Challenges of Defining Sarcopenia: Status Report of the EUGMS Working Group on Sarcopenia

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Breakdown of muscle, bone, and fat are characteristic features of cachexia, sarcopenia, frailty, and starvation. These are overlapping conditions with unclear distinctions. The progressive decline of lean body mass leads to decreased mobility, impaired functionality, metabolic disturbances, and ultimately to death. In order to foster the understanding of sarcopenia and to develop treatment options, an operational definition of sarcopenia for both research and clinical practice is urgently needed.

For this purpose, the European Geriatric Medicine Society (EUGMS) has gathered a group of international experts in the field of geriatrics and nutrition (ie, the European Sarcopenia Working Group [ESWG]). Other European scientific organizations, such as the European Society of Clinical Nutrition and Metabolism (ESPEN), the International Academy of Nutrition and Aging (IANA), and the International Association of Gerontology and Geriatrics—European Region (IAGG-ER), have nominated representatives to the group.

The ESWG addresses the following questions:

- What is sarcopenia?
- Which items will define sarcopenia?
- What are the planned measurements of these items?

• How does sarcopenia relate to other diseases/conditions?

Definition of Sarcopenia

In 1989, Irwin Rosenberg proposed the term sarcopenia (Greek sarx or flesh + penia or loss) to describe the age-related decrease of muscle mass.[1] Sarcopenia has become a strong concept, but it still needs dissemination into public awareness, as well as into medical practice. The ESWG defines sarcopenia as a "syndrome characterized by progressive loss of muscle mass and strength with a risk of adverse outcomes." It is moreover defined as a geriatric syndrome (ie, a condition that is common, complex, and a costly state of impaired health in older individuals).[2] Geriatric syndromes result from incompletely understood interactions of disease and age on multiple systems, producing a constellation of signs and symptoms. Delirium, falls, and incontinence are other examples of geriatric syndromes.

Discussion is ongoing about whether to restrict the definition of sarcopenia to mere age-related muscle wasting, and thus to distinguish sarcopenia from the muscle wasting that occurs with disease (cachexia), physical inactivity, bed rest, and starvation.[3,4] Alternatively, sarcopenia could serve as an umbrella concept including all forms of muscle wasting (Fig 1). So far, studies that have reported on prevalence of sarcopenia use muscle mass alone as the determinant. None distinguish the etiology of muscle wasting, mainly because of the probable fact that it is impossible to clearly separate the individual etiologic contributions to muscle wasting. This would argue for the use of sarcopenia as an umbrella concept. Moreover, if sarcopenia is viewed as an age-related phenomenon alone, the concept will mainly become an issue for gerontologists with relevance primarily for public health measures. Sarcopenia as an umbrella concept for all muscle wasting would enable sarcopenia to serve as a tool for physicians to use in clinical care.

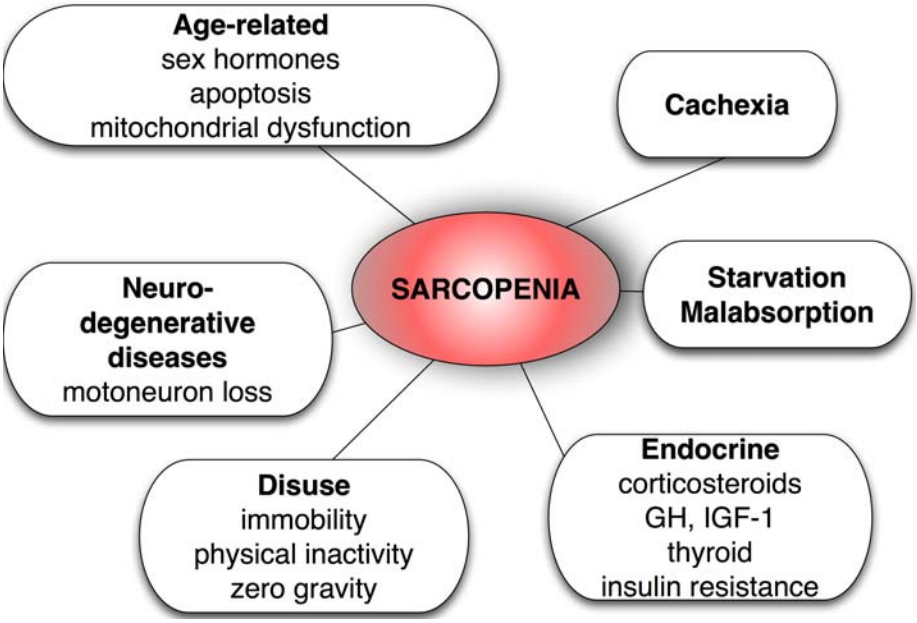

Fig 1. Sarcopenia as an umbrella concept with multiple etiologies.[5]
GH=growth hormone, IGH-1=insulin-like growth factor 1

