Multiparametric assessment of sarcopenia in systemic sclerosis: prognostic implications and interplay with malnutrition

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Abstract

Objective

Sarcopenia, defined by the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) as loss of muscle strength, mass and function, is an underestimated complication in systemic sclerosis (SSc). We aimed to assess sarcopenia prevalence in SSc, identify clinical correlations, and evaluate its prognostic impact.

Methods

Consecutive adult SSc patients underwent multidisciplinary same-day assessment (rheumatologists, physiotherapists, nutritionists) and HAQ administration. Sarcopenia was diagnosed using the EWGSOP2 algorithm: SARC-F questionnaire and/or clinical suspicion for screening, muscle strength testing for probable sarcopenia, confirmation with reduced appendicular skeletal muscle mass (by bioelectrical impedance vector analysis [BIVA]), and severity by impaired physical performance. Malnutrition was assessed by BIVA. Mortality was recorded after ≥12 months follow-up.

Results

Among 204 enrolled patients (86.8% female, mean age 62.3 years), 100 (49%) were at risk of sarcopenia. Of these, 89 (43.6%) had reduced muscle strength (probable sarcopenia), 54 (26.5%) showed low muscle mass (confirmed sarcopenia), and 25 (12.3%) had impaired physical performance (severe cases). Sarcopenic patients were older ($p<0.001$) and had higher HAQ scores ($p<0.001$). Malnutrition was identified in 69/204 patients (33.8%) and was more prevalent in sarcopenic patients (72.2% vs. 24.6%, $p<0.001$). Sarcopenia was strongly associated with malnutrition (OR 5.69, $p<0.001$). Mortality was significantly higher in sarcopenic patients (16.7% vs. 2.7%, $p=0.001$), who also showed reduced survival ($p<0.001$). Sarcopenia predicted mortality (HR 8.99, $p=0.001$), remaining an independent predictor after adjustment for age (HR 4.09, $p=0.04$).

Conclusion

Sarcopenia is frequent in SSc, closely associated with malnutrition, disability and mortality. Sarcopenia is an independent prognostic factor, therefore routine screening and multidisciplinary management are warranted.

Key words

sarcopenia, systemic sclerosis, malnutrition, muscles, survival

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Introduction

Systemic sclerosis (SSc) is a rare, chronic connective tissue disease characterised by a complex pathogenesis and highly heterogeneous clinical manifestations. It represents one of the most challenging conditions for rheumatologists due to its variable presentation and range of severity, and for patients, it is a lifelong disease with a substantial impact on quality of life (1).

Sarcopenia is an insidious and often underdiagnosed complication in patients with SSc. Several factors may predispose to its development, including advanced age, concomitant malnutrition, and disease activity with multiorgan involvement, which frequently leads to functional disability (2-4). Sarcopenia, in turn, further exacerbates physical impairment and contributes significantly to the decline in quality of life in this patient population (5). According to the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), sarcopenia is defined as a progressive and generalised skeletal muscle disorder recognised as a muscle disease. It is associated with an increased risk of adverse outcomes, including falls, fractures, physical disability, and mortality. Sarcopenia is considered probable when low muscle strength is detected; the diagnosis is confirmed by the presence of reduced muscle quantity. When low muscle strength, low muscle quantity, and low physical performance are all present, sarcopenia is classified as severe (6).

Despite growing interest in the musculoskeletal manifestations of SSc, evidence on sarcopenia in this population remains limited and fragmented. Most available studies rely on small cohorts, apply heterogeneous diagnostic criteria, or assess only selected components of muscle status, leading to wide variability in reported prevalence estimates. Moreover, the prognostic implications of sarcopenia in SSc are still largely unexplored. The aim of this study was to assess the prevalence of sarcopenia in a large cohort of patients with SSc through a multiparametric characterisation based on the diagnostic algorithm proposed by the EWGSOP2. Furthermore, we explored the associations between sarcopenia and disease-specific clinical features and evaluated its prognostic impact on mortality.

