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International Journal of Geriatrics and Gerontology

Review Article

Aryana IGPS. Int J GeriatrGerontol: IJGG-109.
DOI: 10.29011/IJGG-109. 180009

Sarcopenia in Elderly

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Citation: Aryana IGPS, Kuswardhani RAT (2018) Sarcopenia in Elderly. Int J GeriatrGerontol: IJGG-109. DOI: 10.29011/IJGG-109. 180009

Received Date: 22 February, 2018; **Accepted Date:** 27 February, 2018; **Published Date:** 8 March, 2018

Abstract

Aging process will lead to progressive decline skeletal muscle mass, muscle strength and muscle function. Sarcopenia was introduced by Irwin Rosenberg in 1989 to describe the decline in muscle mass due to aging process. Sarcopenia is one of geriatric syndrome, it is caused by multifactorial and allows it to be prevented. Sarcopenia defines a syndrome with characteristics of progressive and generalized decrease of skeletal muscle mass and muscle strength accompanied by the risk of disability and decreasing quality of life and death. Prevalence of sarcopenia was increase by age, 60-70 years report 5-13%, >80 years was 11-50%. There are several mechanisms of various diseases and pathogenesis: age-related, endocrine problem, neuro-degenerative disease, disuse, inadequate nutrition and cachexia condition. Diagnosis will be confirmed if low muscle mass ad with minimal one of muscle strength and muscle function. Management sarcopenia should be comprehensive including exercise/physical activity, nutrition, testosterone, estrogen, growth hormone, Vitamin D, and ACE inhibitor. The important management were exercise and nutrition, other pharmacotherapy and hormonal therapy still need more excellence study, for future consideration.

Keywords: Elderly; Muscle; Geriatric syndrome; Sarcopenia

Introduction

The aging process will lead to a progressive decline of the skeletal muscle which will decrease the strength and function of the muscle. In 1989 Irwin Rosenberg has introduced the term "sarcopenia" to describe the decline in muscle mass due to the aging process. The origin of the word sarcopenia is Sarx/flesh and penia /loss [1]. The use of this term for clinical practice and research is still very rare. The geriatric syndrome is a term often used for age-related declines in general, complex and requiring special treatment. The geriatric syndrome is the result of complex interactions that have not been fully understood. Interactions occur between several diseases, systems, and pathogenesis that result in the appearance of certain symptoms and signs. Sarcopenia is very rational when included as one of the geriatric syndromes because it is caused by a multi factorial and its appearance allows it to be prevented [2].

Based on the European Working Group on Sarcopenia in Older People (EWGSOP) defines the definition of sarcopenia: a syndrome with characteristics of progressive and generalized decrease of skeletal muscle mass and muscle strength accompanied by the risk of disabling, decreasing quality of life and death [3]. The data in Europe show that the prevalence of sarcopenia between the ages of 60-70 years is reported 5-13%. This number increased sharply at age> 80 years that is between 11-50%. The ≥60 year's old population in the world is around 600 million in 2000 so it can be estimated that about 50 million suffer from sarcopenia. In Indonesia, which has a large population and an increasingly elderly population will also face great sarcasm. Moreover, the protein diet of Indonesians compared with other countries is much lower will further increase the incidence of sarcopenia [3,4].

Mechanism of Sarcopenia

There are several mechanisms underlying the mechanisms of various diseases and pathogenesis. Mechanisms include impaired protein synthesis, proteolysis, neuromuscular integrity, and muscle fat content [5].

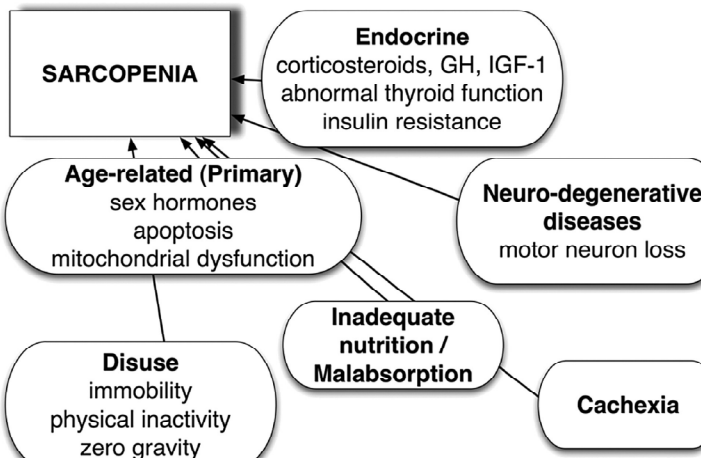

Figure 1: Mechanism of sarcopenia [6].

Diagnosis and Classification

The diagnostic criteria of sarcopenia are: 1. Decreased muscle mass2. Determination of muscle strength 3. Decreased ability of physical activity Diagnosis is confirmed if there is criterion 1 plus criterion 2 or 3. Sarcopenia based on the cause is divided into 2, namely primary and secondary as seen in (Table 2), while based on the stadium is divided into 3 as shown in (Table 1) [6].

