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Original Article

Prevalence of sarcopenia in pre-frail community dwelling older adult and utility of SARC-F, SARC-CalF and calf circumference in case finding

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Abstract

Objective: To determine the prevalence of sarcopenia in the pre-frail community dwelling older adults based on the Asian Workgroup for Sarcopenia (AWGS 2019) criteria. In addition, the utility of case finding using the SARC-F, SARC-CalF and calf circumference on impact of prevalence was explored. **Methods**: 75 older adults ≥65 years old were recruited between October 2019 and March 2020. The algorithms of AWGS 2019 was applied retrospectively to pre-frail participants recruited for an intervention study in primary care setting. In addition to demographics, SARC-F, calf circumference (CC), muscle mass, grip strength, gait speed, 5-time chair stand timing and short physical performance battery test (SPPB) were measured, to determine sarcopenia using AWGS 2019. SARC-CalF was determined using SARC-F and CC. **Results**: The prevalence of sarcopenia based on AWGS 2019 algorithm was 16.0%, possible sarcopenia 73.3% and severe sarcopenia 12.0%. Using SARC-F for case finding reduced the overall prevalence of sarcopenia to 4.0%, possible sarcopenia to 12.0% and severe sarcopenia to 4.0%. Positive percentage agreement of case finding criteria of SARC-F, SARC-CalF and calf circumference for sarcopenia was 33%, 42% and 58% respectively. **Conclusions**: Using the AWGS 2019 without case finding, the prevalence of sarcopenia was 16%. However, using SARC-F for case finding underestimated prevalence in this group by 75%. Utility of SARC-F for case finding in pre-frail requires further evaluation.

Keywords: Sarcopenia, Calf circumference, AWGS 2019, Case finding, Pre-frail

Introduction

Sarcopenia was first defined by Rosenberg in 1989 as age-related loss of skeletal muscle mass which subsequently evolved to low skeletal muscle mass and function, and most recently to low skeletal muscle mass, low muscle strength, and/or low physical performance by European Working Group on Sarcopenia in Older People 2 (EWGSOP2) and Asian Workgroup for Sarcopenia (AWGS 2019)[1-4]. Sarcopenia is associated with poor quality of life, depression, falls, functional decline, cognitive impairment and mortality[5-7]. The prevalence of sarcopenia varies depending on the diagnostic criteria and setting, from 5.5% to 25.7%[4,8-10]. Diagnosis and definition of sarcopenia is continuing to evolve and as yet, there is no single gold standard consensus which can used in both research and clinical environment. The most widely used definition of sarcopenia in Asia was first introduced by the Asian Working Group in 2014[11]. Following the release of EWGSOP2 in 2018 focussing on low muscle strength as key characteristic of sarcopenia, detection of low muscle quantity and quality to confirm diagnosis; and physical performance to stratify severe sarcopenia in addition to incorporating case finding[12]; the Asian Workgroup subsequently published the AWGS 2019 Consensus Update incorporating the Asian norms[4]. The objective of this cross-sectional analysis was to determine the

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Variable	All n=75	Possible cases n=12 (16.0%)	No Sarcopenia n=63 (84.0%)	Sarcopenia n=10 (73.3%)	p-value[a]
Age, years	73 ± 6	74 ± 6	72 ± 6	75 ± 6	0.108
Gender					0.859
Female	42 (56.0)	32 (58.2)	35 (55.6)	7 (58.3)	
Male	33 (44.0)	23 (41.8)	28 (44.4)	5 (41.7)	
Ethnicity					0.306
Chinese	60 (80.0)	44 (80.0)	53 (88.3)[b]	7 (11.7)	
Malay	8 (10.7)	5 (9.1)	6 (75.0)	2 (25.0)	
Indian	7 (9.3)	6 (10.9)	4 (57.1)	3 (42.9)	
BMI, kg/m^2	25.5 ± 4.5	25.6 ± 4.8	25.7 ± 4.2	24.0 ± 5.9	0.066
Hand grip strength, kg	22.4 ± 7.2	20.8 ± 6.3	23.1 ± 7.4	18.9 ± 4.8	0.066
Gait speed (mean), m/s	0.9 ± 0.3	0.9 ± 0.3	1.0 ± 0.3	0.8 ± 0.2	0.056
5-Chair stand time (mean), s	13.7 ± 4.8	15.3 ± 4.8	13.1 ± 3.5	17.0 ± 8.6	0.272
SPPB (mean)	9.4 ± 2.2	8.8 ± 2.0	9.7 ± 2.0	8.3 ± 2.5	0.084
Height adjusted appendicular muscle mass (ASM), kg/m^2	7.6 ± 2.3	7.7 ± 2.4	8.0 ± 2.3	5.8 ± 0.9	<0.01
BMI adjusted ASM, kg/BMI	0.76 ± 0.31	0.77 ± 0.35	0.80 ± 0.32	0.57 ± 0.15	<0.01
SARC-F, (mean)	1.5 ± 1.8	1.7 ± 1.8	1.3 ± 1.7	2.5 ± 1.9	0.029
Calf circumference (mean), cm	35.6 ± 3.8	35.6 ± 3.9	36.0 ± 3.8	33.7 ± 2.8	0.026
SARC-CalF (mean)	4.2 ± 4.7	4.5 ± 4.7	3.4 ± 4.2	8.3 ± 5.2	<0.01

