Original Article

Screening for sarcopenia and its health outcomes in hospitalized elderly individuals

Triagem da sarcopenia e os desfechos clínicos em indivíduos idosos hospitalizados

DOI: 10.37111/braspenj.2023.38.2.10

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Unitermos:
Sarcopenia. Idoso. Hospitalização.

Keywords:
Sarcopenia. Aged. Hospitalization.

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Submission
26 of February 2023

Accepted for publication
24 of June 2023

ABSTRACT

Introduction: This study aims to identify the risk of sarcopenia at admission and its health outcomes. **Methods:** This was an observational, longitudinal, and prospective study, with elderly individuals aged 60 years or older, evaluated within 72 hours after admission to a private hospital, between 2020 and 2021. We collected demographic, clinical, and nutritional data from the patients' medical records, applied the SARC-CalF questionnaire and measured the handgrip strength, skeletal muscle mass index and gait speed test. **Results:** There were 101 patients, of whom 60.4% (n = 61) were male, with a mean age of 74.2 ± 8.7 years. Risk of sarcopenia was identified in 22.8% (n = 23) of the patients, confirmed in 6.1% (n = 6) and considered severe in 4% (n = 4). This study found an association between the risk of sarcopenia and age, marital status, educational level, body mass index, and nutritional risk. The odds of elderly individuals presenting with risk of sarcopenia increases by 69.350-fold if the calf circumference is inadequate, by 31.417-fold if underweight and by 6.645-fold if classified as at nutritional risk. In terms of the health outcome, after 30 days, 98% of patients were discharged. **Conclusion:** The prevalence of risk of sarcopenia and sarcopenia was similar to that described by other authors and nutritional factors were considered strong predictors of the risk of sarcopenia, reinforcing the importance of assessing body composition in hospitalized elderly individuals.

RESUMO

Introdução: Esse estudo tem como objetivo identificar o risco de sarcopenia na admissão e seus desfechos clínicos. **Método:** Utilizamos uma abordagem observacional, longitudinal e prospectiva, com indivíduos idosos com 60 anos de idade ou mais velhos, avaliados dentro de 72 horas depois da sua admissão, em um hospital privado entre 2020 e 2021. Dados demográficos, clínicos e nutricionais foram coletados dos registros médicos dos pacientes, aplicamos o questionário SARC-CalF e mensuramos a força da dinamometria manual, índice de massa muscular esquelética e teste de velocidade de marcha. **Resultados:** Tínhamos 101 pacientes, dos quais 60,4% (n = 61) eram homens, com idade média de 74,2 ± 8,7 anos. O risco de sarcopenia foi identificado em 22,8% (n = 23) dos pacientes, confirmado em 6,1% (n = 6) e considerado grave em 4% (n = 4). Esse estudo achou uma associação entre o risco de sarcopenia e a idade, estado civil, nível educacional, índice de massa corporal e risco nutricional. A chance de indivíduos idosos de apresentar sarcopenia aumenta em 69,3 vezes, se a circunferência da panturrilha é inadequada, 31,4 vezes, se o paciente está abaixo do peso, e 6,6 vezes, se classificado sob risco nutricional. Em termos de desfecho de saúde, depois de 30 dias, 98% dos pacientes receberam alta. **Conclusão:** A prevalência do risco de sarcopenia e sarcopenia foi similar ao descrito por outros autores e fatores nutricionais foram considerados como fortes preditores do risco de sarcopenia, reforçando a importância de investigar a composição corporal em indivíduos idosos hospitalizados.

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INTRODUCTION

Despite being a natural process, aging is characterized by several physiological and functional changes that impact the health and nutritional status of elderly individuals[1]. Geriatric syndromes represent a relevant public health problem, with increased costs from primary to tertiary care. One of the main geriatric syndromes is sarcopenia, defined for the first time by Rosenberg et al.[2], as a decrease in muscle mass related to aging.

In 2019, the European Working Group on Sarcopenia in Older People (EWGSOP) proposed a new definition and algorithm for the diagnosis of sarcopenia, to facilitate its detection in clinical practice. According to this consensus, the strength, assistance with walking, rising from a chair, climbing stairs, and falls (SARC-F) questionnaire should first be applied to detect the elderly individuals most likely to have this geriatric syndrome. Next, to identify probable sarcopenia, muscle strength is evaluated by validated methods, such as hand grip strength (HGS) and the sit-to-stand test[3]. Finally, the diagnosis is confirmed by the presence of low muscle quantity or quality, which can be measured, for example, by dual-energy X-ray absorptiometry (DEXA) or electrical bioimpedance. Physical performance, assessed by several functional tests, is used to categorize the severity of the condition[3].

