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Sarcopenia as a problem of old age - a form of rehabilitation

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Abstract:

Background: Sarcopenia as a disease has relatively recently become the object of research and the work of the academic community. Despite this, sarcopenia is an increasingly serious social problem, it can be seen in a large number of statistics and epidemiological studies. Among geriatric patients, along with their multiformity and the associated use of a large amount of medicines, it causes many negative effects related to the functioning of the whole organism as well as the quality of life of the patient himself.

Material and methods: Analysis of available literature, articles in the Google Scholar and PubMed database using keywords: sarcopenia, geriatrics, rehabilitation, loss of muscle mass.

Results: Among the studies and recommendations concerning sarcopenia, a continuous lack of clear, transparent and confirmed diagnostic criteria can be stated. At the diagnosis of this disease, an X-ray or a bioelectrical impedance analysis is used. Other methods used are functional tests, including a six-minute walk test or "Timed-Up and Go" test (TUG). In the case of rehabilitation of people with sarcopenia, the most effective form of kinesitherapy is

individually selected resistive training, which has a positive effect not only on muscle mass growth, but also the body's protein metabolism and the improvement of the endocrine system. Physiotherapy is the most commonly used method of physical therapy, among other methods of rehabilitation there are also therapeutic massage, aqua aerobics, vibratory training, and Nordic Walking and diet supplementation.

Conclusions: Sarcopenia in geriatric patients, especially with ineffective treatment and rehabilitation, has a destructive impact on both the physical and mental sphere of the patient. There is a great need for more extensive research, both on the whole disease process and the effectiveness of forms of assistance to patients.

Key words: sarcopenia, geriatrics, rehabilitation, loss of muscle mass

Introduction

The problem of population aging affects many countries, including Poland. According to current forecasts until 2050, people over 65 will constitute 1/3 of our country's population. Moreover, it is estimated that the pace of aging in Poland will be the fastest among EU countries [1].

The aging process is associated with the occurrence of numerous pathologies and diseases with which the phenomenon of polypharmacy, that is the patient's taking several drugs at the same time, is associated. In the body there is a loss of muscle mass, muscular atrophy and deterioration of function of organs and tissues. Unfavorable pathological phenomena occurring in the body lead to the limitation of physical fitness. Among diseases that impair the functioning of elderly people, sarcopenia is also mentioned in addition to dementia or depression. The European Working Group on Sarcopenia in Older Persons (EWGSOP) in spring 2010 developed the "European consensus on the definition and diagnosis of sarcopenia". This document raises the problem of defining sarcopenia, describes the causes of its formation and defines diagnostic methods. It is also a source of valuable advice on clinical practice [1,2,3,4].

It is estimated that the problem of sarcopenia can affect from several to several dozen percent of older people and increases with age. Loss of muscle mass characteristic for this disease increases the risk of injuries and falls, which makes functioning difficult. Deepening disability can lead to dependence of patients on family and loss of independence. This leads to deterioration of the patient's life comfort. In addition, sarcopenia can become one of the

elements of the weakness syndrome. A number of adverse events resulting from sarcopenia leads to more frequent hospitalizations, it also includes increased mortality. Prevention and treatment of this disease should be multidisciplinary. Physiotherapeutic activities play an important role in this process, which allows to maintain the greatest possible muscular strength and counteract adverse changes resulting from the disease [1,2,3].

Definition of Sarcopenia

Sarcopenia as a disease entity is not yet acceptable and uniform definition. Irwin Rosenberg proposed the first concept in 1989. He assumed that sarcopenia (sarx - "body" and penia - "loss") is an age-related decrease in muscle mass [5]. In 2010 The European Working Group on Sarcopenia in Older People – *EWGOSP* in its "*European consensus on the definition and diagnosis of sarcopenia*" determined that it is a syndrome characterized by progressive and generalized loss skeletal muscle mass and strength with the risk of adverse effects such as physical disability, poor quality of life and death [6]. However, it should be mentioned that the latest research suggests that two concepts should be defined separately: dynapenic and sarcopenia. Dynapenia is a reduction in muscle strength or, more broadly, a weakening of muscle function. It can overtake sarcopenia even for several years, and the loss of muscle mass itself does not have to cause a decrease in muscle strength, because it is influenced by many other factors associated with the neuromuscular system [7,8]. According to some, however, the concept of "sarcopenia" as a loss of muscle mass and strength with age is already so rooted that a change in its determination could cause misunderstandings in the scientific and clinical areas.

