A Basic Review of Sarcopenia Diagnosis

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ABSTRACT

Associated with aging, sarcopenia is characterized by a decline in skeletal muscle mass, muscle strength and physical performance, eventually resulting in reduced physical capability, disability, poor quality of life, mortality in older people and high health care expenditure. The prevalence varies significantly by population characteristics, disease status, diagnostic criteria and measurement tools. It is essential to achieve an accurate diagnosis of sarcopenia for the management plan to be effective. This review briefly discusses the essential steps in diagnosing sarcopenia: Find – Assess – Confirm - Severity.

Keywords sarcopenia, sarcopenia diagnosis, case finding, muscle strength, performance, muscle mass

INTRODUCTION

Sarcopenia is a clinical syndrome characterized by decreased muscle mass and function closely related to aging. It was first identified by Rosenberg in 1988, coining the term from the Greek words *sarx* and *penia*, which mean 'flesh' and 'loss', respectively. [1] Since the National Institute on Aging held the first sarcopenia workshop in 1994, a continuous rise in interest and, subsequently, in research emerged to help understand its significance and mechanisms. Sarcopenia compromises mobility, independence and quality of life. Numerous studies have investigated the adverse consequences of sarcopenia, which include increased risks of falls, fractures, hospitalization and eventually disability and even death, all together summing up to high medical expenses. The prevalence of sarcopenia in older adults varies considerably by population characteristics, disease status and the diagnostic criteria and measurement tools utilized. The prevalence rates are between 5% and 25%, ranging from 5% to 13% in community-dwelling older people aged 65 years and above, rising to 20% to 25% in those aged 80 years and older.[2] But despite the relatively high prevalence rates and severity of adverse consequences, the awareness and knowledge about sarcopenia are considerably low.[3]

Age-related decrease in skeletal muscle mass has been reported to occur at a rate of approximately 3% to 8% per decade after age 30, with the rate of decline going higher after 60 years old.[4] Sarcopenia, a generalized involuntary loss of mass, strength, and skeletal muscle function has been considered a disorder because of its progressive nature. In 2016, the World Health Organization (WHO)'s International Statistical Classification of Diseases and Related Health Problems (ICD) recognized sarcopenia as a disease.[5]

The baseline survey of the Longitudinal Study of Ageing and Health in the Philippines (LSAHP)

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investigated older Filipinos' health status and well-being and possible correlates. Data were collected from over 5,000 community-dwelling Filipinos aged 60 and over.[6] The activities of daily living (ADLs), created by Sidney Katz in 1950, collectively describe the primary and essential skills required for independent personal care, such as eating, bathing and mobility.[7] The ADLs included in the LSAHP were taking a bath and/or shower, dressing, eating, standing up from a bed or chair or sitting down on a chair, walking around the house, going outside (leaving the house) and using the toilet. It was reported that 22% of older Filipino people encounter difficulty performing at least one of the seven ADLs. Older people find it most difficult to leave the house and females have more functional difficulty than males. [6] The Nagi measure of physical functioning was one of the disability measures utilized in the LSAHP, of which, out of the 10 items, the older people had difficulty performing the following tasks: prolonged standing for two hours, carrying 10- and 5-kilogram load, climbing 10 steps without resting, and walking 200 to 300 meters. It was observed that the number of ADL difficulties rose from 2.1 among those in the 60-year-olds to 2.7 among those in their 70s and further increased to 3.4 among those in their 80s.[6] Table 1 shows the percentages of respondents in the LSAHP who experienced ADL difficulties.

According to LSAHP, 19% of older adults surveyed experienced a fall within the past 12 months, with an average of 1.7 falls. The average frequency of falls increases with age, with the oldest group (80 years old and above) reporting an average of two falls in 12 months. Among those who suffered a fall, 15% reported being seriously injured necessitating medical treatment.[6]

The current literature reviews describe and discuss the different elements of sarcopenia, including its association with frailty and chronic medical illnesses. This mini-review presents a brief discussion on the process of diagnosing sarcopenia from the screening step to utilizing instruments and tools to confirm the diagnosis. The short format of this review allows easy comprehension of the topic so that more stakeholders (students, healthcare practitioners, medical practitioners - generalists and specialists) will benefit.