Methods

Study population

Consecutive adult patients routinely followed at the outpatient Scleroderma Clinic of the University of Pisa were enrolled between March 2022 and March 2024. The study was approved by the local ethics committee (*CEAVNO* approval n. 15464), and all participants provided written informed consent prior to inclusion. Epidemiological, clinical, and serological data related to SSc were collected. Subjects were further classified according to fulfilment of 2013 ACR/EULAR SSc classification criteria or the VEDOSS criteria (7, 8). A multidisciplinary team consisting of rheumatologists, physiotherapists and nutritionists evaluated each patient on the same day to assess the presence of sarcopenia and malnutrition. The Health Assessment Questionnaire (HAQ) was administered to evaluate functional disability (9) and the UCLA SCTC GIT 2.0 questionnaire to capture gastrointestinal burden (10). Mortality rate was assessed in patients with at least one year of follow-up.

Assessment of sarcopenia

Sarcopenia was assessed according to the comprehensive diagnostic algorithm proposed by EWGSOP2 guidelines (6). It is a multi-step process that starts from the identification of subjects at risk up to the evaluation of severe cases of sarcopenia.

Phase I: case finding. The SARC-F is a five-item, self-reported questionnaire used to screen for individuals at risk of sarcopenia. The total score ranges from 0 to 10, with scores ≥4 indicating an increased risk of sarcopenia and associated poor outcomes (11). Patients with a pathological score on the SARC-F questionnaire were combined with those presenting a clinical suspicion of sarcopenia (*i.e.* reporting symptoms such as falls, slow gait speed, unintentional weight loss, or visible muscle wasting), to thus constitute the pool of subjects at risk of sarcopenia.

Phase II: muscle strength. Upper limb muscle strength was assessed using the hand grip test, with the patient seated and the elbow flexed at 90°, performing three trials for each hand. The best result for each hand was taken, and the average between the two hands was calculated. Pathological hand grip values were defined as <27 kg for men and <16 kg for women (12). Lower limb muscle strength was assessed using the 5-time sit-to-stand test (5STS), which measures the time required for a patient to stand up five times from a seated position without using the arms. 5STS times greater than 15 s were considered pathological (6). Patients at risk who had at least one pathological result between the hand grip test and the 5STS were classified as having probable sarcopenia.

Phase III: muscle quantity. The identification of subjects with reduced muscle mass began with the quantification of appendicular skeletal muscle mass (ASMM), which was then normalised by dividing it by the square of the height to obtain ASMM index (ASMMI, kg/m^2). Bioelectrical impedance vector analysis (BIVA), a technique used to assess malnutrition in patients with SSc (13), was used to quantify ASMM. Pathological ASMMI values were defined as <7.0 kg/m^2 for men and <5.5 kg/m^2 for women (6, 14). Patients with probable sarcopenia who also had reduced muscle quantity were classified as having confirmed sarcopenia.

Phase IV: physical performance. Low physical performance was assessed using three complementary methods. The Short Physical Performance Battery (SPPB) is a composite tool that includes balance assessment, a 4-meter walking test, and the 5STS. The total score ranges from 0 to 12, with values ≤8 indicating poor physical performance (15). The Timed Up and Go (TUG) test was used to evaluate dynamic balance, considered pathological when ≥20 s (16). Finally, gait speed derived from the 4-meter walking test of the SPPB was considered impaired when ≤0.8 m/s. Patients with confirmed sarcopenia who showed impairment in at least one physical performance test were classified as having severe sarcopenia.

Assessment of nutritional status

In addition to quantifying ASMM, BIVA was also employed to evaluate patients' nutritional status. After resting supine on the examination table for 5 minutes, whole-body bioelectrical impedance analysis was performed using the BIA 101 BIVA device (Akern, Italy), which delivers an alternating sinusoidal current of 800 μA at a frequency of 50 kHz. Measurements were obtained using a tetrapolar electrode configuration (17). Resistance and reactance values were recorded, adjusted for patient height, and compared with the tolerance ellipses of a reference population to assess body composition (18). Malnutrition was defined as the position of the impedance vector falling in the lower right quadrant, outside the 75th percentile of the reference tolerance ellipse along the horizontal axis (19). Serum levels of haemoglobin (normal values >11.5 g/dL for women and >13.0 g/dL for men) and albumin (normal values >3.5 g/dL), biomarkers associated with both sarcopenia and malnutrition (13, 20), were collected.

Statistical analysis

Continuous data were described using mean and standard deviation, while categorical variables were reported as absolute and relative frequencies. The distribution of continuous variables was assessed through visual inspection of quantile-quantile plots; in uncertain cases, the Shapiro-Wilk test was applied. According to data distribution, comparisons between groups were performed using either the two-tailed Student's t-test or the Mann-Whitney U-test for independent samples. Differences in categorical variables between groups were assessed using Pearson's Chi-square test or Fisher's exact test, depending on the sample size for each comparison.

