

# Pathogenesis and Management of Sarcopenia



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## KEYWORDS

- Sarcopenia • Muscle strength • Muscle atrophy • Frailty • Aging • Senescence
- Fall risk • Skeletal muscle mass loss

## KEY POINTS

- Sarcopenia is a prevalent but under-recognized problem in the elderly population, causing limitation of activities of daily living and increasing the risk of fall and mortality.
- To date, a common clinical definition and diagnostic criteria for sarcopenia are lacking. The most commonly used screening tool developed by the European Working Group on Sarcopenia in Older People has several limitations but is endorsed by many professional medical societies.
- The goal of this article is to promote awareness among physicians of early recognition of sarcopenia and its management in the geriatric patient population.

## INTRODUCTION

The term Sarcopenia (Greek, *sarx* for:“flesh” and *penia* for “loss”) refers to the phenomenon of reduction of both muscular mass and function with aging.<sup>1</sup> Muscle strength is a critical component of walking, and its decrease in the elderly contributes to a high prevalence of falls. Sarcopenia is significantly associated with self-reported physical disability in both men and women, independent of ethnicity, age, morbidity, obesity, income, or health behaviors.<sup>2</sup> Reduced muscle strength with aging leads to loss of functional capacity and is a major cause of disability, mortality, and other adverse health outcomes.<sup>3</sup> As the number and proportion of older persons in the population continue to rise, sarcopenia-related morbidity will become an increasing area of health care resource utilization.

Initial descriptions of sarcopenia focused on loss of muscle mass and did not consider inclusion of muscle strength or physical impairment as part of the disease

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process.<sup>3</sup> The 2010 European Working Group on Sarcopenia in Older People (EWG-SOP) recognized that muscle strength and muscle mass are significant components of sarcopenia. The group defined sarcopenia as a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength with risk of adverse outcomes such as physical disability, poor quality of life, and death.<sup>4-6</sup> Early recognition and intervention can mitigate some of these deleterious outcomes.

## EPIDEMIOLOGY

There is a significant variability in the reported prevalence of sarcopenia. A recent study of community-dwelling older adults (average age of 67 years) in the United Kingdom found the sarcopenia prevalence to be 4.6% in men and 7.9% in women using the EWG-SOP criteria.<sup>7</sup> A study from the United States, conducted among older adults with an average age of 70.1 years, reported the prevalence of sarcopenia to be as high as 36.5%.<sup>8</sup> In a Japanese population of community-dwelling elderly adults, the prevalence of sarcopenia ranged from 2.5% to 28.0% in men and 2.3% to 11.7% in women (using dual-energy X-ray absorptiometry [DEXA] for measuring lean body mass), and 7.1% to 98.0% in men and 19.8% to 88.0% in women (measured by bioelectrical impedance analysis).<sup>9</sup> In a large cohort of 2867 community-dwelling older adults (age >65 years) in Taiwan, the prevalence of sarcopenia varied from 3.9% to 7.3% with prevalence reaching 13.6% among men aged 75 years and older.<sup>10</sup> Much of the difference in these estimates may be due to the lack of uniform criteria to diagnose sarcopenia.

## RISK FACTORS

Sarcopenia is considered by most to be an inevitable part of aging. However, the degree of sarcopenia is highly variable and is dependent upon the presence of certain risk factors.

### *Lifestyle Lacking Exercise*

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Lack of exercise is believed to be the foremost risk factor for sarcopenia.<sup>11</sup> A gradual decline in muscle fiber numbers begins around 50 years of age.<sup>12</sup> The decline in muscle fiber and strength is more pronounced in patients with sedentary lifestyle as compared to patients who are physically more active. Even professional athletes such as marathon runners and weight lifters show a gradual, albeit more slower, decline in their speed and strength with aging.<sup>12</sup>

### *Hormone and Cytokine Imbalance*

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Age-related decreases in hormone concentrations, including growth hormone, testosterone, thyroid hormone, and insulin-like growth factor, lead to loss of muscle mass and strength. Extreme muscle loss often results from a combination of diminishing hormonal anabolic signals and promotion of catabolic signals mediated through proinflammatory cytokines such as tumor necrosis factor alpha (TNF- $\alpha$ ) and interleukin-6 (IL-6).<sup>13</sup> Elevated levels of both TNF- $\alpha$  and IL-6 have been shown to be present in skeletal muscles of older individuals.

### *Protein Synthesis and Regeneration*

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A decrease in the body's ability to synthesize protein, coupled with inadequate intake of calories and/or protein to sustain muscle mass, is common in sarcopenia. Oxidized proteins increase in skeletal muscle with aging and lead to a buildup of lipofuscin and cross-linked proteins that are inadequately removed via the proteolysis system. This

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