Table 1 The level of functional loss using the Nagi measures of physical functioning (Source: Ogena, 2019).

Percent who Experience Difficulty with the ff. activities	SEX			AGE GROUP				TOTAL
	Male	Female	Sig	60-69	70-79	80+	Sig	
Walk 200 to 300 meters	20.5	33.5	***	19.4	37.7	56.2	***	28.3
Climb 10 steps without resting	23.8	39.3	***	21.9	45.6	66.8	***	33.1
Stand (go without sitting) for 2 hours	32.0	42.8	**	29.4	48.0	66.9	***	38.4
Continue to sit for 2 hours	17.8	23.6	n.s.	19.1	21.3	33.0	**	21.2
Stoop or bend your knees	20.8	23.8	n.s.	16.8	27.3	44.1	***	22.6
Raise your hands above your head	8.5	5.9	n.s.	5.5	7.2	14.1	***	6.9
Extend arms out in front of you as if to shake hands	3.6	3.5	n.s.	1.8	4.8	10.4	***	3.5
Grasp your fingers or move your fingers easily	6.0	8.6	*	5.9	8.7	14.1	***	7.6
Lift an object weighing approximately 10 kg	20.0	50.1	***	26.9	48.8	75.0	***	38.0
N	2,411	3,574		3,760	1,552	674		5,985
Lift an object weighing approximately 5 kg	38.9	33.0	n.s.	20.7	40.0	55.3	***	34.3
N	517	1,900		1,123	781	514		2,418
% who experienced difficulty in performing any of the 10 activities	47.4	66.1	***	47.9	72.2	86.9	***	58.6
N	2,411	3,574		3,760	1,552	673		5,985
Mean number of Nagi activities with difficulty	3.40	3.76	*	3.19	3.73	4.86	***	3.64
N	1,142	2,360		1,799	1,118	585		3,502

*$p<0.05$,
**$p<0.01$, ***$p<0.001$, n.s. = not significant
Source: Calculated by DRDF using original LSAHP data.

REVIEW OF CURRENTLY AVAILABLE MEASURES

A working definition and diagnostic criteria for sarcopenia was published by the European Working Group on Sarcopenia in Older People (EWGSOP) in 2010. Sarcopenia is a syndrome of progressive and generalized loss of skeletal muscle mass and strength accompanied by risks of adverse outcomes of morbidity (eg, falls, physical disability, poor quality of life) and mortality. Low muscle mass and low muscle function (strength or performance) have been recommended by EWGSOP to be included as criteria in sarcopenia diagnosis. The documentation of criterion 1 plus documentation of either criterion 2 or criterion 3 are required in the diagnosis (Table 2). This initiative promoted awareness in identifying and caring for people at risk for or with sarcopenia. In 2018, the Working Group reconvened (EWGSOP2) and formulated updates on the recommendations for sarcopenia, including an algorithm for screening or case-finding.(Figure 1) In the updated guidelines, muscle strength becomes the most critical criterion because it has been identified and considered as more appropriate than mass in predicting adverse outcomes.[8]

Case Findings

The healthcare provider should be able to elicit symptoms and signs referable to sarcopenia, such as episodes of falling, feeling weak, slow speed in walking, difficulty rising from a chair, or weight loss. SARC-F is a questionnaire designed to screen patients at risk for sarcopenia using self-reported information about falls, mobility and strength. SARC-F assesses five components: **S**trength, **A**ssistance with walking, **R**ise from a chair, **C**limb stairs, and **F**alls.[9] Different language versions of the SARC-F questionnaire have been validated in Asia, and studies have demonstrated an independent association between results and unfavorable clinical outcomes.[10] A score of ≥4 on the SARC-F questionnaire is required to screen for sarcopenia. It should prompt a referral of at-risk persons for further work-ups to obtain a definitive diagnosis rather than a community-based follow-up.[10]