n (%) unless otherwise stated; mean ± SD; [a]Significant difference *between those with and without sarcopenia;* [b]*Prevalence within the same ethnicity for sarcopenia and no sarcopenia.*

Table 1. Characteristics of participants.

prevalence of sarcopenia using revised AWGS guidelines in the pre-frail community dwelling older adults. In addition, the utility of proposed case-finding using SARC-F, CC and SARC-CalF in the population were also evaluated.

Methods

The algorithms of AWGS 2019 was applied retrospectively to older adults ≥65 years recruited for an ongoing intervention study in two primary care practices in Singapore between October 2019 and March 2020. Participants were pre-frail based on initial screening using the FRAIL questionnaire[13]. The exclusion criteria included known dementia, pacemaker, active cancer with/without treatment or unable to walk a distance of 100 m independently. The study protocol was approved by National Healthcare Group (NHG) Domain Specific Review Board (DSRB) and all participants sign an informed consent form. The study followed the ethical guidelines of the declaration of Helsinki.

The interview questionnaire included questions on demographics, physical and mental health including SARC-F. Muscle strength was measured using a handheld dynamometer (Jamar), taking the maximum of two trials on the dominant hand. Muscle mass was evaluated using a bioelectrical impedance (BIA) scale (Inbody S10 device) in the seated position. Appendicular skeletal muscle mass (ASM) was calculated by adding the lean mass of the four limbs and normalised by height by taking ASM divided by square of height in metres.

The SARC-F is a self-reported questionnaire and used as a rapid diagnostic tool for sarcopenia[14]. It consists of five questions including lifting and carrying 10 pounds, walking across a room, transferring from bed/chair, climbing a flight of 10 stairs and frequency of falls in the past one year. The scoring range from 0 to 10, with ≥4 suggesting sarcopenia.

In addition to SARC-F, SARC-F with calf-circumference (SARC-CalF) or calf circumference (CC) alone are recommended tools for case finding tool in sarcopenia[4,15,16]. CC was measured at the widest girth of the calf using an inelastic measuring tape with the participants seated with soles entirely in contact with the floor. As recommended by AWGS 19, CC <34 cm for men and <33 cm for women or SARC-CalF ≥11 was used for case finding for sarcopenia.

Based on AWGS 2019, "possible sarcopenia " was

		POSSIBLE CASES n=55 (73.3%)		ALL SARCOPENIC CASES n=12 (16.0%)		SEVERE SARCOPENIC CASES n=9 (12.0%)	
Assessments	Prevalence[a] (%)	Positive percentage agreement (%)	Negative percentage agreement (%)	Positive percentage agreement (%)	Negative percentage agreement (%)	Positive percentage agreement (%)	Negative percentage agreement (%)
SARC-F (≥4 points)	33.3	16	85	33	87	33	86
Calf-circumference (Male <34cm; Female <33cm)	58.3	28	75	58	79	44	75
SARC-calF (≥11 points)	41.7	17	90	42	90	33	88

[a]Prevalence amongst those diagnosed with sarcopenia.

Table 2. Positive and negative agreement of case finding criteria in AWGS 2019.

defined as either low muscle strength or low physical performance, "sarcopenia" as low muscle mass with either low muscle strength or low physical performance and "severe sarcopenia" as presence of low muscle mass, low muscle strength and low physical performance.

Characteristics of participants with and without sarcopenia were compared using Mann-Whitney U Test and Chi-Square Test. Statistical analyses were conducted with the use of SPSS Version 25 and p-values less than 0.05 were considered statistically significant.