Items That Define Sarcopenia

Current definitions rest on muscle mass determinations. Mainly T-score definitions are used (eg, absolute muscle mass less than two standard deviations [SD] below the mean for healthy young men and women are used as cutoff).[6] The skeletal muscle mass index (SMI) (ie, skeletal muscle mass/body mass x 100) is suggested, where class I sarcopenia is defined as SMI within 1 to 2 SD of young adults, and class II sarcopenia as SMI <2 SD of young adults.[7] Schutz et al suggested the fat-free mass index (ie, fat-free mass/height^2 <median of a reference population).[8]

The ESWG recommends an extension from muscle mass alone as the basis for the diagnosis. The alternative is to combine low muscle mass plus low muscle function (strength or performance)

for the diagnosis. A suggestion is to use a diagnosis based on documentation of any two of the three criteria—low muscle mass, low muscle strength, or low physical performance. The Special Interest Group of Nutrition in Geriatrics of ESPEN recently adopted the combination of reduced muscle mass ≥2 SD below mean of percentage of muscle mass in young adults (in National Health and Nutrition Examination Survey [NHANES]) plus impaired muscle function as evidenced by 4-meter (m) walking speed of <0.8 m/second.

Measurement of Sarcopenia

Muscle mass is measured by computed tomography (CT) scan, magnetic resonance imaging (MRI), dual energy X-ray absorptiometry (DEXA), and bioimpedance analysis. For measurement of muscle strength, lower limbs are perhaps more relevant than upper limbs for gait and physical function. However, handgrip strength is widely used and is well correlated with most relevant outcomes. A wide range of tests of physical performance are available. The short physical performance battery (SPPB) evaluates balance, gait, strength, and endurance.[9] The SPPB recently was recommended by an international working group for use in clinical trials in frail older persons.[10] Usual gait speed may serve as an easier measurement and give enough information,[11] at least in the clinical setting. Further alternatives for potential measurement options, including the Timed-Up-and-Go Test, are described in the Table below.

Table. Measurements of Sarcopenia

Dimension	Research	Clinical Practice

Muscle mass	Anthropometry CT MRI Potassium DEXA BIA	Anthropometry Bioelectrical impedance analysis (BIA) DEXA
Muscle strength	Handgrip strength Knee flexion/extension (1RM) Peak expiratory flow	Handgrip strength Peak expiratory flow
Physical performance	SPPB Gait speed 6-minute walk Stair climbing Timed Up and Go	SPPB Gait speed Timed Up and Go

Sarcopenia Subcategories and Staging

The ESWG has discussed possible subclassification and staging of sarcopenia. Because a single cause of sarcopenia is sometimes identified, whereas otherwise no evident cause is isolated, the categories of primary and secondary sarcopenia sometimes are useful. Sarcopenia is considered primary (or age-related) when no other cause is evident but aging itself, while sarcopenia is considered secondary when one or more causes are readily identified, such as disuse-related sarcopenia, disease-related sarcopenia, or starvation-related sarcopenia.

Sarcopenia staging (ie, determining the severity of the condition) also is discussed. A suggestion is to use the stages mild, moderate, and severe, or an alternative terminology of latent, preclinical, and clinical sarcopenia. These are issues that the coming work of the ESWG will solve and present in a consensus report.

Research Areas

The ESWG has indicated several areas of research for the development of the sarcopenia concept. Examples are definition of reference populations for mass, strength, and performance; longitudinal and cross-sectional studies of risk factors and associated conditions; new target populations such as post acute, nursing home, and sarcopenic obese individuals; and new validated diagnostic tools and standardization of some instruments.

As main outcome measures in intervention trials, physical performance (SPPB, gait speed) sometimes is advocated.[10] Secondary outcome measures include strength (handgrip, knee flexion), mass (DXA, CT, MRI), activities of daily living (basic, instrumental), quality of life, and mortality.

Suggested Screening Strategy

The ESWG may suggest gait speed measurement as the easiest and most reliable way to begin sarcopenia screening in practice (Fig 2). A cutoff of less than 0.8 m/second would identify risk for sarcopenia.[10,12] Coming work will settle these questions.