After excluding collinearity issues by calculating the variance inflation factor, a multivariable logistic regression analysis was performed to identify independent predictors of confirmed sarcopenia. Results were expressed as odds ratios (OR) with corresponding 95% confidence intervals; the pseudo-R^2 of the final model was also reported. Finally, a time-to-event analysis was performed to assess survival probability in relation to the presence of sarcopenia. Kaplan-Meier survival curves were generated and compared using the log-rank test. To quantify the risk of mortality associated with sarcopenia, a univariable Cox proportional hazards regression model was first fitted to estimate the hazard ratio (HR) and its 95% confidence interval and the corresponding concordance statistic. This model was then extended to a multivariable Cox regression to assess the influence of age.

A p-value <0.05 was considered statistically significant. All analyses were performed using R software (R Core Team 2025, R Foundation for Statistical Computing, Vienna, Austria).

Results

Study population

A total of 204 patients were enrolled (86.8% female, mean age 62.3 ±12.9 years). The epidemiological and clinical characteristics of the cohort are summarised in Table I. Briefly, the majority of patients presented with the limited cutaneous subtype and were anti-centromere positive (57.8% and 53.9%, respectively). A subgroup of 21 patients met criteria for the preclinical VEDOSS form. The most frequent organ involvements were interstitial lung disease (27.9%) and digital ulcers (28.9%).

Assessment of sarcopenia

Figure 1 summarises the results obtained by applying the diagnostic algorithm for sarcopenia according to the EWGSOP2 guidelines.

- *Case finding*. SARC-F questionnaire yielded a mean score of 2.2±2.5, with pathological results in 59 (28.9%) patients. When combined with 61 patients presenting clinical suspicion of sarcopenia, a total of 100 individuals (49% of the cohort) were classified as being at risk for sarcopenia.
- *Muscle strength*. In the overall cohort, the hand grip test showed a mean value of 18.1±8.0 kg, with pathological results observed in 100

patients (49.0%). The 5STS had a mean completion time of 16.4±10.6 s and was pathological in 81 cases (39.7%). When considering the subgroup of 100 patients at risk for sarcopenia, the mean hand grip strength was 14.2±6.6 kg, with 73 subjects (35.8%) falling below the pathological threshold. The 5STS in this subgroup showed a mean time of 20.6±13.6 s, with pathological performance in 60 cases (29.4%). Within this subgroup, a total of 89 patients (43.6% of the whole cohort and 89.0% of the at-risk subgroup) had at least one pathological result in either the hand grip test or the 5STS and were thus classified as having probable sarcopenia.

- *Muscle quantity*. In the overall cohort, the mean ASMMI was 6.3±1.2 kg/m², being pathologically reduced in 65 (31.9%) cases. When considering the subgroup of 89 patients with probable sarcopenia, the mean ASMMI was 5.9±1.0 kg/m². Within this subgroup, 54 individuals (26.5% of the total cohort and 60.7% of those with probable sarcopenia) showed insufficient muscle mass and were thus classified as having confirmed sarcopenia.
- *Physical performance*. In the overall cohort, the mean SPPB score was 9.4±2.4, being pathological in 56 (27.5%) patients. The TUG showed a mean completion time of 9.7±6.5 s, with pathological results in 10 (4.9%) cases. Mean gait speed was 1.2±0.3 m/s, being reduced in 24 (11.8%) subjects. When considering the subgroup of 54 patients with confirmed sarcopenia, the mean SPPB score was 8.2±2.7, with pathological values in 25 (12.3%) cases. The TUG revealed a mean completion time of 12.5±9.6, impaired in 6 (2.9%) patients, while gait speed averaged 1.1±0.3 m/s, and was reduced in 13 (6.4%) subjects. Overall, 25 patients with confirmed sarcopenia (12.3% of the total cohort and 46.3% of those with confirmed sarcopenia) showed at least one pathological physical performance test and were therefore classified as having severe sarcopenia.

Table I. Epidemiological and clinical characteristics of the cohort (n=204).