Primary sarcopenia Age-related sarcopenia	No other cause evident except ageing
Secondary sarcopenia Activity-related sarcopenia	Can result from bed rest, sedentary lifestyle, deconditioning or zero-gravity conditions
Disease-related sarcopenia	Associated with advanced organ failure (heart, lung, liver, kidney, brain), inflammatory disease, malignancy or endocrine disease
Nutrition-related sarcopenia	Results from inadequate dietary intake of energy and/or protein, as with malabsorption, gastrointestinal disorders or use of medications that cause anorexia

Table 1: Category of sarcopenia by cause [6].

Stadium	Muscle mass	Muscle strength	Performance
Presarcopenia	Decreased	-	-
Sarcopenia	Decreased	Decreased or	Decreased
Severe sarcopenia	Decreased	Decreased	Decreased

Table 2: Stadium Sarcopenia [6].

Measurement Techniques

The measurement parameters of sarcopenia should measure muscle mass and muscle function. The measurement will consist of measurement of muscle mass, muscle strength and muscle function (physical performance). Experts still find it difficult to get a normal score or cut off and determine the best inspection techniques to get the most accurate results. Some techniques that can be used can be seen in (Table 3) [5].

Variable	Research	Clinical practice
Muscle mass	Computed tomography (CT)	
	Magnetic resonance imaging (MRI)	BIA
	Dual energy X-ray absorptiometry (DXA)	DXA
	Anthropometry	Anthropometry
	Bioimpedance analysis (BIA)	
	Total or partial body potassium per fat-free soft tissue	
Muscle strength	Handgrip strength	Handgrip strength
	Knee flexion/extension	
	Peak expiratory flow	
Physical performance	Short Physical Performance Battery (SPPB)	SPPB
	Usual gait speed	Usual gait speed
	Timed get-up-and-go test	Get-up-and-go test
	Stair climb power test	

Table 3: Measurement of muscle mass, muscle strength and muscle function in clinical and practical research.

Measurement of muscle mass or lean body mass with body imaging with CT and MRI is a standard gold measure but more expensive. The use of BIA is very cheap and easy to do because it can be taken anywhere. But the accuracy of the results is still below the standard. The anthropometric examination is also very easy to do but it is not advisable to diagnose sarcopenia because of its very high error rate [4].

Measurement of muscle strength by using handgrip strength is good enough. Studies show this examination has a good correlation with inferior limb strength, mobility and Activities Daily Living (ADL). Handgrip Strength is a simple check so it is good for both clinical and research practice. Examination of knee

flexion/extension as well as handgrip only this examination requires equipment and training first, so it is less well used for practical clinical. Peak Expiratory Flow (PEF) is excellent for measuring respiratory muscle strength but cannot be used to measure overall muscle strength [3].

Physical performance examination is the examination of the muscle function by performing physical activity. All such checks in Table 3 are simple and easy to do. Inspection with SPPB is a standard check for physical performance. But the stair climb power test is only used for research only [3].

The flow used by EWGSOP to diagnose sarcopenia is as shown in (Figure 2) below.

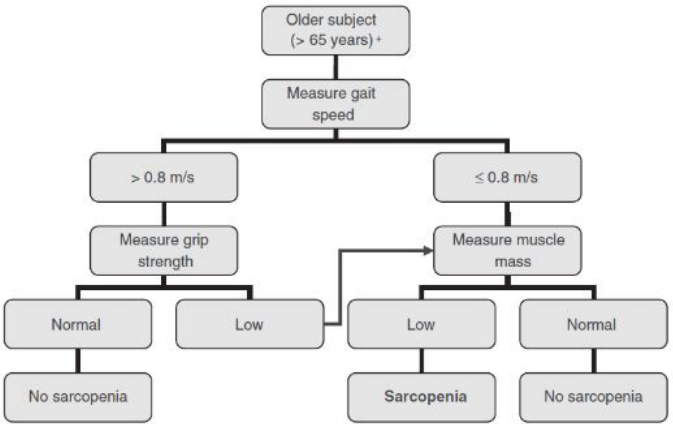

Figure 2: Algorithm of sarcopenia [3].

The first examination is done is the ability of physical activity (physical performance) after that just done the examination of muscle strength and muscle mass.

Management

Exercise and Physical Activity

Physical activity is indispensable in the management of sarcopenia. The type of exercise and physical activity required is aerobic such as swimming, walking or running. This can increase muscle mass and muscle strength. Unused muscle will be atrophy and vice versa. Progressive Resistance Training (PRT) is a gradual and consistent exercise that has been proven to improve the function of muscles (physical performance) both ability to walk, up and go test, and ability to climb stairs. The PRT program is also safe for elderly patients with various comorbid diseases as it can be done gradually according to the patient's ability [5].