Problems associated with sarcopenia

In the aging process, muscle mass decreases faster in men, however, female gender is considered a risk factor for the development of sarcopenia [9]

Sarcopenia is a disease that has many related problems. Low physical activity, resulting from your own choice, as a result of an injury or illness, causes an increase in body fat and muscle atrophy from non-use. Sarcopenia is also accompanied by other diseases. rheumatoid arthritis is observed, advanced organ failure of the heart, lungs, liver, kidneys, brain. The use of drugs, for example, antibiotics leads to the disruption of processes in the body[2].

with age, the available alpha motor neurons and motor units are reduced, as a result of which motor coordination deteriorates, muscle fibers lose their ability to regenerate [34].

Sarcopenia is also accompanied by endocrine disorders. Cortisol accelerates the catabolism of the muscles, there is a decrease in the activity of growth hormone, there is hyperthyroidism, insulin resistance and obesity [2,10].

Nutrition is also an important issue. Improper nutrition, consumption of products of low nutritional value contributes to the development of sarcopenia and leads to the weakening of muscle and muscle strength and weight loss [2,33].

Diagnostics

Sarcopenia is a disease whose methods of diagnosis have changed over the last decade. During the diagnosis, attention is paid mainly to the assessment of skeletal muscle mass and strength. It is also necessary to examine the patient's physical fitness. In 2010, the EECSOP group proposed diagnostic criteria in which the objective criterion 1 was necessary to diagnose the disease and the criterion 2 or 3 was additionally proven. The criteria respectively mean: criterion 1 – lowered muscular mass, criterion 2 – reduced skeletal muscle contraction force, criterion 3 – decrease in mobility [11]. In the same year, recommendations were issued by the European Society for Clinical Nutrition and Metabolism Special Interest Groups (ESPEN SIG), which specified that only the low muscle mass and the walking speed down to below 0.8 m/s are sufficient to diagnose sarcopenia [12]. However, in 2018 the EECSOP group decided to change the diagnostic criteria. It was argued that it was a complex methodology to assess skeletal muscle strength. It is now emphasized that during diagnostics of sarcopenia more attention should be paid to assessing muscle strength, which is much easier to study [13].

The first element of diagnosis in previous criteria was the determination of skeletal muscle mass. For these purposes, imaging diagnostic methods that can distinguish muscle tissue from fat tissue were used. These methods include, for example, computed tomography, magnetic resonance imaging and dual energy X-ray absorptiometry. Each study had some drawbacks. The first two methods were quite expensive, and the computed tomography exposed the patient to radiation with high doses of X rays. In turn, densitometry, although a very accurate method, unfortunately had a very immobile apparatus, and the maximum body weight of the patient was limited to 130 kilograms. In 2018, at the meeting of the EECSOP group, it was concluded that there was no explicit recommendation regarding the study of muscle mass, nor was a specific cut-off point determined [13, 14,15].

Analyzing the 2010 criteria, after evaluating muscle mass, the skeletal muscle strength was assessed. This criterion from 2018 passed now the first place. Various techniques are used

to assess muscle strength. One of the tests is the isometric measurement of the strength of the hand grip. In this test, a standard hand-held gauge is used. Other ways to test muscular strength measure the power in a global way and relate to the physical fitness of the body. One of the tests recommended by the EECSOP group is Short Physical Performance Battery (SPPB). Components of physical activity are assessed, including muscular endurance and strength, gait and balance. The test consists of several parts and includes repeated 5 times getting up from the chair, balance test when standing with joined feet and overcoming a distance of 244 cm. The patient can receive from zero to four points for each stage [14,15]. Another recommended method to examine physical fitness is the assessment of the patient's own walking speed. The result of a 400-m walk test can be a prognosis for mobility disability or the need to use orthopedic equipment. The “Timed-Up and Go” test (TUG) also allows to assess the speed of the walk. The patient performs standing up from the sitting position, walking distance of 3 m from the seat, rotation, return and sitting back. Obtaining a time of 7 to 10 seconds is the correct result. For assessing the muscular strength of the lower limbs, a simple test including stairs climbing can be used, which can be created by each physiotherapist independently, depending on the hospital conditions and diagnostic needs [15,16].