Results

Complete data was available for 75 participants. The prevalence of sarcopenia amongst the pre-frail older adults in primary care was 16.0%, possible sarcopenia 73.3% and severe sarcopenia 12% without case finding. The mean age of the participants was 73±6 years and slightly more than half were females (56.0%) (Table 1). The population was predominantly Chinese (80.0%), and the prevalence of sarcopenia was highest amongst the Indian followed by Malay ethnic group. There were significant differences between the sarcopenic and non-sarcopenic for SARC-F, SARC-CalF scores, calf-circumference and height adjusted appendicular muscle mass. While non-significant, sarcopenic participants had lower BMI, lower grip strength, slower gait speed, and longer 5-chair stand time.

As our study population were community dwelling ambulant older adults from primary care setting screened to be pre-frail with no prior complaints of functional decline, case finding using SARC-F would have reduced the prevalence of sarcopenia to 4.0%, possible sarcopenia to 12.0% and severe sarcopenia to 4.0%. The positive percentage agreement of case finding criteria of SARC-F, SARC-CalF and CC was 33%, 42% and 58% for sarcopenia and 33%, 33% and 44% for severe sarcopenia respectively (Table 2).

Discussion

The prevalence of sarcopenia in our pre-frail participants was 16.0% which is similar if not slightly higher than usual prevalence amongst many Asian countries[10]. The overall prevalence of pre-frail older adult in Singapore is 37% and pre-frail are more likely to have sarcopenia than non-frail[17-19].

It is well known that sarcopenia is under-diagnosed and poorly managed, and applying the case finding approach using SARC-F will fail to identify sarcopenia in up to 75% of pre-frail older adults. Using SARC-F as a screening tool has a low sensitivity and high specificity, and this findings have been replicated in other studies using the EWGSOP2 algorithm with similar case finding approaches which may not necessarily be restricted to high prevalence settings[20-23]. The addition of calf circumference to SARC-F (SARC-CalF) did improve the positive agreement percentage from 33% to 42%. Studies have shown that SARC-CalF has a higher sensitivity and provides a greater diagnostic accuracy over SARC-F[24]. Among the proposed assessments for case finding, CC had the highest positive percentage agreement of 58% which was in keeping with previous studies that CC is a good estimate of appendicular skeletal muscle mass, functional status and a good indicator for sarcopenia[16,25,26]. One of the limitation of SARC-F and SARC-CalF is recall bias or due to poor judgement of their capability to execute the tasks in the SARC-F questionnaire especially for the question 'Are you able to carry 10 pounds?' where participants have responded to not have done so in a long time hence, response to this questions are often assumptive[27]. In addition, there would also be recall bias in cognitively impaired older adults.

The proportion of severe sarcopenia in our sarcopenic

participants was 75% which is rather high but similar to EWGSOP2[20]. In many previous studies, severe sarcopenia has been associated with increased mortality and these older adults may benefit from immediate assessment and intervention[22].

The main limitation of our study is small sample size, however, despite that our results were reproducible with different sample sizes and our population is representative of community dwelling older adults.

Conclusions

Using AWGS 2019, the prevalence of sarcopenia in pre-frail community-dwelling older adults was found to be 16.0%. However, using SARC-F for case finding significantly underestimated prevalence in this group. It is not known to what extent will the AWGS 2019 with/without case finding will be useful in predicting adverse outcomes in these individuals. The benefit of the new guideline is seen in the identification of possible sarcopenia where early identification with recommended targeted intervention may improve muscle strength and/or performance. Utility of SARC-F for case finding in pre-frail requires further evaluation.

Authors' contribution

RM: Study concept and design. LJY and NAL: Acquisition of data. RM and LJY: Analysis and Interpretation of data. RM, LJY and NAL: Drafting of the manuscript. RM: critical revision of the manuscript.