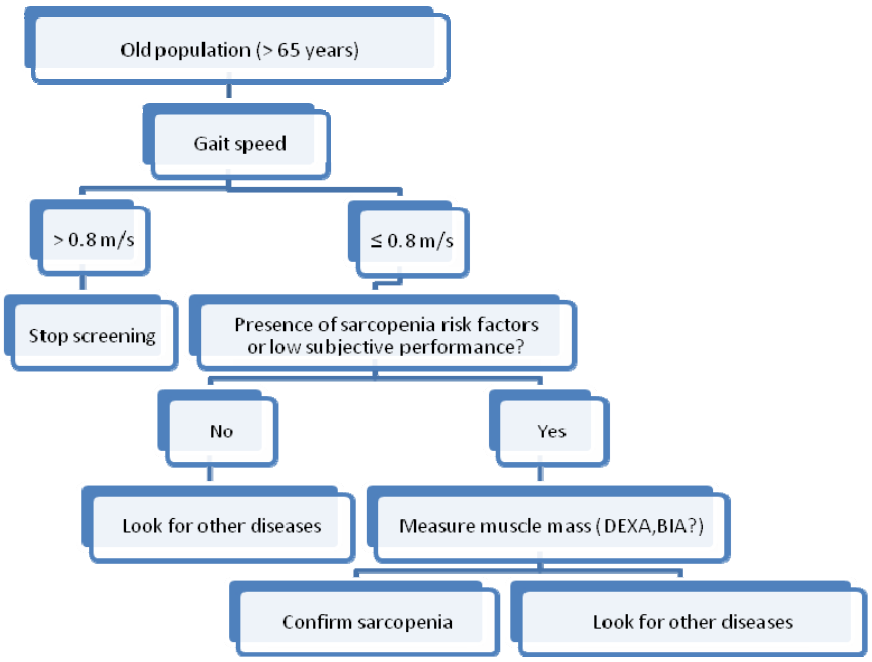

Fig 2. ESWG algorithm for sarcopenia screening in older individuals.

Conclusion

The reported suggestion is the result of two 2-day seminars during the spring of 2009. The schedule is to have one more seminar and finalize the conclusions by early fall 2009, draft a consensus paper, and have it endorsed by the supporting scientific organizations before submission of the manuscript prior to the end of 2009.

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Cederholm

Q & A

Q: I like the framework. The problem is the term "sarcopenia." Sarcopenia has been used in multiple studies to look at muscle mass. It is hard to take a term that is in everybody's mind as one thing and change it to another thing without confusing people.

Perhaps you should consider using another term. The newer term "dynapenia" may better fit what you are defining, because what you are defining is a change in strength and power. And you are close to defining frailty. In fact, I could take your definition and call it frailty, and very few people would disagree. So you are no longer defining sarcopenia, because you are now taking executive function into account. Once you take everybody with dementia into account, you are going to have major problems.

In my opinion, you need to stick to muscle, because it is very important. It should extend way beyond just old age, and particularly ICU and hospitalized patients.

You have to step back and say, would we be better off leaving sarcopenia as loss of muscle mass? There is good literature for that. It is a step, but it is not what we are interested in. We are interested in strength and power. Use things that would define power. I would use stair climb, for instance. If you use gait speed, it has got to be 1 m/second and not <0.8 m/second, because I think all of the recent literature has said the cutoff is at 1 m at this stage.

It is easier to come up with a new term than to change what everybody believes sarcopenia is. Whether you use "dynapenia" or you come up with a great European term, I think that would

make a huge difference in the acceptability, certainly in the United States and most probably throughout the world.

Dr Cederholm: You can compare that to other processes of finding a feasible or acceptable definition. Discussion on improvement of osteoporosis has taken place, not only to go for bone mass, but to define osteoporosis.

Most of us acknowledge that this is actually a moving target and a process. I really do not share your thought in this way. Of course we have heard "dynapenia" suggested. "Myopenia" has been suggested. Sarcopenia is still a strong concept, and I think it would be acceptable to find a somewhat changed definition.

Q: You are misusing the etymology of the word, though, because sarcopenia is loss of tissue or loss of muscle mass. It has nothing to do with the other things, and it is really important to differentiate those.

We have heard many talks about how basically loss of muscle mass does not always equal loss of strength, does not always equal power. Tendons come in when you are starting to look at power, and I think you have got to be very careful not to lump these together because, as I say, once you lump them together, I think you have gone to frailty. You really need something to define the problems with muscle. I think you are going to struggle with "sarcopenia" as an acceptable term. It may happen, but it is going to cause confusion, and confusion is never good for a field.