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Prevalence of sarcopenia in systemic sclerosis: Assessing body composition and functional disability in patients with systemic sclerosis

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ABSTRACT

Objective: We analyzed the prevalence of sarcopenia among systemic sclerosis (SSc) patients with respect to quality of life, disability, organ involvement, and muscle function.
Methods: A total of 129 patients who met the ACR/EULAR 2013 classification criteria were included. Body composition was measured using bioelectric impedance analysis. Sarcopenia was defined according to the criteria of the European Working Group on Sarcopenia in Older People. Handgrip and knee extension strength and pulmonary peak flow were measured. Physical function was assessed with the Short Form-36 Health Survey and Scleroderma Health Assessment Questionnaire.
Results: Sarcopenia was prevalent in 22.5% of patients. There were significant differences between patients with and without sarcopenia regarding handgrip strength (11.5 [2.0–30.0] versus 18.0 [1.0–41.0] kilogram force [kgf]; $P < 0.001$) and knee extension strength (11.0 [3.5–32.5] versus 17.5 [3.5–88.0] kgf; $P = 0.006$), physical function (38.8 [9.9–85.0] versus 48.8 [0–88.0]; $P = 0.032$) and number of immunosuppressants (2 [0–4] versus 1 [0–5]; $P = 0.009$). There were no differences regarding age (57.0 [32.0–83.0] versus 60.5 [28.0–82.0] years; $P = 0.350$) and disease duration (8 [1–27] versus 7 [0–34] years; $P = 0.350$).
Conclusions: Sarcopenia is common in patients with SSc and is associated with physical impairment that affects everyday life and participation in work. Interestingly, although age is the main risk factor for sarcopenia in the general population, it did not differ between sarcopenic and non-sarcopenic SSc patients in our study. Instead, the number of immunosuppressive drugs was significantly higher among sarcopenic patients.

Introduction

Systemic sclerosis (SSc) is a rare connective tissue disease which manifests as an inflammatory and multiorgan fibrotic disease [1]. Sarcopenia is defined as age-associated loss of muscle mass, strength, and function [2]. Its prevalence is estimated at up to 13% in over-60 y olds [3] and increases with age [3,4]. Sarcopenia has a profound impact on risk of falls, disability, and mortality [5,6]. Previous studies have shown a correlation between malnutrition [7] and lack of moderate physical activity [8] with sarcopenia. Secondary sarcopenia refers to the loss of muscle mass in the context of severe and chronic disease such as malignancy [9,10] or rheumatic disease [11–14] and has been linked to poor clinical outcome.

Primary muscle involvement is a common problem [15] occurring in up to 90% of patients with SSc [16] and is a likely risk

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factor for the development of sarcopenia. Moreover, malnutrition due to gastrointestinal involvement [17], chronic inflammation, steroid therapy, physical inactivity, or terminal organ failure [5] might contribute to a higher prevalence of sarcopenia among SSc patients.

So far, sarcopenia has only rarely been studied in patients with SSc [6,18–21]; however, recent studies from 2017 show that it is gaining attention as a current topic of interest. In a study by Spanjer et al. [20], bioimpedance was validated against whole-body dual-energy X-ray absorptiometry (DXA) and was confirmed as a valid method to assess body composition in SSc patients. They also reported a low fat-free mass index in SSc patients compared to healthy controls. A further recent study from Caimmi et al. found that 9.2% of a cohort of SSc outpatients were malnourished and 20.7% sarcopenic [21]. Doerfler et al. [19] previously investigated a group of 18 patients with SSc and unintentional weight loss and found a prevalence of sarcopenia of 54% in this pre-selected group. Here, sarcopenia was also measured using bioimpedance and was defined as appendicular lean mass/height^2 for women <5.45 kg/m^2 and for men <7.26 kg/m^2. Similarly, in a study on 61 SSc patients, Marighela et al. [18] reported lower lean mass in female patients with SSc when compared with healthy controls, and also lower relative skeletal muscle mass in patients with diffuse SSc compared with patients with limited SSc. Moreover, they found that longer disease duration is associated with a higher risk for developing body composition abnormalities [18]. This has been confirmed by previous data from our group [6].

The aim of our study was to assess the prevalence of sarcopenia according to the definition of sarcopenia developed by the European Working Group on Sarcopenia in Older People (EWGSOP) [22] and to evaluate the impact of sarcopenia on functional parameters and quality of life. In a second step, we characterized clinical features that differ between sarcopenic and non-sarcopenic SSc patients.

Materials and methods

Patient selection

From our center at the Departments of Rheumatology and Clinical Immunology, Charité University Hospital Berlin, Germany, we recruited 129 patients who met the ACR EULAR/2013 classification criteria for SSc, were at least 18 y old, and were able to give written consent. The study was approved by the Charité—Universitatsmedizin Berlin ethics committee (EA1/013/13) before recruitment was started.