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References

1. Rosenberg I. Summary comments: Epidemiological and methodological problems in determining nutritional status of older persons. Am J Clin Nutr 1989;50:1231–1233.
2. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age Ageing 2010;39(4):412-423.
3. Morley JE, Baumgartner RN, Roubenoff R, Mayer J, Nair KS. Sarcopenia. J Lab Clin Med 2001;137(4):231-243.
4. Chen LK, Woo J, Assantachai P, et al. Asian Working Group for Sarcopenia: 2019 Consensus Update on Sarcopenia Diagnosis and Treatment. Journal of the American Medical Directors Association 2020.
5. Veronese N, Demurtas J, Soysal P, et al. Sarcopenia and health-related outcomes: an umbrella review of observational studies. European Geriatric Medicine 2019;10(6):853-862.
6. Chang KV, Hsu TH, Wu WT, Huang KC, Han DS. Association Between Sarcopenia and Cognitive Impairment: A Systematic Review and Meta-Analysis. J Am Med Dir Assoc 2016;17(12):1164 e1167-1164 e1115.
7. Rizzoli R, Reginster JY, Arnal JF, et al. Quality of life in sarcopenia and frailty. Calcified tissue international 2013;93(2):101-120.
8. Woo J, Leung J, Morley JE. Defining sarcopenia in terms of incident adverse outcomes. J Am Med Dir Assoc 2015;16(3):247-252.
9. Su Y, Hirayama K, Han TF, Izutsu M, Yuki M. Sarcopenia Prevalence and Risk Factors among Japanese Community Dwelling Older Adults Living in a Snow-Covered City According to EWGSOP2. J Clin Med 2019;8(3).
10. Shafiee G, Keshtkar A, Soltani A, Ahadi Z, Larijani B, Heshmat R. Prevalence of sarcopenia in the world: a systematic review and meta-analysis of general population studies. J Diabetes Metab Disord 2017;16:21.
11. Chen LK, Liu LK, Woo J, et al. Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia. Journal of the American Medical Directors Association 2014;15(2):95-101.
12. Cruz-Jentoft AJ, Bahat G, Bauer J, et al. Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing 2019;48(1):16-31.
13. Morley JE, Malmstrom TK, Miller DK. A simple frailty questionnaire (FRAIL) predicts outcomes in middle aged African Americans. The journal of nutrition, health & aging 2012;16(7):601-608.
14. Malmstrom TK, Morley JE. SARC-F: A Simple Questionnaire to Rapidly Diagnose Sarcopenia. Journal of the American Medical Directors Association 2013;14(8):531-532.
15. Mo Y, Dong X, Wang XH. Screening Accuracy of SARC-F Combined With Calf Circumference for Sarcopenia in Older Adults: A Diagnostic Meta-Analysis. J Am Med Dir Assoc 2020;21(2):288-289.
16. Hwang AC, Liu LK, Lee WJ, Peng LN, Chen LK. Calf Circumference as a Screening Instrument for Appendicular Muscle Mass Measurement. J Am Med Dir Assoc 2018;19(2):182-184.
17. Merchant RA, Chen MZ, Tan LWL, Lim MY, Ho HK, van Dam RM. Singapore Healthy Older People Everyday (HOPE) Study: Prevalence of Frailty and Associated Factors in Older Adults. J Am Med Dir Assoc 2017.
18. Nishiguchi S, Yamada M, Fukutani N, et al. Differential association of frailty with cognitive decline and sarcopenia in community-dwelling older adults. J Am Med Dir Assoc 2015;16(2):120-124.
19. Bauer J, Morley JE, Schols A, et al. Sarcopenia: A Time for Action. An SCWD Position Paper. J Cachexia Sarcopenia Muscle 2019;10(5):956-961.
20. Reiss J, Iglseder B, Alzner R, et al. Consequences of applying the new EWGSOP2 guideline instead of the former EWGSOP guideline for sarcopenia case finding in older patients. Age Ageing 2019;48(5):719-724.
21. Yang L, Yao X, Shen J, et al. Comparison of revised EWGSOP criteria and four other diagnostic criteria of sarcopenia in Chinese community-dwelling elderly residents. Exp Gerontol 2020;130:110798.
22. Locquet M, Beaudart C, Petermans J, Reginster JY, Bruyere O. EWGSOP2 Versus EWGSOP1: Impact on the Prevalence of Sarcopenia and Its Major Health Consequences. J Am Med Dir Assoc 2019;20(3):384-385.
23. Kera T, Kawai H, Hirano H, et al. Limitations of SARC-F in the diagnosis of sarcopenia in community-dwelling older adults. Archives of gerontology and geriatrics 2020;87:103959.
24. Yang M, Hu X, Xie L, et al. Screening Sarcopenia in Community-Dwelling Older Adults: SARC-F vs SARC-F Combined With Calf Circumference (SARC-CalF). Journal of the American Medical Directors Association 2018;19(3):277.e271-277.e278.
25. Kim S, Kim M, Lee Y, Kim B, Yoon TY, Won CW. Calf Circumference as a Simple Screening Marker for Diagnosing Sarcopenia in Older Korean Adults: the Korean Frailty and Aging Cohort Study (KFACS). Journal of Korean medical science 2018;33(20):e151.
26. Kawakami R, Murakami H, Sanada K, et al. Calf circumference as a surrogate marker of muscle mass for diagnosing sarcopenia in Japanese men and women. Geriatr Gerontol Int 2015;15(8):969-976.
27. Knäuper B, Carrière K, Chamandy M, Xu Z, Schwarz N, Rosen NO. How aging affects self-reports. Eur J Ageing 2016;13(2):185-193.