

Sarcopenia: Hidden but Harmful Risk to Resident Independence

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Of all the conditions and illnesses that affect the elderly, sarcopenia—an age-related loss of skeletal muscle mass and strength—probably isn't high on the list of priorities at most assisted living facilities. But it should be. The condition has serious health and cost-related consequences, including \$18.5 billion in disability costs and expenditures related to falls and fall-related injuries. Sarcopenia is also linked to type 2 diabetes and osteoporosis; and it diminishes independence by interfering with daily functions such as walking and climbing stairs. Even simple tasks such as getting out of bed or rising from a chair can be difficult with sarcopenia.

Assisted living (AL) settings are not alone in their inattention to this condition. According to the Alliance for Aging Research, sarcopenia is a hidden, often ignored condition that receives limited research attention and is not well understood by the public. At the same time, sarcopenia is related to the priority area of chronic diseases and disabling conditions in the Healthy People 2000 objectives set by the Public Health Service for the new millennium.

Nonetheless, sarcopenia is a condition of aging and, therefore, quite common in long term care settings such as assisted living. One study of elderly men and women in New Mexico showed that over 50% of people over age 80 had sarcopenia.



Compared to non-sarcopenic individuals in the study, sarcopenic women had 3.6 times and men had 4.1 times the rate of disability.¹

Although the prevalence of this condition in AL is unknown, consider the fact that approximately 45% of Americans are age 60 and older. People begin to lose muscle mass around age 30. By age 50, most individuals have lost an average of 10% of their muscle mass;

by the time they are 70, people have lost about 40%.

Unfortunately, sarcopenia is not preventable. However, its progression can be slowed through progressive resistance training and other muscle-strengthening exercises. Studies have shown gains of 50% or more in muscle strength with appropriate resistive training even in individuals age 90 and older.

Assisted living residents are prime

candidates for these activities and for sarcopenia awareness programs and other efforts to address the condition.

Etiology of Sarcopenia

Numerous changes take place in skeletal muscles as people age. These include:

- Decreased muscle mass and cross-sectional area
- Infiltration of fat and connective tissue
- Decrease in contractile fiber number
- Decrease in contractile fiber size
- Accumulation of internal nuclei, ring fibers, and ragged fibers
- Disarrangement of myofilaments and Z-lines
- Accumulation of lipofuscin and nemaline rod structures
- Proliferation of the sarcoplasmic reticulum and t-tubular system

Of course, one of the most notable changes is the reduction in muscle mass. Although many studies regarding sarcopenia have focused on limb musculature, research has confirmed that there may be changes in fiber density, muscular tension, muscle strength, and muscular contraction in facial, masticatory, and lingual skeletal musculature as well. The age-associated changes reflect underlying sarcopenia in the head and neck muscles. This diminished muscle mass may be casually linked to increased risk of dysphagia.

The etiology of sarcopenia remains unclear, but possible factors involved include:

- Loss of alpha neurons in the central nervous system with age
- Change in hormonal milieu in favor of a more catabolic muscle profile, with reduced growth hormone, testosterone, and estrogen
- Increased production of catabolic cytokines, particularly interleukin-6 and possibly interleukin-1 beta and tumor necrosis factor-alpha
- Reduced physical activity, lead-

ing to fat accumulation and perhaps to resistance to anabolic effects of insulin

- Reduced dietary intake of protein and energy

As people age, they tend to reduce their levels of exercise and physical activity—especially when they develop illnesses and conditions that make this activity difficult or painful. How, age-related loss of muscle mass and strength cannot be attributed completely to reductions in physical activity.

Numerous studies conclude that it is clear how important it is to address sarcopenia in assisted living facilities, where functional decline and impairments often lead to nursing facility placement.