Female, n (%)	177 (86.8)
Age, mean (SD), years	62.3 (12.9)
Body mass index, mean (SD), kg/m²	25.1 (4.7)
Autoantibody profile	
- anti-centromere, n (%)	110 (53.9)
- anti-topoisomerase I, n (%)	54 (26.5)
- anti-RNA polymerase III, n (%)	9 (4.4)
VEDOSS, n (%)	21 (10.3)
Overt SSc, n (%)	183 (89.7)
- limited cutaneous SSc, n (%)	118 (57.8)
- diffuse cutaneous SSc, n (%)	40 (19.6)
- sine scleroderma, n (%)	25 (12.3)
- interstitial lung disease, n (%)	57 (27.9)
- history of digital ulcers, n (%)	59 (28.9)
- pulmonary arterial hypertension, n (%)	21 (10.3)
- immunosuppressants, n (%)	62 (30.4)
- steroids, n (%)	18 (8.8)
- antifibrotics, n (%)	11 (5.4)

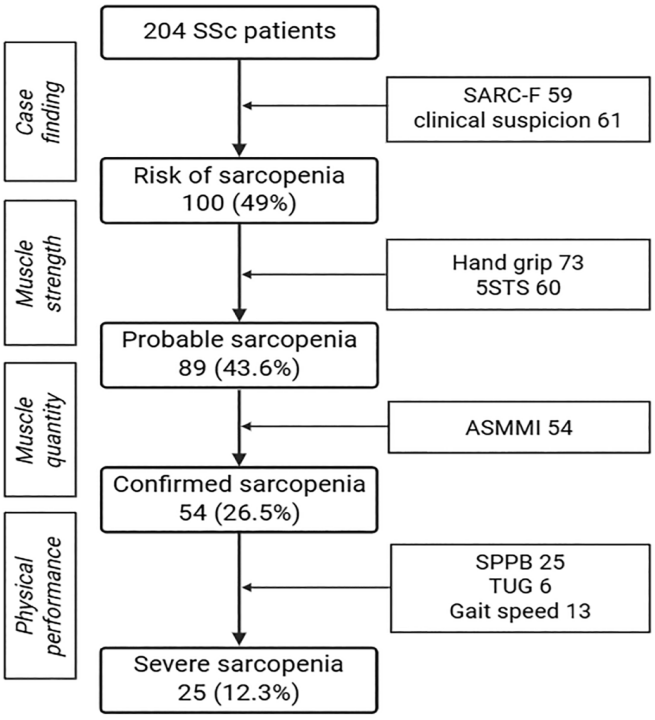

Fig. 1. Results following diagnostic algorithm for sarcopenia according to EWGSOP2 guidelines.

When evaluating associations with disease characteristics, patients with confirmed sarcopenia were significantly older than those without (71.3±10.1 *vs*. 59.1±12.2 years; $p<0.001$), while no significant differences were observed in gender distribution. All patients with sarcopenia fulfilled the classification criteria for overt SSc, with no cases classified as VEDOSS ($p=0.004$). No significant differences were found in cutaneous subsets or autoantibody profiles. Among organ manifestations, only a history of digital ulcers showed a trend toward association with sarcopenia ($p=0.06$). Chronic steroid treatment was associated with sarcopenia ($p=0.009$), whereas no findings were noted for immunosuppressants and antifibrotics. HAQ scores were significantly higher in sarcopenic patients (0.9±0.8 *vs*. 0.4±0.5; $p<0.001$), indicating greater functional disability, while no clear differences emerged for UCLA SCTC GIT 2.0 questionnaire.

Relationship between sarcopenia and malnutrition

Overall, BIVA identified 69 patients (33.8%) with malnutrition in the en-

Table II. Multivariable logistic regression analysis of factors associated with confirmed sarcopenia.

Variable	OR	95% CI	*p*-value
Age	1.07	1.03-1.11	**<0.001**
Male sex	1.85	0.58-5.68	0.2
History of digital ulcers	1.64	0.73-3.64	0.2
Malnutrition	5.85	2.67-13.32	**<0.001**
Hypoalbuminemia	1.41	0.31-6.92	0.6
Steroid treatment	2.15	0.65-7.31	0.2

Table III. Comparison of sarcopenia diagnostic measures by nutritional status.