Nutrition

Many elderly patients can not adhere to an adequate protein diet. Dietary protein is the key to the occurrence of sarcopenia. The recommended diet for healthy people is 0.8 grams / kgBB / day (RDA = recommended diet allowance). In the elderly age> 70 years 40% protein diet less than the RDA. This will facilitate the occurrence of sarcopenia. In elderly patients with recommended minimum dietary sarcopenia is in accordance with the RDA (0.8) and will be increased to be 1-1.5 g / kgBB / day in accordance with increased physical activity and comorbid that exist. Muscle formation in addition to exercise requires adequate protein intake. Adequate protein diets and exercise are the main therapies in the management of sarcopenia [5].

Testosterone

Testosterone produced by leydig cells in men and thecal ovarian in women will decrease as a result of the aging process. Testosterone is instrumental in forming muscle mass and protein synthesis in muscles. The concentration of Sex Hormone Binding Globulin (SHBG) that binds testosterone in the blood increases with age so that free testosterone levels become smaller. Testosterone therapy in some studies has been shown to improve sarcopyrogenic but the results are varied. Important things to consider in testosterone therapy are the risk of prostate cancer and other side effects such as fluid retention, gynecomastia, polycythemia, and sleep apnea [7].

Estrogen

Decreased estrogen also plays a major role in the occurrence of sarcopenia. Hormone Replacement Therapy (HRT) in women for sarcopenia is still controversial. HRT with estrogen in sarcopenia can only increase muscle mass not yet optimal results to improve muscle function (physical performance). The most important risk that is feared in the use of HRT estrogen is breast cancer that until now has not been tested [7].

Growth Hormone

Growth hormone (GH) can maintain muscle and bone mass. The role of GH is to stimulate the secretion of IGF 1 as an anabolic hormone from the liver that stimulates the production of muscle cell muscle and muscle protein contractile. GH supplement therapy is still debated. The expected effect is not yet optimal. Side effects are also high, such as fluid retention, gynecomastia, orthostatic hypotension and carpal tunnel syndrome [7].

Vitamin D

Levels of vitamin D in the elderly decreased up to 4 times lower compared with adult age. Vitamin D plays a role in muscle and bone metabolism. Vitamin D will bind to the Vitamin D receptor in muscle causing protein synthesis and increased calcium uptake through cell membranes. Low levels of vitamin D are associated with the occurrence of muscle atrophy to facilitate the occurrence of sarcopenia. Low Vitamin D levels are often also associated with muscle weakness with general weakness symptoms in elderly. But vitamin D supplementation therapy to improve physical performance is also still not consistent. Things to watch out for in

vitamin D supplements are the occurrence of nephrolithiasis and hypercalcaemia [5,7].

Angiotensin Converting Enzyme Inhibitor (ACE-inhibitor)

Treatment using ACE inhibitors has long been recognized as both primary and secondary prevention of cardiovascular events and stroke. ACE-inhibitor therapy is currently also useful for musculoskeletal. The mechanism of beneficial effects of ACE-inhibitors on musculoskeletal through several mechanisms such as anti-inflammatory effects, endothelial function improvements and angiogenesis effects improves muscle circulation (Figure 3).

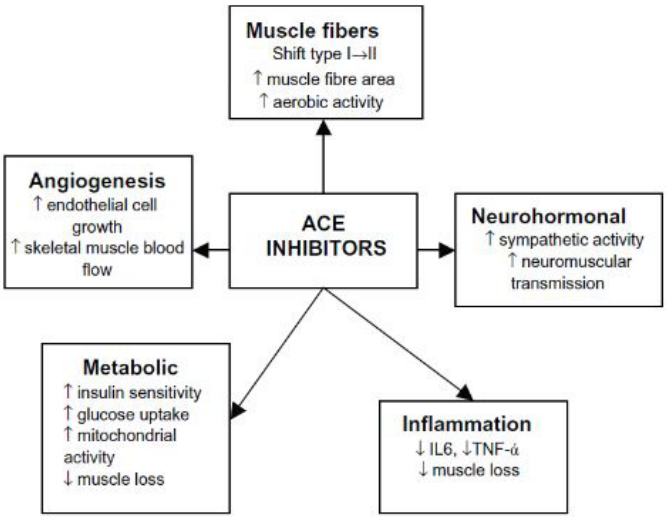

Figure 3: Effects of ACE-inhibitors on the musculoskeletal [7].

Few studies have been conducted to determine the effect of ACE-inhibitors on musculoskeletal so that more and larger studies are needed to prove the most promising effect seen in the above mechanism. Other future therapies include myostatin inhibitors, Peroxisome-Proliferator-Activated Receptor-δ (PPAR-δ) and Adenosine Monophosphate (AMP) -activated protein kinase. Myostatin interferes with GH in the muscles to facilitate the occurrence of atrophy and sarcopenia. Giving follistatin (myostatin antagonist) will be able to increase protein synthesis in muscle and increase muscle mass. This therapy is very potential for sarcopenia but still needs further research. PPAR- δ and AMP-activated protein kinase are proteins that regulate metabolism and muscle contraction. Giving agonist PPAR- δ and AMP-activated protein kinase can improve physical ability and exercise but this is still in animal experiments only [7].

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