Balneo Research Journal DOI: http://dx.doi.org/10.12680/balneo.2015.1082 Vol.6, No.1, February 2015

SARCOPENIA: DIAGNOSIS, STAGES AND TREATMENT

Pasca Luminita Aurelia[1 2], Dogaru Gabriela[1 3], Donca Valer[1 2]
1. "Iuliu Hatieganu" University of Medicine and Pharmacy Cluj-Napoca
2.Clinical Municipal Hospital Cluj-Napoca
3. Clinical Rehabilitation Hospital Cluj-Napoca

Abstract

Sarcopenia is defined as the age-related loss of skeletal muscle mass and decline of function. The causes of sarcopenia are multi-factorial. The diagnosis of sarcopenia should be considered in all older patients who present with declines in physical function, because of potential consequences for the development of frailty and disability. There are numerous techniques to assess muscle mass, muscle strength and physical performance. Treatment consists of nutritional (macro- and micronutrients) and physical activity (resistance exercise) regimens adapted to person. There is an emerging role for testosterone and anabolic steroids in severe sarcopenia.

Keywords: sarcopenia, muscle, aging, disability, frailty

Sarcopenia is a syndrome characterized by progressive and generalized loss of lean muscle and low muscle function, strength and/or physical performance with a risk of adverse outcomes such as physical disability, poor quality of life and death.

Sarcopenia is defined as a loss of muscle mass in older patients, by more than 2 SDs from the mean in younger adults. (1) It is known that sarcopenia can be considered for muscle, what osteoporosis is for bone.

Like osteopenia that predicts risk for a bone fracture, sarcopenia can be a powerful predictor of late-life disability.

Different methods of measurement and several cut-off points have been used by various epidemiological studies to establish the prevalence of sarcopenia. Apparently, it has a prevalence of 5 – 13% in persons aged 60 – 70 years and 11 – 50% in persons older than 80 years. In 2000, it was estimated that there were 600 million people aged >=60, a figure that will reach 1.2 billion by 2025 and 2 billion by 2050.

In 1931, Macdonald Critchley, neurologist at King`s College Hospital in London, noted muscle lost with aging process, especially at the level of intrinsic hand and foot muscles (2). Then in 1988, at a meeting in Albuquerque, New Mexico, Irwin Rosenberg proposed the term “sarcopenia” to describe this age-related decrease of muscle mass (3). While sarcopenia is mainly observed in older people, it can also develop in younger adults, as is likewise the case for dementia and osteoporosis. When it develops as a consequence of old age alone it is considered primary sarcopenia because over the age, from 20 to 80 years of age, there is approximately a 30% reduction in muscle mass and a decline in cross-selectional area about 20% (4). When other additional causes lead to its development it is termed secondary sarcopenia. Many of these additional factors tend to cluster, thus the etiology may be considered to be multi-factorial in older people. Factors such as neuro-degenerative diseases, physical inactivity, endocrine dysfunction, inadequate nutrition, drug treatments, chronic diseases, and inflammation can be involved.

Staging for sarcopenia is based on severity, leading hence to a clinical guideline to the management of the condition. The European Working Group for the Study of Sarcopenia in Older People (EWGSOP) suggests a conceptual staging as ‘presarcopenia’, ‘sarcopenia’, and ‘severe sarcopenia’. Various tests were performed on individuals, leading to the establishment of

stages for sarcopenia, which may help in selecting better treatments and evaluation protocols.

While the "presarcopenia" stage is characterized by low muscle mass without impact on muscle strength or physical performance, the "sarcopenia" stage can have low muscle mass plus one of either low muscle strength or low performance and "severe sarcopenia" is comprised of all of these elements (5)

In elderly people, sarcopenia is common in other syndromes associated with muscle wasting like cachexia, frailty syndrome and sarcopenic obesity.

Cachexia was defined as a complex metabolic syndrome characterized by loss of muscle mass with or without loss of fat mass, frequent in elders with severe pathology such as cancer, congestive cardiomyopathy and end-stage renal disease.