	No malnutrition (n=135)	Malnutrition (n=69)	*p*-value
SARC-F, score	1.6 (2.1)	3.4 (2.8)	**<0.001**
SARC-F ≥ 4, n	27 (20.0%)	32 (46.4%)	**<0.001**
Hand grip, kg	20.2 (8.0)	13.9 (6.1)	**<0.001**
Hand grip < cut-off, n	49 (36.3%)	51 (73.9%)	**<0.001**
5STS, s	14.5 (7.1)	20.3 (14.8)	**<0.001**
5STS > 15 s, n	42 (31.1%)	39 (56.5%)	**<0.001**
ASMMI, kg/m²	6.7 (1.1)	5.6 (0.9)	**<0.001**
ASMMI < cut-off, n	21 (15.6%)	44 (63.8%)	**<0.001**
SPPB, score	10.0 (2.1)	8.3 (2.8)	**<0.001**
SPPB ≤ 8, n	24 (17.8%)	32 (46.4%)	**<0.001**
TUG, s	8.5 (3.2)	12.2 (10.0)	**<0.001**
TUG ≥ 20 s, n	4 (3.0%)	6 (8.7%)	0.08
Gait speed, m/s	1.2 (0.3)	1.1 (0.3)	**0.002**
Gait speed ≤ 0.8 m/s, n	9.0 (6.7%)	15.0 (21.7%)	**0.002**

Continuous data are expressed as mean (SD).

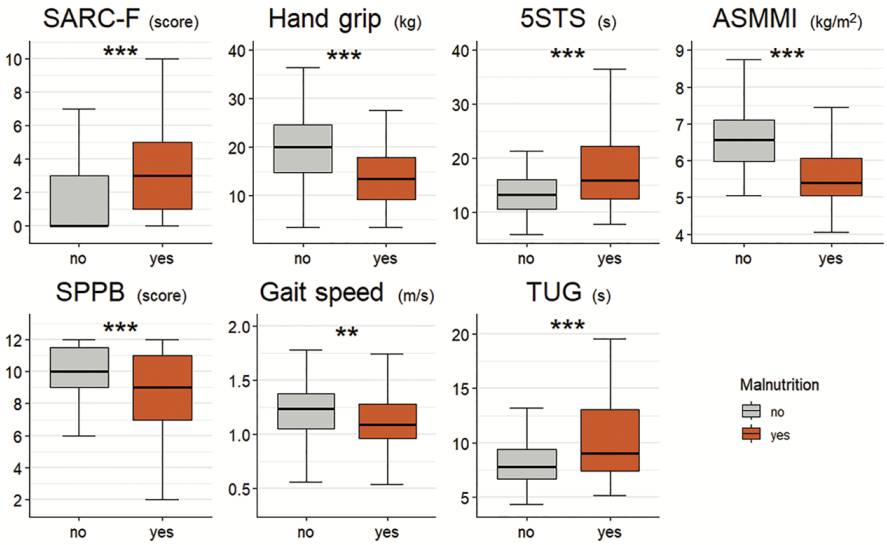

Fig. 2. Sarcopenia-related parameters in malnourished *versus* non-malnourished patients.

tire cohort. Anaemia was present in 35 cases (17.2%), while hypoalbuminaemia was detected in 11 (5.4%). Among the 54 patients with confirmed sarcopenia, 39 (72.2%) also had concomitant malnutrition, indicating a significantly higher prevalence of malnutrition in this subgroup ($p<0.001$).

No significant differences were observed for anaemia, while a slight trend was noted for hypoalbuminaemia ($p=0.07$).

Table II presents the results of the multivariable logistic regression model including age, gender, history of digital ulcers, chronic steroid treatment, malnutrition, and hypoalbuminaemia (pseudo-$R^2=0.28$). After adjustment, only age and malnutrition remained significantly associated with confirmed sarcopenia ($p<0.001$ for both). Specifically, malnourished patients had an OR of 5.69 (95% CI: 2.58–12.94) for having sarcopenia.

Delving into the relationship between sarcopenia and malnutrition, all tests and parameters included in the diagnostic algorithm for sarcopenia showed significantly worse results in malnourished patients. This held true for all continuous parameters and for most pathological thresholds (Table III). Such a clear difference was observed for SARC-F scores, muscle strength tests, ASMMI, and physical performance tests (Fig. 2). These findings highlight that malnutrition is associated with markedly impaired muscle status across all domains investigated.

Survival analysis

After enrolment, the cohort was followed for a mean period of 22.0±5.9 months, during which 13 deaths were recorded. Mortality was significantly higher among sarcopenic patients compared to non-sarcopenic ones (9/54 (16.7%) *vs*. 4/150 (2.7%); $p=0.001$).