Clinical parameters

We gathered demographic and clinical data including sex, age, disease duration, cutaneous subset (limited cutaneous subset [lsSSc]; diffuse cutaneous subset [dsSSc]; mixed connective tissue disease [MCTD]; undifferentiated connective tissue disease [UCTD]), number of drugs per day, number of immunosuppressive medications, and number of comorbidities (Charlson Comorbidity Score) and measured laboratory parameters including autoantibodies and C-reactive protein according to standardized procedures. Body weight was measured with a portable electronic scale (seca 910, Hamburg, Germany) to the nearest 0.1 kg and height with a portable stadiometer (seca 220 telescopic measuring rod) to the nearest 0.1 cm. Weight and height were used to calculate the body mass index (BMI; in kg/m^2).

Malnutrition risk

The Malnutrition Universal Screening Tool (MUST) was used to identify malnourished patients or those at risk of malnutrition. The screening tool includes BMI, unplanned weight loss, and the presence of acute disease. The sum of the scores from each category gives the overall risk of malnutrition: 0 – low risk, 1 – medium risk (observe), ≥2 – high risk (treat) (Malnutrition Advisory Group, www.bapen.org.uk).

Organ-specific disease severity

The condition of the gastrointestinal tract was assessed with the Medsger's Severity Scale. The scale describes the severity of organ involvement in SSc: 0 – normal, 1 – mild, 2 – moderate, 3 – severe, and 4 – end stage. We used 3 – severe as the cut-off value for a poor condition [23].

The degree of lung involvement was evaluated based on the presence of lung fibrosis (interstitial lung disease [ILD]) in combination with forced vital capacity (FVC). An FVC of ≥70% was deemed normal [24]. The presence of pulmonary arterial hypertension (PAH) was also documented.

Muscle involvement was evaluated based on the presence of current or recent myositis assessed by computer tomography.

Body composition

Whole body impedance was measured using Nutriguard M (Data Input, Darmstadt, Germany) according to a standardized protocol [25]. In brief, patients were measured in the supine position, at 50 kHz applying alternating electric current of 800 μA. Appendicular lean mass (ALM) as an indicator of muscle mass was calculated according to the equations by Scafoglieri et al. [26] and stratified according to height^2.

Definition of sarcopenia

Sarcopenia was defined as having low lean mass and low muscle strength as suggested by the EWGSOP criteria: We therefore used the ALM/height^2 cut-off values for low lean mass (two standard deviations (SD) below mean of young adults) and BMI-stratified handgrip strength cut-off values for low muscle strength [22]. The cut-off values for ALM/height^2 are 7.26 kg/m^2 for men and 5.5 kg/m^2 for women.

Muscle strength

Handgrip strength was measured in the non-dominant hand with a Jamar dynamometer (Sammons Preston Rolyan, Chicago, USA). The patients performed the test sitting with shoulder adducted and neutrally rotated forearm, elbow flexed to 90 degrees, and forearm and wrist in neutral position. Patients were instructed to perform three maximal isometric contractions within 30 seconds and the highest value of three tests was used for the analysis. Knee extension strength was measured with the Digimax dynamometer (mechatronic GmbH, Darmstadt, Germany) while the patients were seated, legs not touching the floor. The right leg was then fixed with a sling, which was connected to the wall behind the patients and connected with a force sensor. Patients were then encouraged to perform three maximum knee extensions and the highest value was documented. Peak expiratory flow was assessed with the ASSESS Peak Flow Meter (Respironics, HealthScan Inc, NJ, USA). Patients were told to exhale as fast and forcefully as possible. The test was carried out three times and the highest reading was recorded.

Physical function

Physical function was measured with the quality of life Short Form-36 Health Survey [27]. In brief, the questionnaire consists of 36 questions, is self-administered, and assesses quality of life and wellbeing in eight multi-item scales. For the purpose of this analysis, we used the aggregated summary of the single scales, the Physical Component Summary.

Severity of disease-specific disability

We used the German version of the Scleroderma Health Assessment Questionnaire (SHAQ) to measure the patients' degree of disease-related impairment [28], a score that is well established and commonly used in SSc [29].

Statistical analysis

Patients were divided into two groups according to the presence of sarcopenia. The data are presented as percentages for categorical variables and median (minimum and maximum) for continuous variables. To identify significant differences between the sarcopenic and non-sarcopenic patients, we used the Mann-Whitney U Test and χ^2 test by IBM SPSS Statistics 23. Results with a significance level of $P < 0.05$ were considered statistically significant.