Sarcopenia has a negative impact on health, which may result in physical capacity limitations, increased incidence of falls, depression, worsened quality of life, prolonged hospitalizations, increased hospital readmission rates, and mortality[4]. Its prevalence varies among the elderly population, affecting 13% to 24% of individuals aged 65 to 70 years and more than 50% of individuals older than 80 years[5].

The SARC-F questionnaire was developed with the objective of screening among the elderly population for individuals who are more likely to develop sarcopenia. This questionnaire was translated and validated for the Brazilian population through the study Enhancing SARC-F: Improving Sarcopenia Screening in the Clinical Practice[6]. That study found that the application of the questionnaire alone was not sufficient to correctly screen the elderly population regarding the increased risk of sarcopenia. However, when combined with calf circumference measurement (SARC-CalF), there was a significant improvement in the screening of the syndrome, without compromising the other parameters, thus allowing its use in clinical practice[7]. The SARC-CalF evaluates muscle strength, the need for assistance in walking, the ability to rise from a chair and to climb stairs, the frequency of falls, and calf circumference (CC). The final score ranges from 0 to 20 points for each category, where the suggestion of sarcopenia arises when the total score is greater than 106.

One of the validated techniques proposed by the EWGSOP to evaluate muscle strength is the hand grip. This method is widely used due to its low cost, availability, ease of use, and strong correlation with lower limb strength[3]. Bioelectrical impedance analysis (BIA) is a fast, practical, and noninvasive tool for the evaluation of body composition. As tissues lower in fat have lower resistance to electrical current, BIA can be used to estimate the fat mass and fat-free body mass[8].

In elderly individuals, CC is the anthropometric measurement most closely correlated with muscle mass. In addition, because it is one of the measurements least affected by subcutaneous fat deposition, CC is considered the most suitable for indirectly assessing changes in muscle mass in this population. Brazilian population studies suggest a cutoff point of 34 cm for males and 33 cm for females[7].

The four-meter gait speed test is a simple physical test proposed for the evaluation of functional capacity in elderly individuals that is capable of reflecting physical and physiological changes over time. The test does not require specific equipment and training and is easy to apply and interpret[9]. The time the individual takes to walk four meters at a normal pace is measured with a stopwatch, and then the gait speed is calculated by dividing the distance walked by the time spent. It is recommended for the test to be performed three times, with a one-minute interval between tests, to obtain the gait speed[9]. Walking aids are allowed if the participant normally uses such equipment in their daily life. At the end of the course, the gait speed is calculated, with the cutoff point for low physical performance being a mean speed $\leq$0.8 m/s[3]. The hospital environment may contribute to the development of sarcopenia since immobilization (bedrest confinement) and low intake of food sources of protein are observed in many patients[10]. Thus, this study aims to describe the prevalence of elderly individuals at increased risk of and diagnosed with sarcopenia in the first 72 hours of hospital admission and to assess the health outcomes resulting from this clinical condition.

METHODS

This is an observational, longitudinal, and prospective study, with elderly individuals aged 60 years or older, who were admitted in the past 72 hours to any hospital unit of a private hospital in São Paulo, Brazil, between 2020 and 2021. We excluded patients when the necessary information could not be obtained (e.g., patients presenting with cognitive deficit, neurodegenerative diseases, severe psychiatric dysfunctions confirmed in the medical records that could impact the completion of the SARC-CalF questionnaire, measurement of the CC and HGS for anatomical or clinical reasons, or contraindications for the performance of BIA, such as patients with a pacemaker, extensive metal prostheses, or in respiratory isolation for COVID-19). The sample size was determined considering the expected prevalence of sarcopenia of 12.9%

in hospitalized elderly individuals[10], with a 95% confidence interval and maximum error of 7%. Thus, the minimum sample size was 89 elderly individuals.

The following data were collected: sex, age, marital status, educational level, previous hospitalization in the past 30 days, current diagnosis, comorbidities, weight, height, body mass index (BMI) classified according to the Pan American Health Organization (PAHO), nutritional risk according to the Nutritional Risk Screening 2002 (NRS 2002), and degree of malnutrition according to the Global Leadership Initiative on Malnutrition (GLIM). Additionally, 30 days after sarcopenia screening, data on the following health outcomes were collected: hospital discharge, length of hospital stay, death, transfer to another service, or still hospitalized.