Despite of implication of inflammation, insulin resistance and anorexia with decreases in muscle protein, sarcopenia can be only a part of cachexia, but the two conditions are not one and the same. (6)

Frailty is a geriatric syndrome resulting from age-related cumulative declines across multiple physiologic systems, characterized by unintended weight loss, fatigue, exhaustion, slow gait speed and low physical activity. Sarcopenia and frailty overlap, because the inability to develop adequate muscle power is one of the causes of frailty. While not all patients with sarcopenia are frail, sarcopenia may sometimes lead to frailty (7). The general concept of frailty refers not only to physical, but to psychological and social dimensions, including cognitive status, social support and other environmental factors. (8)

Sarcopenia is commonly associated with infiltration of fat into the muscle (sarcopenic obese) in conditions such as malignancy, rheumatoid arthritis and aging, because lean body mass is lost while fat mass may be preserved or even increased. (9)

In general, intramuscular and visceral fat increase with aging, while subcutaneous fat declines. The adipose tissue accumulation around and between muscle fibers occurs concomitantly with reductions in muscle cross-sectional area. Changes in muscle composition or fat infiltration lower muscle quality and physical performance. (10)

There are numerous biomarkers – biological, functional and imaging-related - that could be used in the evaluation of sarcopenia. The most common biological markers of sarcopenia are inflammatory, such as C-reactive protein, Interleukin-6 and tumor necrosis factor-alfa; clinical parameters like hemoglobin, serum albumin, urinary creatinine, hormones (dehydroepiandrosterone sulfate, testosterone, insulin-like growth factor-1), vitamin D, products of oxidative damage and antioxidants (carotenoids, alfa-tocopherol). (11) Quantitative assenssment of sarcopenia could be performed with techniques that assess muscle mass, muscle strength and physical performance in clinical practice or for research.

Clinically, dual energy X-ray absorptiometry (DXA) or bioimpedance analysis (BIA) appear to be the best measures of sarcopenia.

DXA is the most commonly used imaging technique, an attractive alternative method both for research and for clinical use to distinguish fat, bone, and lean tissues. The radiation exposure associated with DXA is low and highly acceptable. BIA estimates the volume of fat and lean body mass, and it is popular, very simple, inexpensive, easy to use and appropriate for both ambulatory and bedridden patients, but its results are far from being accurate. The BIA results can be easily altered by fluid retention and health status in general, so the Society of Sarcopenia, Cachexia and Wasting Disorders has discouraged the use of BIA for the assessment of sarcopenia (12). Also computed tomography (CT scan), magnetic resonance imaging (MRI) are gold standard

for estimating muscle mass or lean body mass.

CT accurately measures a direct physical property of the muscle like cross-sectional area and volume and assesses muscle density; the radiation exposure associated with this technique is higher than with DXA.

The lack of radiation exposure makes magnetic resonance imaging technique the method of choice for the study of sarcopenia. The major limitations of this methodology are complexity and higher costs and the inability to use it for patients with older models of implanted metal devices like joint prostheses, pace-makers and for patients who are extremely obese.

One of the most recently developed noninvasive and painless techniques which might find larger application for the evaluation of sarcopenia is electrical impedance myography (EIM), which detects changes in the conductivity and permittivity of skeletal muscle caused by alterations in muscle composition and structure.

There are fewer well-validated techniques to measure muscle strength. Isometric hand grip strength is strongly related with lower extremity muscle power, knee extension torque and calf cross-sectional muscle area (13). Low handgrip strength is a clinical marker of poor mobility and a better predictor of clinical outcomes than low muscle mass. In practice there is a linear relationship between baseline handgrip strength and incident disability for activities of daily living (ADL) (14). Knee flexion techniques are suitable for research studies, but their use in clinical practice is limited by the need for special equipment and training.

In people without lung disorders, peak expiratory flow (PEF) is determined by the strength of respiratory muscle.

Some of the tests of physical performance, used for research and clinical practice are Short Physical Performance Battery (SPPB), usual gait speed, the 6-minutes walk test and the stair climb power test.

Some of the recent, more promising treatments for sarcopenia have been shown to be nutritional therapies, androgen therapy and physical activity amongst other behavioral and pharmacological strategies. Significant improvements were observed following nutritional interventions. A rate of 0.8 g/kg/day is recommended for daily protein consumption. For older people with higher risks of malnutrition and significant comorbidities the rate can be adjusted to 0.8 – 1.2 g/kg/day (15). Also, to maintain proper muscle function it is recommended to provide an adequate vitamin D supply. Nutrients that contain an adequate amount of vitamin D are fatty fish or liver. However they need to be supplemented with 700 – 800 IU/day of vitamin D for an optimal intake (16). Vitamin C and E, and other micronutrient-containing (selen, zinc) foods have an anti-oxidant role, and should be added to the diet in order to decrease oxidative damage, and thus reduce functional decline. In order to take advantage of their anti-inflammatory properties, omega3-polyunsatured fatty acid containing foods, such as walnuts, rapeseed or soy oil and fatty sea-fish should be consumed.