More likely, this loss is the result of several interacting factors, including:

- Malnutrition (inadequate protein intake)
- Increased oxidative stress
- Dysregulation of catabolic cytokines
- Low testosterone and estrogen
- Decreased physical activity
- Low growth hormone and insulin-like growth factor-1

These, in turn, are associated with:

- Decreased food intake
- Decreased walking speed
- Falls
- Impaired activities of daily living (ADLs)
- Impaired thermoregulation

- Decreased basal metabolic rate
- Osteoporosis
- Impaired balance

Functional Consequences of Sarcopenia

To date, there is only a limited understanding of sarcopenia's functional and metabolic consequences. However, there are several widely recognized consequences related to the effect on function, including gait, balance problems, and increased falls and fall risk. Sarcopenia also may put elderly individuals at increased risk of chronic diseases such as diabetes and osteoporosis.

Numerous studies have examined sarcopenia's effect on the function of elderly individuals; and their conclusions make it clear how important it is to address this condition in assisted living facilities, where functional decline and impairments often lead to nursing facility placement.

Over the years, researchers have found a connection between calf strength and walking speed and a significant link between leg extensor power and walking speed, as well as the ability to rise from a chair and climb stairs. Sarcopenia also has been associated with increased risk of falls in older adults; and reduced lower extremity strength has been implicated as a contributing factor to nursing facility placement. Evidence also exists to suggest a possible relationship between muscle mass and bone density and, therefore, a link between sarcopenia and osteoporosis.

Studies even have suggested that sarcopenia has an effect on body temperature and thermoregulatory processes in both warm and cool environments.² Low muscle mass also is connected to decreased blood volume, which affects cardiovascular response to exercise and heat stress. In cold environments, low muscle mass is linked to impaired peripheral insulation and a decreased capacity for shivering thermoregulation.

Observations that skeletal muscle

is the main site of glucose uptake following an oral glucose tolerance test even have caused some experts to speculate that sarcopenia may contribute to an age-related decline in glucose tolerance. However, the lack of a documented connection between muscle mass and glucose tolerance does not support this theory.

Managing Sarcopenia

Treatments to slow or reverse age-related declines in muscle mass and quality generally can be divided into three categories:

- Hormonal interventions
- Exercise
- Nutritional supplements

Because the mechanisms involved in the development and progression of sarcopenia are poorly understood, options currently available to manage the condition are limited. To date, progressive resistance training is the best available intervention to slow or reverse age-related decline in muscle mass or strength. While some other treatments have shown promise, more study is required before they can be recommended to any degree. Nonetheless, it is important to understand the therapy options and their risks and benefits.

Hormonal Treatments

The decline of growth hormone (GH) with aging is due to decreased GH response to growth hormone releasing hormone (GHRH) and an increased inhibitory effect of somatostatin.

There is a good bit of data about the use of GH in addressing sarcopenia, possibly because it was one of the earliest investigated treatments for the condition. The foremost study on GH and sarcopenia was conducted by Rudman et al in 1990.³ The authors found that GH treatment resulted in an 8.8% increase in lean body mass. Both plasma glucose and systolic blood pressure increased by 7%, but no

Elements of an Effective Program to Address Sarcopenia in ALFs

- Awareness program for staff, residents, and family members about sarcopenia
- Involvement of residents in resistance training exercises
- Early detection and treatment of malnutrition
- Testosterone supplementation considered in elderly hypogonadal men with sarcopenia
- Oxandrolone possibly tried in elderly men and women with sarcopenia (2-4-week courses; may be repeated intermittently)
- Introduction of smoking cessation programs

subjects in the study became frankly diabetic or hypertensive.

Generally, while this and other studies have shown GH therapy to increase lean body mass, GH did not increase muscle strength or function. Additionally, there was a high incidence of side effects. In one study, frequent adverse events included carpal tunnel symptoms,⁴ arthralgias, and glucose intolerance.

Several studies have indicated that GH therapy reverses age-associated muscle wasting but not muscle weakness.⁵ Nonetheless, a high cost greatly limits its clinical utility. The cost, along with its side effect profile, makes GH a less than ideal choice for managing sarcopenia in the elderly.