After study approval by the research ethics committee of the hospital (CAAE no. 39388920.7.0000.5461), patients were given the informed consent form and the SARC-CalF questionnaire. The latter consists of five questions related to: strength and the ability to walk, rise from a chair, and climb stairs; the occurrence of falls; and the CC measurement at the point with the greatest CC (with a cutoff point of 34 cm for men and 33 cm for women)[6]. In patients for whom the final score was greater than 10, the flowchart for the diagnosis of sarcopenia recommended by the EWGSOP in 2019[3] was followed.

HGS was assessed using a digital manual hydraulic dynamometer, when possible, in the dominant hand, with the patient seated with the elbow flexed at 90° and the forearm and wrist in neutral rotation. When the patient could not sit, the measurement was performed with the patient lying down with the elbow flexed at 30°. The participants were asked to squeeze the dynamometer as hard as possible for a few seconds. Three measurements were taken, with an interval of 1 minute between attempts, and the highest value among the three measurements was used. The cutoff points for low HGS were <27 kg for men and <16 kg for women in inpatient units, and <11 kg for men and <7 kg for women in intensive care units[3,11].

The skeletal muscle mass index (SMMI) was calculated using electrical bioimpedance, with cutoff values proposed by the EWGSOP, of <7 kg/m^2 for men and <5.5 kg/m^2 for women[3].

For the gait speed test, the evaluator instructed the participant to walk at a normal pace for four meters and recorded the time the elderly individual took to perform this task. At the end of the course, the gait speed was calculated from the time recorded, with the cutoff point for low physical performance being a mean speed of ≤0.8 m/s[3]. The normality of the quantitative variables was tested by the Shapiro–Wilk test to inform the choice of equivalent parametric or nonparametric tests. A descriptive analysis of the data was performed, and the chi-square test or Fisher's exact test was used to evaluate the association between qualitative or categorical variables, and the Mann–Whitney test was used for continuous variables. A logistic regression model was used to evaluate the association between potential risk factors and the probability of having a prevalent risk of sarcopenia. The significance level considered for the inferential analyses was 5%.

RESULTS

In total, 101 patients met the eligibility criteria: 60.4% (n=61) were male, 79% (n=79) were married, 86.7% (n=85) had completed higher education, and their ages ranged from 61 to 100, with a mean of 74.2 years (SD=8.7).

In terms of the reason for hospital admission, 49.5% (n=50) were hospitalized for clinical, 33.7% (n=34) for surgical, and 16.8% (n=17) for cancer treatment, and 18.8% (n=19) were admitted in the past 30 days.

Regarding the associated comorbidities, 54.5% (n=55) had hypertension, 33.7% (n=34) cancer, 24.8% (n=25) diabetes, 21.8% (n=22) heart disease, 12.9% (n=13) previous pulmonary conditions, and 10.9% (n=11) neurological diseases.

With respect to the BMI, 50.5% (n=51) were eutrophic, 30.7% (n=31) were overweight, and 18.8% (n=19) were underweight. Regarding anthropometry, most of the elderly individuals, 76.2% (n=77), had adequate CC.

In terms of nutritional diagnosis, 22.8% (n=23) of the patients had a score indicative of nutritional risk according to the NRS 2002, of whom 30.4% (n=7) were classified as moderately malnourished and 26.1% (n=6) as severely malnourished according to the GLIM.

Application of the SARC-CalF revealed that 22.8% (n=23) of the patients had a risk of sarcopenia, of whom 65.2% (n=15) had inadequate HGS and were classified as probable sarcopenia.

Following the flowchart for diagnosis, the prevalence of sarcopenia was 26.1% (n=6), confirmed by reduced SMMI, and it was considered severe in 17.3% (n=4) of patients with reduced gait speed.

When evaluating the factors associated with the risk of sarcopenia, this study found a significant association between the quantitative variables age (p=0.005) and CC (p=0.000) and between the following categorical variables: marital status, educational level, BMI, and nutritional risk (Table 1).

Table 2 shows the results of the logistic regression analysis. In this model, the odds of the elderly individual presenting a risk of sarcopenia increases by 69.3-fold if the CC is inadequate, by 31.4-fold if the individual is underweight, and by 6.6-fold if the individual is classified as at nutritional

risk according to the NRS 2002. No significant associations were found between the variables and patients with probable, confirmed, and/or severe sarcopenia, possibly due to the small sample size with such diagnoses.

In terms of the health outcome, after 30 days, 98% (n=99) of the patients had been discharged from the hospital, only 2% (n=2) of the patients remained hospitalized, and no patient died. No significant difference was found between the length of hospital stay and the risk of sarcopenia (p=0.146).