Testosterone in low doses has been shown to increase muscle mass, and at higher doses it also provides for additional muscle strength (17); when added to the treatment plan of frailer individuals, testosterone reduces the rate of mortality when compared to placebo. (18) The management of sarcopenia can properly be conducted with resistance exercise and an adequate protein intake. The former, when performed two, three times weekly, will improve gait speed, climbing stairs, timed get-up-and-go and overall muscle strength in older people (19).

Sarcopenia represents a major cause of disability and increased health cost in elders. It occurs frequently but like most geriatric syndromes it is rarely recognized

by physicians. Clinicians should also consider sarcopenia in patients who present with difficulties in performing activities of daily living, have a history of recurrent falls or have chronic conditions associated with muscle loss like type 2 diabetes, chronic heart failure, COPD, rheumatoid arthritis (20).

References

1.Morley JE. Sarcopenia: diagnosis and treatment. J Nutr Health Aging 2008;12:452-6

2.Critchley M. The neurology of old age. Lancet. 1931;1:1221-30

3.Rosenberg IH. Sarcopenia: origins and clinical relevance. J Nutr.1997;127:990S-IS

4.Frontera WR, Huges VA, Fielding RA, et al. Aging of skeletal muscle: a 12-yr longitudinal study. Journal of Applied Physiology.2000; 88(4):1321-6 [PubMed:10749826]

5.Sarcopenia: European consensus on definition and diagnosis, Report of the European Working Group on Sarcopenia in Older People. Age and Aging 2010;39:414

6.Evans WJ, Morley JE, Argiles J et al. Cachexia: a new definition. Clin Nutr 2008; 27:793-9

7.Morley JE, Kim MJ, Haren MT, Kevorkian R, Blanks WA. Frailty and the aging male. Aging Male. 2005;8:135-40

8.Bauer JM, Sieber CC. Sarcopenia and frailty: a clinician's controversial point of view. Exp Gerontol 2008; 43:674-8)

9.Prado CM, Lieffers JR, Mc Cargar LJ et al. Prevalence and clinical implications of sarcopenic obesity in patients with solid tumours of the respiratory and gastrointestinal tracts: a population-based study. Lancet Oncol 2008; 9:629-35

10.Visser M, Kritchevsky SB, Goodpaster BH et al. Leg muscle mass and composition in relation to lower extremity performance in men and women aged 70 to 79: the health, aging and body composition study. J Am Geriatr Soc 2002; 50:897-904

11.Matteo Cesari, Roger A. Fielding, Marco Pahor, Bret Goodpastern et al. Biomarkers of sarcopenia in clinical trials-recommendations from the International Working Group on Sarcopenia. J CaChexia Sarcopenia Muscle 2012;3:184-186

12.Morley JE, Abbatecola AM, Argiles JM, Baracos V, Bauer J, Bhasin S, et al. Sarcopenia with limited mobility: an international consensus. J. Am Med Dir Assoc.2011;12:403-9

13.Laurentani F, Russo C, Bandinelli S et al. Age-associated changes in skeletal muscles and their effect on mobility: an operational diagnosis of sarcopenia. J Appl Physiol 2003; 95:1851-60

14.Al Snih S, Markides K, Ottenbacher K et al. Hand grip strength and incident ADL disability in elderly Mexican Americans over a seven-year period. Aging Clin Exp Res.2004; 16:481-6

15.Volkert D. The role of nutrition in the prevention of sarcopenia. Wien Med Wochenschr (2011) 161/17-18:413

16.Bischoff-Ferrari HA, Dawson-Hughes B, Staehelin HB, et al. Fall prevention with supplemental and active forms of vitamin D: a meta-analysis of randomized controlled trials. BMJ, 339: b3692, 2009.

17.Wang C, Nieschlag E, Swerdloff R et al. Investigation, treatment and monitoring of late-onset hypogonadism in males: ISA, ISSAM, EAU, EAA and ASA recommendations. Eur J Endocrinol 2008; 159:507-14

18.Morley JE. Weight loss in older persons: new therapeutic approaches. Curr Pharm Des 2007;13:3637-47

19.Liu CJ, Latham NK. Progressive resistance strength training for improving physical function in older adults. Cochrane Database Syst Rev. 2009; 3: CD002759

20.International Working Group on Sarcopenia. Sarcopenia: an undiagnosed condition in older adults. Current Consensus Definition: Prevalence, Etiology and Consequences. J Am Med Dir Assoc. 2011; 12(4): 249-256.