As illustrated in Figure 3, Kaplan-Meier survival analysis showed a significantly lower survival probability in patients with confirmed sarcopenia (log-rank test: $\chi^2=15.8$, df=1, $p<0.001$). Median survival was not reached in the sarcopenic group, while it was estimated at 40.3 months in the non-sarcopenic group.

In univariate Cox regression analysis, sarcopenia was significantly associated with an increased risk of mortality, showing an HR of 8.99 (95% CI 2.43–33.28; $p=0.001$) and good model discrimination (concordance =0.77). In the multivariable Cox model adjusting for age, sarcopenia remained an independent predictor of mortality, with an HR of 4.09 (95% CI 1.05–15.98; $p=0.04$). This multivariable model had very good discriminative ability (concordance =0.89) and overall statistical significance (likelihood ratio test $p<0.001$).

Discussion

SSc encompasses several factors that predispose patients to the development of sarcopenia, making the two condi-

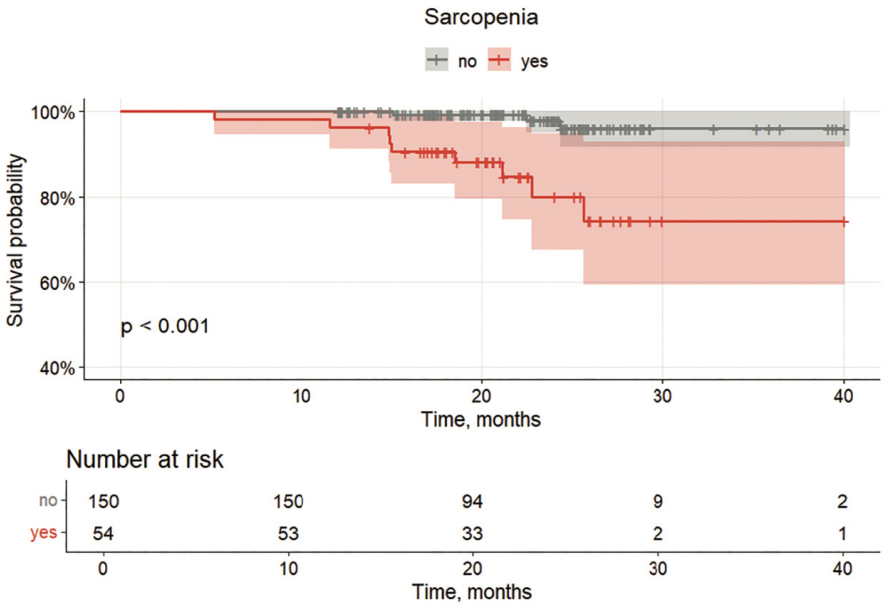

Fig. 3. Kaplan-Meier survival curves according to the presence of sarcopenia.

tions intrinsically connected. Despite this association, sarcopenia remains largely underdiagnosed in routine clinical practice, and its assessment is often hindered by heterogeneity in diagnostic approaches. In this work we applied the diagnostic algorithm proposed by the EWGSOP2 guidelines, which offers a comprehensive, multiparametric framework for evaluating all dimensions of muscle status. This approach emphasises how a multidisciplinary team involving the collaboration of rheumatologists, physiotherapists, and nutritionists, is essential both in the diagnosis and management of sarcopenic SSc patients.

Beginning with the first step of the algorithm, our findings, consistently with previous literature (21), highlight that the SARC-F questionnaire, while useful, should not be used alone as a screening tool. Its limited concordance with clinical evaluation in case finding underscores the need for integration with physician-led assessment to effectively identify patients at risk of sarcopenia. Low muscle strength, now recognised by the EWGSOP2 as the key characteristic of sarcopenia (6), showed a high prevalence of impairment in both upper and lower limbs in our cohort. Although several techniques are available to assess muscle mass, the use of BIVA additionally allows for evaluation of nutritional status, especially considering that BIVA proved to outperform BMI in identifying body composition abnormalities in SSc (13). Finally, low physical performance was also relatively frequent in our cohort, contributing to the classification of nearly half of sarcopenic patients as having severe sarcopenia. This functional impairment highlights the importance of early identification and potential reversibility of physical limitations. In this regard, evidence from a systematic review supports the beneficial effect of structured exercise programs in SSc (22).