Table 1 – Association between the risk of sarcopenia and the demographic, clinical, and nutritional variables of elderly individuals hospitalized in the past 72 hours in a private hospital in São Paulo, Brazil.

Variables	N (%)	*p* value
Sex		0.467[a]
Male	11 (47.8)	
Female	12 (52.2)	
Marital status		0.021[b]
In a partnership (married)	14 (60.9)	
Not in a partnership (single, widowed, divorced)	9 (39.1)	
Educational level		0.008[b]
Primary/Secondary education	7 (31.8)	
Higher education	15 (68.2)	
Current diagnosis		0.133[a]
Clinical	13 (56.5)	
Surgical	4 (17.4)	
Oncological	6 (26.1)	
Comorbidities		
Diabetes	5 (21.7)	0.790[b]
Hypertension	12 (52.2)	0.816[b]
Heart disease	5 (21.7)	1.000[a]
Neurological disease	5 (21.7)	0.119[b]
Cancer	8 (34.8)	1.000[a]
Previous pulmonary condition	6 (26.1)	0.069[b]
Nutritional diagnosis		0.000[a]
No nutritional risk	11 (47.8)	
With nutritional risk	12 (52.2)	
Degree of malnutrition		0.243[b]
No malnutrition	4 (33.3)	
Moderate malnutrition	3 (25.0)	
Severe malnutrition	5 (41.7)	
BMI classification		0.000[a]
Low weight	13 (56.5)	
Eutrophy	8 (34.6)	
Overweight/Obesity	2 (8.7)	

[a]Chi-square test; [b]Fisher's exact test. BMI = mass index.

Table 2 – Logistic regression analysis for the risk of sarcopenia in elderly individuals hospitalized in the past 72 hours in a private hospital in São Paulo, Brazil.

Variable	Categories	OR*	95% CI	*p* value
Marital status				0.021
	In a partnership	1.000	–	
	Not in a partnership	3.482	1.231–9.846	
Educational level				0.008
	Primary/Secondary education	5.444	1.600–18.529	
	Higher education	1.000	–	
Nutritional diagnosis				0.000
	No nutritional risk	1.000	–	
	At nutritional risk	6.645	2.355-18.748	
CC classification				0.000
	Adequate	1.000		
	Inadequate	69.350	16.959– 283.587	
BMI classification				0.000
	Low weight	31.417	5.576–177.007	
	Eutrophy	2.698	0.534–13.624	
	Overweight/Obesity	1.000	–	

*OR: odds ratio for the risk of sarcopenia. CC = calf circunference; BMI = body mass index.

DISCUSSION

The present study found that 22.8% of patients were at risk of sarcopenia. Similar rates were found by Cristaldo et al.[12], in individuals admitted to a hospital in the Center-West region of Brazil (31.1%). In contrast, Gade et al.[13] identified a higher prevalence in the elderly population, reaching up to 64.5%. It is worth noting that these studies used the SARC-F to screen elderly individuals, whereas in the present study, the SARC-CalF was applied. The lower prevalence of the risk of sarcopenia observed in the present study can be explained by the fact that most patients had adequate CC (74.3%).

Furthermore, more than half of the elderly individuals had probable sarcopenia. Of these, 26.1% were diagnosed with confirmed sarcopenia, and 17.3% were diagnosed with severe sarcopenia. This finding may be explained by the fact that with aging, there is a faster decline in strength than in muscle mass, especially after 60 years of age[14]. Thus, the measurement of muscle strength may be an effective strategy for an earlier identification of limitations in functionality and mobility in this population. In fact, the EWGSOP2[3] established HGS as the primary parameter in the diagnosis of sarcopenia, which is classified as probable when there is reduction in muscle strength.

Although there are few studies in the literature that identify the severity of sarcopenia in hospitalized elderly individuals, most find higher frequencies of this condition than were identified in the present study, with previous studies reporting prevalence of 46% for confirmed sarcopenia[13] and 19.7% for severe sarcopenia[15]. The discrepancy in the rates identified by these authors in comparison with the present study can be explained by the characteristics of the sample: because ours is a private hospital, it is expected that most patients have more favorable financial and social conditions. In support of this rationale, Dorosty et al.[16] found that elderly individuals with low income were 0.97 times more likely to develop sarcopenia than those with medium or high income. A higher purchasing power may favor access to a safe and adequate diet and provide opportunities for multiprofessional care throughout life, factors that may result in a better nutritional status in these individuals.