The Asian Consensus on Sarcopenia 2019, updated by the Asian Working Group for

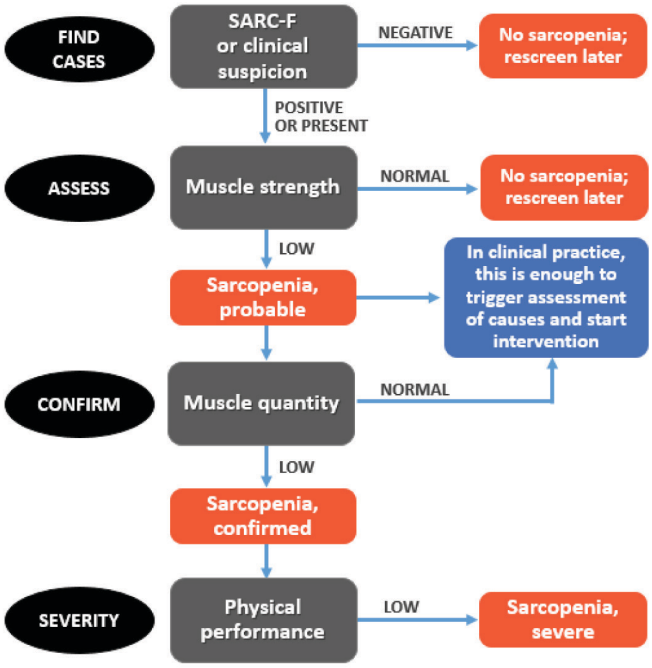

Figure 1 European Working Group on Sarcopenia in Older People 2018 (EWGSOP2) algorithm for case-finding, making a diagnosis and quantifying severity in practice. The steps of the pathway are represented as Find-Assess-Confirm-Severity or F-A-C-S. (Source: Cruz-Jentoft, et al., 2019).

Table 2 2010 and 2018 diagnostic criteria and operational definition of sarcopenia (Source: Cruz-Jentoft et al., 2019).

2010 Criteria for the diagnosis of sarcopenia
Diagnosis is based on documentation of criterion 1 plus (criterion 2 or criterion 3)
Low muscle mass Low muscle strength Low physical performance

2018 Operational definition of sarcopenia
Probable sarcopenia is identified by Criterion 1. Diagnosis is confirmed by additional documentation of Criterion 2. If Criteria 1, 2 and 3 are all met, sarcopenia is considered severe.
Low muscle strength Low muscle quantity or quality Low physical performance

Sarcopenia (AWGS), recommends using either calf circumference (CC), the SARC-F, or the addition of a CC measurement to SARC-F, known as SARC-CalF questionnaires for case finding. As recommended in the protocol for CC measurement, a non-elastic tape is utilized to get the maximum value of both calves. This method has a moderate-to-high sensitivity and specificity in predicting a low skeletal muscle mass or sarcopenia. The AWGS 2019 recommends <34 cm and <33 cm for screening in men and women, respectively. A practical alternative to CC is the 'Yubi-wakka' or the finger-ring test. The index fingers and thumbs of both hands are used to encircle the thickest part of the non-dominant calf. An increased risk for sarcopenia is defined if the measured calf fits the ring finger.[12] SARC-CalF improved the sensitivity of SARC-F by adding CC, with a score ≥11, in diagnosing sarcopenia.[10]

Muscle Strength

In East and southeast Asia, almost all studies on muscle strength, function, performance and sarcopenia utilized handgrip strength (HGS) for measuring skeletal muscle strength. HGS is a simple and fast measurement used as a significant measure of low muscle strength to diagnose sarcopenia. Low HGS is clinically translated to poor mobility and is considered a good predictor of clinical outcome of low muscle mass.[13] According to the AWGS, low muscle strength of HGS is <26 kg in men and <18 kg in women. HGS was recommended by AWGS in 2019 and is a widely used parameter; however, measurement protocols varied between studies.

