head lifting strength was related to dysphagia and poor nutritional status among older patients where EAT-10 was associated with nutritional status at long term care (33-35). Likewise, dysphagia risk by EAT-10 was higher in patients with malnutrition, low SMMI, in the older ages, hospitalizations with pneumonia in the past year, and prescription of modified diet, but not

in the participants with low grip strength, and the presence of diseases and hospitalizations in one year, in this study. Dysphagia risk was higher in the patients with higher BMI in our study. Median BMI of both groups with and without dysphagia risk were 30.7 and 25.5, respectively. Due to the inclusion criteria, the study group comprised of patients mainly with BMIs 18.5 kg/m2 to 29.9 kg/m2 where patients with BMI <18.5 constituted only 3.5% of the population in our study group. So, the small number of study sample, and the features of the patients might have led to those results.

Since 2005, the studies on the relationship of sarcopenia and dysphagia have accumulated in the literature (12, 28, 29, 36, 37). In a retrospective study from Japan evaluating sarcopenia and functional consequences at the hospital on patients ongoing rehabilitation; sarcopenia was related to dysphagia and deteriorated improvement of physical function (37). Sarcopenia was found to be related with an increased dysphagia risk in community-dwelling older persons (38). Finally, in the systematic review published in 2018, it was reported that whole-body sarcopenia and dysphagia are significantly associated (ORs, 4.06; 95% CI, 2.27-7.29) (39). Though, the question of which one is the cause remains, it may be suggested that the dysphagia screening-assessment should be performed in patients with frailty and sarcopenia (40). We could not show an association among dysphagia risk evaluated by EAT-10 and sarcopenia defined by EWGSOP2 criteria and regional thresholds for SMMI (BMI). Though the patients with dysphagia risk were more sarcopenic than the patients with no dysphagia and sarcopenia, the difference was not significant. There are several factors which might affect our result. First of all, the limited number of the study population may have caused the negative result. In addition, the use of new EWGSOP2 criteria for sarcopenia is novel on studies investigating the association of dysphagia and sarcopenia. Likewise, as aforementioned, adjustment of SMM by BMI, and the use of regional SMMI (BMI) thresholds for defining sarcopenia also might have altered the results, and this is the first study concerning those methods and the relation of dysphagia with sarcopenia. Regarding the implementation of EAT-10 to screen dysphagia; EAT-10 is simple, fast, and can be applied by most of the health professionals, and an increased score of EAT-10 may indicate a self-perception of severe dysphagia (15). In a recent study comparing noninvasive swallow tests to videofluoroscopic methods; though none of the swallowing measures were shown to be different regarding safety, several variables such as age, EAT-10, and 3-oz water swallow challenge trended to distinguish efficiency of swallows (41). So, further studies are needed regarding the association of dysphagia with sarcopenia defined by EWGSOP2 criteria.

One of the limitations is that we used regional thresholds reported by Bahat et al adjusted to BMI, as we were not able to define low SMM values in the patients with height adjustment and regional thresholds. Besides, the muscle mass values were absolute, not appendicular. The thresholds suggested by Bahat et al were absolute muscle mass values, so we used those data. Additionally, absolute muscle mass thresholds are not available for EWGSOP2 consensus. The limited number of patients enrolled in our study should also be taken into consideration while evaluating the results. On the other hand, some of those limitations are also strengths of this study such as the use of the regional Turkish data and BMI adjustment for sarcopenia prevalence at the hospital which are novel.

6. CONCLUSION

Dysphagia and sarcopenia are substantial geriatric syndromes leading to poor outcomes. Though we could not show an association between dysphagia risk and sarcopenia with the new revised EWGSOP2 criteria using regional SMMI thresholds; further studies in larger samples with the revised criteria and also with different adjustments and thresholds are needed to reveal possible varying results.

- **Compliance with ethical standards:** All of the processes carried out in our study were compatible with the standards of Faculty of Medicine-Ege University Review Board of Clinical Research Ethics Committee.
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- **Author contributions:** Both authors made contributions to the study concept and design. Materials were prepared, data were collected, and analysis were performed by both SS and MY. SS wrote the initial draft and the authors commented on previous version of the manuscript. The final version was read and approved by both authors.
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