The risk of sarcopenia was significantly associated with age. Muscle loss related to aging involves quantitative and qualitative changes in the structure and function of skeletal muscle[17]. Considering that the mean age in the present study was 74.2 years, this association can be explained by the fact that the reduction in muscle mass can intensify starting at 50 years of age and gradually progress over the years. In addition, muscle strength may decrease by 1.5% per year in the sixth decade of life and by 3% after this age[18]. The findings of Tanaka et al.[19] corroborate this rationale, as they observed a progressive increase in sarcopenia with age, being present in 18.3% of the elderly individuals aged 65 to 74 years and reaching 60.0% in individuals 85 years old or older.

Patients with inadequate CC were 69.3 times more likely to have a risk of sarcopenia than those with adequate CC. This relationship agrees with Bertschi et al.[15], who identified a higher likelihood of confirmed sarcopenia in hospitalized elderly patients with inadequate CC (OR = 4.05). In a recent study conducted by Inoue et al.[20], cutoff points of 34 cm and 33 cm were also used for elderly men and women, respectively, and both studies found that CC can be a useful and reliable measure for sarcopenia screening. The CC has a good correlation with skeletal muscle mass, considering that it is indispensable in the diagnosis of sarcopenia and is a simple measure for the screening of this condition[21].

In the present study, patients with low weight were 31.4 times more likely to have a risk of sarcopenia than individuals with excess weight. In addition, elderly individuals with nutritional risk were 6.6 times more likely to present a risk of sarcopenia than those without nutritional risk. This relationship was also found by Bertschi et al.[15], who identified that hospitalized elderly individuals with low weight and nutritional risk were 3.76 and 5.68 times more likely to have confirmed sarcopenia, respectively. The findings of the present study are also supported by Cheng et al.[22], who observed that participants with low weight had a higher risk of sarcopenia when compared to participants with normal weight (OR = 5.22). In addition, a significant association was identified between elderly individuals at nutritional risk and sarcopenia. These observations suggest that assessing nutritional risk in the elderly population using validated tools, such as the NRS 2002, may be a useful strategy for the detection of individuals at risk of sarcopenia. However, it is important to note that, although the present study found that only individuals with low weight have a higher risk of sarcopenia, BMI alone should not be used to determine this risk. The existence of sarcopenic obesity is a reality, and may also be associated with a functional decline, due to the reduction in muscle quality by the infiltration of fat into muscle, causing an inability to generate sufficient muscle strength relative to the body mass[22].

Individuals who were not in a partnership were 3.48 times more likely to have a risk of sarcopenia. A population-based multicenter study conducted by Daskalopoulou et al.[23] found that married or cohabiting individuals had a lower likelihood of sarcopenia (OR = 0.68). Pang et al.[24] also used the EWGSOP2 algorithm, and found, after a multivariate analysis ($p<0.01$), that married adults had a significant association with a lower risk of sarcopenia. It is expected that married individuals, especially those who are elderly, express greater mutual care and acceptance, which may have protective effects on health[24].

The association between low educational level and increased risk of sarcopenia found in the present study is corroborated by other studies. Oliveira et al.[25] identified a significant association between the risk of sarcopenia and a higher educational level, and Cheng et al.[22] found that secondary or higher education was a protective factor against sarcopenia (OR = 0.50). Individuals with higher educational levels may have more knowledge, supporting their ability to recognize weaknesses in their health and use reliable information for their own care.

The strengths of the present study include the fact that the participants were well described through measurements of muscle strength and physical performance, BIA, and anthropometry. This study also included the most recent definitions of sarcopenia and malnutrition, in addition to obtaining reliable data on medical diagnoses. Furthermore, a multidisciplinary team was trained to measure physical performance, strength, and muscle mass using calibrated instruments validated in the literature. Possible limitations include the reduced number of malnourished individuals with confirmed and severe sarcopenia, which may have resulted in the lack of significant association between the studied variables. Further studies with a larger sample size are needed to confirm the associations between clinical outcome, length of hospital stay, diagnosis, and severity of sarcopenia.

CONCLUSION

In conclusion, this study found sarcopenia risk prevalence and sarcopenia similar to that described by other authors, and indicated that nutritional factors (especially inadequate calf circumference, low weight, and nutritional risk) were strong predictors of the risk of sarcopenia. These findings reinforce the importance of screening for sarcopenia and assessing body composition in the elderly population, in order to implement early actions to minimize the worsening of clinical conditions. Further studies are needed to address the association between severe sarcopenia and health outcomes in hospitalized elderly individuals.

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Study location: Hospital Sírio-Libanês, São Paulo, SP, Brazil.

Conflict of interest: The authors declare that they have no conflicts of interest.