Muscle strength, currently the most reliable measure of muscle function, was utilized as the primary parameter for definition of sarcopenia in 2018 by the EWGSOP2. When low muscle strength is detected, a probable diagnosis of sarcopenia is given, while the presence of low muscle quantity or quality confirms the diagnosis. A diagnosis of severe sarcopenia is given when low muscle strength, low muscle quantity/quality and low physical performance are all present.[8]

Physical Performance

Physical performance is defined as 'an objectively measured whole body function related to mobility.' Physical performance does not only measure muscle function but is now a concept encompassing several aspects as it involves many other body organs and systems, such as bones, balance and other neurological inputs, cardiovascular factors and motivation.[8,14] Impairments in physical performance may occur even before the onset of disabilities.

The measures of muscle strength and physical performance are now being used in clinical practice and research; thus, different tools have been recommended by international specialty societies that can achieve standardized and uniform findings. Physical performance can be measured by gait speed, the Short Physical Performance Battery (SPPB), the Timed Up and Go test (TUG) and the 400-meter walk (Table 3).

Gait speed, a widely used test in clinical practice, is a quick, safe and highly reliable test because it has been shown to predict adverse outcomes related to sarcopenia, such as disability, need for institutionalization, falls and cognitive impairment.[8] There are two main types of tests for gait speed: the short-distance walk tests (2.4 m, 4 m, 6 m, and 10-meter distances) and the long-distance walk tests (400-meter walk test and 6-min walk test), measured either with a stopwatch or an electronic device.[8,14] The 4-meter distance test is a frequently used test; a cut-off speed of ≤0.8 m/s has been recommended to indicate severe sarcopenia.[8] The test-retest reliability on 4-m and 10-m distances was excellent for healthy older adults, with intraclass correlation coefficient (ICC) values ranging from 0.96 to 0.98.[14]

SPPB is a battery of tests for physical performance frequently utilized in clinical practice and research. It was first developed for use in the Established Population for the Epidemiologic Studies of the Elderly (EPESE) at the National Institute on Aging. The battery is composed of tests assessing functional performance of the lower extremities using timed measures of gait speed, standing balance and chair stand tests. The maximum score is 12 points and a score of ≤8 points suggests poor physical performance.[8,14]

The TUG is a quick and objective test that evaluates physical function. The time to complete a complex series of tasks (ie, standing up from a chair, walking 3 meters, turning around, returning and sitting down again) is measured.[8,14] The EWGSOP2 identified a score of ≥20 seconds as the cut-off point for sarcopenia.[8,15]

Table 3 Different tests and tools to characterize sarcopenia in practice and research (Source: Cruz-Jentoft, et al., 2019).

Variable	Clinical Practice	Research Studies
Case finding	SARC-F questionnaire Ishii screening tool	SARC-F
Skeletal muscle strength	Grip strength Chair stand test (chair rise test)	Grip strength Chair stand test (5-times sit-to-stand)
Skeletal muscle mass or Skeletal muscle quality *Sometimes divided by height2 or BMI to adjust for body size	Appendicular skeletal muscle mass (ASMM) by Dual-energy X-ray absorptiometry (DXA)	ASMM by DXA
	Whole-body skeletal muscle mass (SMM) or ASMM predicted by Bioelectrical impedance analysis (BIA)*	Whole-body SMM or ASMM by Magnetic Resonance Imaging (MRI, total body protocol)
	Lumbar muscle cross-sectional area by computed tomography (CT) or magnetic resonance imaging (MRI)	Mid-thigh muscle cross-sectional area by CT or MRI Lumbar muscle cross-sectional area by CT or MRI Muscle quality by mid-thigh or total body muscle quality by muscle biopsy, CT, MRI or magnetic resonance spectroscopy (MRS)
Physical performance	Gait speed	Gait speed
	Short physical performance battery (SPPB)	SPPB
	Timed up-and-go test (TUG)	TUG
	400-meter walk or long-distance corridor walk (400-m walk)	400 m-walk