To the best of our knowledge, this is the largest and most comprehensive study to assess sarcopenia in patients with SSc using the full diagnostic algorithm proposed by the EWGSOP2. Although previous studies have applied elements of the EWGSOP (either the original or updated version) to smaller SSc cohorts (23-26), we were able to confirm their findings within a larger population, while simultaneously providing a complete and integrated assessment of all diagnostic domains. These earlier contributions have been essential in highlighting the clinical relevance of sarcopenia in SSc, and our study builds upon and expands their results, offering additional evidence to support the implementation of systematic screening and evaluation strategies in clinical practice.

Applying the EWGSOP2 diagnostic algorithm, we found a prevalence of sarcopenia of 26.5% in our SSc cohort, which is broadly consistent with the 22% reported in a recent meta-analysis including over 800 patients across nine studies (5). Despite some heterogeneity in diagnostic methods among different studies, these findings reinforce the notion that sarcopenia is a relatively frequent and often severe complication in SSc. Furthermore, our HAQ data confirmed the negative impact of sarcopenia on patient-reported outcomes, with significantly higher levels of disability and poorer quality of life among sarcopenic patients, in line with previously published observations (23). When analysing the associations with disease-related features, our findings clearly indicate that sarcopenia is strongly correlated with older age, a well-established risk factor in the general population. Interestingly, sarcopenia was observed exclusively in patients with overt SSc and was entirely absent in those with preclinical VEDOSS, corroborating the notion that muscle involvement emerges predominantly in more advanced stages of the disease.

Another major finding of our study is the strong interrelationship between sarcopenia and malnutrition, an overlap previously reported in the literature (2, 3, 23), and here confirmed in a larger SSc cohort. Malnutrition was markedly more prevalent among sarcopenic patients and emerged as an independent predictor of sarcopenia in multivariate analysis. Furthermore, malnourished individuals consistently showed poorer performance across all domains of the diagnostic algorithm, reinforcing the notion that nutritional status plays a pivotal role in the pathophysiology and severity of sarcopenia in SSc. Given the deep impact that both sarcopenia and malnutrition exert on patients with SSc, a clear message emerges for clinical practice: these conditions must not be overlooked, and their assessment should be systematically integrated into routine care. When one is identified, the other should be actively investigated, and both require prompt, targeted interventions to mitigate their effects.

Finally, one of the most clinically relevant findings of our study is the prognostic value of sarcopenia in patients

with SSc. Over a mean follow-up period of nearly two years, sarcopenic patients showed a significantly higher mortality rate and a markedly reduced survival probability. Importantly, sarcopenia remained a significant and independent predictor of mortality even after adjustment for age, with a four-fold increased risk of death. These results underscore the critical role of sarcopenia not only as a comorbidity but also as a key determinant of poor prognosis in SSc. Interestingly, our findings contrast with those of a recent Thai study (27), which reported no differences in survival between sarcopenic and non-sarcopenic SSc patients. This discrepancy may be attributed to differences in diagnostic definitions, measurement techniques or cohort features, and reinforces the need for further prospective research on this topic.

There are some limitations to acknowledge for this study. The final cohort has a lower representation of SSc patients with a more severe clinical phenotype, which theoretically would have had a greater impact on sarcopenia. However, since these were consecutive patients, our cohort closely reflects real-world epidemiology, and the posthumous inclusion of patients with interstitial lung disease and/or diffuse skin subsets would introduce selection bias. In some patients, the severity of joint involvement, especially in the hands, may have affected the accurate assessment of muscle strength. For this reason, applying a multiparametric diagnostic algorithm helps reduce the bias a single parameter could bring in the diagnosis of sarcopenia.

In light of our findings, the identification and management of sarcopenia in SSc should be regarded as a clinical priority. Early recognition, along with targeted multidisciplinary interventions, may not only improve physical function and quality of life, but also potentially impact long-term outcomes, including survival.

Conclusion

Our findings highlight sarcopenia as a frequent and clinically meaningful comorbidity in SSc, with a significant impact on physical performance, disability and, most importantly, survival. Its strong interrelationship with malnutrition further underscores the need to consider these two conditions as commonly overlapping severe comorbidities in SSc. Clinicians should be aware of their frequent co-occurrence, actively screen for both, and initiate timely, targeted interventions when either is identified. In this context, a multidisciplinary approach that engages rheumatologists, physiotherapists and nutritionists is essential to ensure comprehensive assessment and effective management, with the ultimate goal of improving patient-centred outcomes in SSc.

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