Starting from 2018, in the diagnostic criteria, the EECSOP2 group proposed a new research algorithm, called F-A-C-S, meaning Find-Assess-Confirm-Severity Pathway. The point is to confirm the diagnosis of sarcopenia adequately and to examine low muscle quality using the DEXA (Dual-Energy X-ray Absorptiometry) or BIA method [13]. BIA is a simple, portable technique and what's important, highly acceptable to patients. The merit is also easiness of performing the analysis at the bedside of a patient who is bedridden and non-ambulant. BIA involves passing of a small AC electrical current through the body. The current is conducted by water in the body, so the impedance is inversely proportional to total water in the body, which makes it possible to calculate the total muscle mass. BIA does not require qualified staff. The other value is relatively inexpensiveness and no need to expose patients to radiation. BIA has a serious disadvantage in that muscle mass measurements may be distorted due to the hydration status and sometimes to the presence of edema. To avoid possible variability of the results, it is very essential that BIA measurements should be performed in a specific, standardized way [14,15,16].

In conclusion, the new EECSOP2 group guidelines make it easier to diagnose sarcopenia. The manual dynamometer is a simple, portable, cheap and easy-to-use device, while the muscle strength test, i.e. the test of getting up from the chair, is also uncompromised. The

new algorithm of diagnostic allows for the earlier diagnosis of the disease, therefore its promotion is important all over the world [13].

Epidemiology

The process of losing motor units is a natural result of aging. It starts around the age of 30, but it is slowly starting to about 50 years of age. In the next decades of life, however, you can observe the acceleration of this process. Muscle wasting is an unavoidable process even in physically active people. The frequency of sarcopenia which is defined according to the EEC SOP constitutes approximately 10% in the population of people between 60 and 70 years of age. In the population of people over 80, this value is over 50%. It is estimated that the problem described in the article currently affects over 50 million people in the world. The total mass of skeletal muscles in young people is about 45% of body weight and after 70 years of age it decreases to about 27%. With middle age, man loses about 1% of muscle mass annually. Between 3 and 8 decades of life, lean body mass decreases by 15-30%. Urinary creatinine excretion, which is a marker of muscle mass, is reduced by 50% between 20 and 90 years, which directly translates into serum creatinine and estimated glomerular filtration rate. In parallel, there is a reduction in muscle density and their periphery, and fat tissue increases. The process described above is the result of a decrease in the number of muscle fibers and a decrease in the percentage of muscle fiber type II from about 60% in young people to about 30% in the eighth decade of life. The decrease in muscle strength between 5 and 7 years of age is 30% and another 30% (20-40%) between the 7th and 8th decade of life, 50% or more - in the 9th decade of life [17,18].

Physical therapy in sarcopenia

The use of physical treatments requires knowledge of the body's response to a given stimulus. It is also important to observe how the patient reacts to the procedure - it is very important for older people. The body's response to physical treatments depends on the tissue, strength, mode of action and type of stimulus, duration of treatment, body surface and area of procedure [19]. Physical therapy treatments have been used in patients with sarcopenia.

According to the available literature, resistance training is the most effective way to fight sarcopenia [2]. Older people, for various reasons, do not devote the right amount of time to exercise, some do not engage in any physical activity. The solution can be the use of whole body WB-EMS electrostimulation in combination with simple exercises. It affects the speed of

muscle protein synthesis. This is an innovative method that allows one-time activation of 8-12 muscle groups. The intensity can be individually selected for the patient [2, 19]. In one study, the authors confirm the effectiveness of EMS for the whole body. The treatment allows you to increase muscle mass and is safe for older people with sarcopenia [2].

Kinesitherapy in sarcopenia

Physical activity in the fight against sarcopenia brings great results. This is frequent an intervention. Better results are obtained when exercises are performed in a group because the level of motivation and support increases. In addition, people who are active throughout their lives will be much less exposed to the emergence of sarcopenia [14].