Testosterone

Serum testosterone levels have been shown to be associated with muscle mass and strength in both animals and humans. Testosterone levels decline with age, and 50-70% of individuals age 65 and older are hypogonadal (ie, have low testosterone levels).⁶

A number of studies have tested the effect of testosterone supplementation on muscle mass and strength. For the most part, the literature has indicated that the response to testosterone supplementation is variable in older males, with improvements in lean mass, muscle strength, fat mass,

and fat distribution demonstrated in some but not all studies. Further, doses of testosterone that produce physiological concentrations of testosterone in men increased muscle mass and strength in hypogonadal but not in eugonadal (ie, normal testosterone levels) subjects.⁷

Long-term randomized trials are needed to better define the risk-benefit ratio before this treatment can be recommended.

Oxandrolone, a synthetic androgen, also has been studied to address sarcopenia.⁸ Compared with testosterone, oxandrolone has a 10:1 anabolic: androgenic ratio and it generally is well tolerated. The most common side effects are transient elevations in transaminase levels and reduction in HDL. However, this drug is prohibitively expensive for most individuals, with a price tag of over \$500 for 30 10-mg tablets.

DHEA and Estrogen

The direct biologic activity of adrenal androgens (DHEA) and dehydroepiandrosterone sulfate (DHEAS) is minimal. Longer and larger-scale randomized controlled trials are needed before drawing any real conclusions about the validity of DHEA supplementation for managing sarcopenia.

Menopause is associated with decreased lean body mass and increased fat mass, so it is not surprising that several studies have looked

at the benefits of using estrogen to treat sarcopenia.⁹ Cross-sectional and longitudinal studies have linked estrogen replacement to increased muscle mass and function. However, limited clinical trials have found no effect on muscle mass—although estrogen does prevent the central accumulation of fat. The links between breast cancer and heart disease to estrogen replacement also make this a less than ideal choice of treatment for assisted living residents with sarcopenia.

While there has been a limited amount of study regarding the use of caloric multi-nutrient supplements on sarcopenia, these generally have indicated no beneficial gains in muscle mass and strength. Creatinine, a protein supplement, has been shown to enhance the gains in muscle mass and strength after exercise but had no effect when given without exercise.

Impact of Exercise

Perhaps the most cost-effective treatment with the least risk to address sarcopenia is exercise.¹⁰ Strength training results in an increase in muscle size. This is mainly the result of an increase in contractile protein content. Strength training may be defined as “exercise in which the muscles are challenged to generate progressively increasing force over time.” Research has shown muscle strength to increase in response to training. And a number of studies have shown that older men and women demonstrate similar or greater strength gains compared with young individuals as a result of strength training.

Assisted living residents are prime candidates for resistance training. Even residents in their 80s and 90s can benefit from this type of exercise. Progressive resistance training should include a combination of high-intensity and low-volume training tailored for the individual resident’s fitness level and physical ability. Resistance training sessions

generally should consist of two, 45-minute sessions per week, with two days recovery time between each workout. The training should include at least one set of 10-15 reps per major muscle group and completion of 8-10 exercises for all major groups. Multi-joint exercises are preferable to single-joint movements. To improve balance, Tai Chi activities or classes may be useful.

Putting the Muscle in Sarcopenia

Assisted living facilities can help their residents age in place more successfully by making identifying

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and addressing sarcopenia a priority. This should start with education for staff, residents, and family members about the condition and its connection to functional decline, falls, and other problems that are more likely to lead to lost independence, illness, or transfer to a nursing facility.

Successful treatment of sarcopenia not only benefits residents but it also reduces care, staffing, and transfer costs for facilities. Therefore, ALFs should consider creative, viable means to involve residents appropriately in resistance training and balance enhancement classes and activities. This could mean onsite programs or partnerships with sen-

ior centers, local fitness clubs, and other community organizations.

By pumping up their attention to sarcopenia, ALFs can keep their residents healthy, safe, and independent for longer periods of time. Who could say no to such a proposition?

ALC

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