Skeletal Muscle Mass

Different diagnostic procedures can estimate the quantity or mass of skeletal muscles, with several methods utilized to adjust the results for height or body mass index (BMI).[8] The benchmarks or gold standards for noninvasive quantification of skeletal muscle are magnetic resonance imaging (MRI) and computed axial tomography (CT). However, the utilization of MRI and CT is limited by their high costs, non-portability, and the need for expert personnel to perform the tests. Furthermore, there is still the need to clearly define cut-off values using these machines.[8] Another machine for noninvasive quantification of muscle mass is the dual-energy X-ray absorptiometry (DXA). DXA consistently estimates appendicular skeletal muscle mass (ASMM). However, different devices, software packages and versions utilized in the machines may give different results. Additionally, the DXA results can be affected by the patient's hydration status.[8] Another technique to estimate the total or appendicular skeletal muscle mass is bioelectrical impedance analysis (BIA). It does not directly measure muscle mass, but instead obtains a muscle mass estimate based on electrical conductivity of the whole body. BIA utilization is limited by the lack of standardized protocol in muscle mass measurement and varying cut-off values that depend on the machine model.[5,16] Ultrasound is a potentially good diagnostic option because it is a portable, easily accessible, non-ionizing imaging technique that provides dynamic assessment of soft tissue structures. Furthermore, ultrasound has been investigated to have the potential to assess small muscle groups [17] accurately. Though ultrasound is not included in the currently available guidelines, such as the EWGSOP and AWGS, the use of ultrasound as a diagnostic tool for muscle assessment in different patient populations has been evaluated in several studies, such as its use in hospitalized older adults,[18] patients receiving hemodialysis,[19] and patients with liver cirrhosis [20] to screen for sarcopenia or assess its severity.

The Gaps in Healthcare Utilization

The study by Kalseth and Halvorsen (2020) described the healthcare costs of different age groups in adults. The age group of 65 or older adults represent only 15% of the population but are responsible for almost half of the total healthcare cost. Most of the

healthcare spending in old age is concentrated on long-term care, including difficulties in performing ADLs.[22] Similarly, in the Philippines, 3 in 10 older people reported feeling sick in the past 12 months and considered seeking medical consultation.[6]

Among the chronic non-communicable diseases listed in the LSAHP, hypertension, arthritis, diabetes and cataracts were included as the most prevalent.[6] Sarcopenia and its associated conditions, frailty and undernutrition, were not included even though underweight was mentioned as highly prevalent among the older age group. Another factor that may affect nutritional status and needs to be considered in this age group is the onset of deteriorating oral health.[6]

The impact of sarcopenia and its consequences on the older Filipino population is now being recognized. There has been an increase in interest in the different aspects of sarcopenia, particularly in epidemiology and diagnosis, translated into clinical research. Proper management of any conditions or illnesses begins with the knowledge of basic science and critical thinking. The most appropriate treatment can be offered only if an accurate and correct diagnosis is given. The available international guidelines recommend different methods for case finding and confirming the diagnosis of sarcopenia.

CONCLUSION

Sarcopenia significantly impacts older people's quality of life because of its major adverse outcomes, including impaired mobility, significant disability and even death. Early detection as well as timely and proper intervention, therefore, are essential to better treatment outcomes, preventing disease progression and diminishing the occurrence of complications. A combination of nutritional intervention and resistance exercise has been identified as a more effective management than a single therapeutic approach.[21, 22, 23]

This concise review allows easy comprehension of the topic so that more stakeholders (ie, students, healthcare practitioners, medical practitioners - generalists and specialists) can benefit. Some of the initiatives that may be undertaken are the inclusion of the study on sarcopenia in the allied health sciences and medical school curriculum and enhancing disease awareness through continuing medical education (CME) programs for primary care providers. Revisiting the existing health policies [24] and implementing them at the municipal and barangay levels should be conveyed to relevant stakeholders.

CONFLICT OF INTEREST: The authors have no conflict of interest to declare.

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