Resistance exercises are crucial. It increases the synthesis of proteins and hormones that, if not functioning properly, can cause sarcopenia. Research has shown that progressive resistance exercises bring beneficial effects in the form of increased muscle strength even in seniors [20].

Aerobic exercises (swimming, running, walking) are also recommended for people struggling with sarcopenia. By performing this kind of effort, the synthesis of proteins is increased, thanks to which it is possible to maintain adequate muscle mass and strength or increase it. In addition, aerobic training increases the maximum aerobic power, as well as improving cardiorespiratory fitness. Endurance activity is increased by increasing frequency, duration and intensity [16]. Recent discoveries show that the best results can be obtained by using a regular training program that combines both resistance and endurance exercise.

During the use of resistance exercises, the main goal is the staged loading of muscles, which causes adaptation in the form of increased muscle strength, mass and muscle function. Due to the fact that sarcopenia very often affects the elderly, it is important to remember that physical activity is adjusted to age. This will allow you to eliminate or reduce the risk of injury. Important components of the resistance exercise program are the warm-up and cooling stages. For older people, they should last longer, ie warm up for 15-20 minutes, and cooling for 10-15 minutes, while the main part should take 20-45 minutes. Intensity is determined, among others, on the basis of the heart rate. According to ACMS, the intensity of training with resistance should be at the level of 65% -75%. It is important that the resistance movement takes place in its entirety. Such exercises can be performed 2-4 days a week, keeping in mind the minimum interval of 48 hours between individual trainings. During one training it is recommended to

perform 8-10 exercises and 8-12 repetitions of each one. Sometimes, however, it is necessary to change the above-described recommendations after confrontation with the state of health of the person, its illnesses or co-morbid diseases. It is important not to stop breathing. This is a common mistake [21].

Analysis of many training programs has shown that resistance training lasting 12-24 weeks, can lead to an increase in muscle strength by a minimum of 25% in both women and men over 50 years of age. In addition, after 15 weeks of exercise in people over 70 years of age, the risk of falls decreases [18].

It is proven that the training program for people struggling with sarcopenia should be multi-component and include: resistance, endurance, coordination, equivalent and stretching exercises. It is not advisable to use only one type of effort. The best results are achieved by combining individual forms of exercise. A good training of people with sarcopenia brings many benefits. There is an increase in muscle strength, improvement in efficiency and balance, as well as a reduction in the risk of falls, which is extremely important because sarcopenia most often affects the elderly. In addition, you can achieve a faster walk and improve the ability to climb up and down the stairs. As you can see, physical activity in the fight against sarcopenia brings many benefits, which ultimately affect a significant improvement in the quality of life of people [22].

Sarkopenia - other forms of rehabilitation.

In the course of rapid disease development, which is sarcopenia, the muscular strength of the organism is reduced. Muscle dysfunction leads to rapid fatigability, hindering functioning in everyday life and fulfilling basic social roles. Multidirectional rehabilitation is carried out in order to reduce onerous disease symptoms and improve the quality of life. To extend the range of treatment, in addition to basic physiotherapy, additional forms of rehabilitation are introduced, such as: therapeutic massage, aqua aerobics, vibratory training, Nordic Walking and diet supplementation [23,24]. Run on aqua aerobics, it is a combination of corrective gymnastics with aerobics and swimming elements. This form of rehabilitation has a lot of interest among the elderly, because it is a combination of physical therapy and good fun. The water environment positively affects both the physical and mental state of man [24,25].

When choosing the right type and intensity as well as the frequency of treatments, one should take into account the current state of health, the degree of physical fitness and the mental state of persons suffering from sarcopenia. It is important to take into account the functional

status of all body systems, and above all the respiratory and circulatory system. As a result of the weakening of physiological processes, the body may react undesirably even to the smallest stimuli, so all contraindications to perform a given procedure should be taken into account and an accurate interview should be carried out before starting the therapy [25,26].

Regular, everyday walks are also used to counteract progressing sarcopenia. Nordic Walking is recommended for its simplicity. Using poles in addition to stimulating the correct posture, allows you to ensure safety during marches on uneven surfaces, which contributes to reducing the risk of falls and injuries [27].

The massage has a great application in the treatment of geriatric patients. The most frequently used type is the so-called classic massage. The main goals of massage in sarcopenia is analgesic effect, improving blood supply, mobility in massaged joints and increase in muscle mass. Systematic massage has a positive effect on the regulation of sleep and the improvement of well-being. Before the first treatment, remember to adjust the appropriate intensity of stimuli. It is advisable to start with gentle treatments and then gradually increase the intensity. In order to get positive results, massage is recommended about 2-3 times a week [23,26].

One of the forms of rehabilitation enabling the improvement of muscular tone of the body is the use of vibration training - the so-called vibroterapii. The proven positive effect of vibration on the musculoskeletal system has its source in increasing muscle strength and increasing the content of myosin in muscle tissue. The advantage of using this method is ease of use and little time commitment of the patient [25].

Implementation of a properly selected diet and diet supplementation is a very important part in improving the health of people fighting sarcopenia. A balanced diet combined with correctly selected resistance training gives the best results. Applying about 20-30 grams of protein with each meal, gives the maximum effect stimulating the growth of muscle protein synthesis. Positive stimulating effects also have regular consumption of exogenous amino acids, eg leucine. Due to adverse effects of excessive caloric restriction (eg weakness, malaise, loss of muscle mass, osteoporosis), the diet should be properly balanced. Moderate calorie reduction, gives positive effects in counteracting the loss of muscle tissue [24].

Summary

In the aging process the body's ability to biosynthesis of proteins is decreasing. The predominance of catabolic processes over anabolic causes that the loss of muscle mass

progresses even faster in the elderly. Waste of muscle mass characteristic of sarcopenia results in weakness which in turn increases the risk of injuries, falls and may affect the balance and gait. This leads to increase the number of hospitalizations and decrease in the quality of life of patients affected by this disease. Therefore this disease poses a challenge to healthcare. Sarcopenia coexisting with other diseases causes worse prognosis, longer period of hospitalization and in some cases premature death. Due to the growing rate of aging of Polish society and other countries, sarcopenia which is a common geriatric disease should become a priority of the health care system. Early diagnosis and implementation of preventive measures can protect potential patients from the adverse effects of the disease, stay in hospitals, long-term rehabilitation and improve the quality of life of older people.

Discussion:

Sarcopenia is a term understood as loss of muscle mass and strength with age. It is a serious problem among older people due to the consequences that it brings. Among them are: weakness syndrome, body balance disorder, developing disability, increased risk of falls and decreased ability to perform daily activities. Sarcopenia occurs in about 10% of the population between 60 and 70 years of age. In people over 80, this value exceeds 50% [28,29].

Several methods are used to diagnose sarcopenia. Bioelectrical impedance (BIA) is quite common. Other methods are: isometric measurement of hand grip strength, Short Battery of Physical Fitness (SPPB), which assesses the components of physical activity: muscular endurance and strength, gait and balance, as well as a 6-minute walk test and "Timed-Up and Go" test. However, the suggested methods of detection of sarcopenia do not give an unambiguous diagnosis. In the era of the increase in the number of elderly people, there is still a lack of research that will clarify the criteria for its recognition. That is why the problem of sarcopenia deserves more attention [4,5,30].

The most effective form of sarcopenia treatment is to undertake physical activity. Numerous studies have confirmed that the use of resistance exercises most contributes to the growth of muscle mass. The best effects in the fight against sarcopenia provide a combination of several types of exercise: resistance exercises, endurance training, coordination, equivalent and stretching exercises. Other forms of rehabilitation are also: therapeutic massage, physical therapy, aqua aerobic, Nordic Walking. A very important issue in the treatment of sarcopenia is a well-balanced diet containing large amounts of proteins necessary for the synthesis of muscle proteins [15,16,31].

In summary, the sarcopenia affects more and more people in old age. However, the awareness of this problem in society is small. It is necessary to conduct further research on the diagnostics of sarcopenia. Currently, there are several methods that are unable to confirm the diagnosis unambiguously. The problem of sarcopenia should be given more attention, also in the context of public awareness about it [20,32].

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