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# Overlaps between Frailty and Sarcopenia Definitions

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## Abstract

Aging is characterized by the catabolism of muscles leading to sarcopenia and frailty. These are two geriatric syndromes with partly overlapping phenotypes. Primary sarcopenia, i.e. loss of muscle mass and function related to aging alone, usually precedes frailty. Thus, robustness passes from sarcopenia over frailty to disability leading eventually to a mortal outcome. Frailty (defined according to the phenotype model) encompasses states as exhaustion, weakness, and slowness, whereas sarcopenia, combining mass and function, is more strictly focused on muscles. Frailty is age related, whereas sarcopenia is also related to disease, starvation, and disuse. In general, the criteria for the two conditions overlap, but frailty requires weight loss, whereas sarcopenia requires muscle loss. Both gait speed and hand grip strength are suggested to be used as diagnostic measures for the two conditions since muscle function is crucial for any of the two syndromes. It is suggested that frailty screening should be part of the geriatric comprehensive assessment starting with measuring walking capacity and complemented by taking a history of fatigue and low activity. For younger adults (i.e. <70 years), sarcopenia screening could first register gait speed or hand grip strength and then body composition measurements. Simple questionnaires are feasible clinical alternatives. Treatment of frailty and sarcopenia overlaps, i.e. provide adequate protein and vitamin D supplementation, and encourage resistance exercise.

## **Sarcopenia, Frailty, and Aging Well**

Advanced aging is characterized by the catabolism and degeneration of organs and organ functions. Reserve capacities in major organ systems are absorbed and finally depleted. Impaired activities of daily living ensue, followed by disability, i.e. severe limitations in major life activities, and eventually death.

Aging well is usually characterized by the ability to live independently, move freely in- and outdoors without the support of others and to have good memory and intellectual capacity [1]. When these conditions prevail, social interaction with family and friends is facilitated, which may enhance quality of life. From this description, it is easy to recognize muscles and brain functions as crucial for quality of life at advanced age. Brain dysfunction with aging leads to dementia, whereas muscle dysfunction with aging leads to sarcopenia and frailty.

### **Sarcopenia or Frailty – Which Comes First?**

Sarcopenia and frailty are two fairly recently defined geriatric syndromes [2, 3], meaning that they are commonly occurring, have a strong clinical impact, have a multitude of underlying etiologic mechanisms, and they have fairly well-described phenotypes. Interestingly, the two phenotypes show considerable overlapping, especially if physical frailty is meant by frailty, as it has been defined by most authors over the last 15 years.

Defining frailty may follow the ‘index’ model or the ‘phenotype’ model [4]. The original index model is based on an accumulation of health deficits that mounts to a score, i.e. the ratio (0–1) of deficits present to the number of deficits counted [5, 6]. The somewhat more accepted phenotype model requires that some (i.e. three) criteria of the following five criteria are met: weight loss, exhaustion, low activity, slowness, and weakness [7].

Primary sarcopenia, i.e. loss of muscle mass and function related to aging alone [8], precedes frailty, whereas frailty is a risk factor for disability. Thus, the aging trajectory from a state of robustness and good health passes from sarcopenia over frailty to disability and death. Frailty may be viewed as a more complex condition mainly related to advanced age. The features of frailty defined by the frailty phenotype model [7] encompass terms as exhaustion, weakness, and slowness, which are conditions that are not strictly and exclusively related to muscle function. On the other hand, the concept of sarcopenia is rather focused on the muscle itself and, according to the more recently launched definitions [8–10], not only related to aging. The features of sarcopenia are the combined

**Table 1.** Diagnostic criteria for frailty and sarcopenia

Frailty	Sarcopenia
Walking capacity	Gait speed
Weight loss	Muscle loss
Exhaustion, fatigue	Grip strength

finding of the more muscle-specific conditions of reduced muscle mass and impaired strength or function [11]. Thus, sarcopenia may also be related to disease, starvation, and disuse, i.e. secondary sarcopenia [8].

### Definition of Sarcopenia versus Frailty

The distinction between frailty and sarcopenia is also reflected by the different use of the ‘loss of mass’ criterion. Frailty requires weight loss, which could be either muscle or fat loss, as one of its five criteria according to the frailty phenotype [7]. On the other hand, sarcopenia requires muscle loss as one criterion. The other criterion of sarcopenia is directly related to muscle strength or power as it is suggested to be measured by gait speed or hand grip strength. Slowness and weakness of frailty are also measured by walking speed and hand grip strength, whereas exhaustion and low activity are related to self-reported fatigue and walking capacity, respectively. Thus, there are great overlaps between the definitions and diagnostic criteria of the two conditions (table 1).

Obviously, muscles are crucial for any of the two syndromes, strongly implicating the important impact of good muscle function for independent aging as well as well functioning despite suffering from a disease.

### Is There a Clinical Implication of a Distinction between Frailty and Sarcopenia?

A question that may arise in clinical settings is whether the screening and diagnostic efforts should focus on identifying frailty or sarcopenia in order to identify individual cases that need to be further assessed and offered treatment.

A model that could be suggested is to partly separate the efforts for geriatrics and elderly care on one hand and health care for adults on the other. For geriatric and elderly care, there is already a quite strong acceptance to use the model of the geriatric comprehensive assessment, which usually takes the mental (Geriatric Depression Scale), cognitive (Mini Mental State Examination), and

nutritional status (short form of the Mini Nutritional Assessment) into account. An assessment of physical function should be integrated as a natural part of the geriatric comprehensive assessment. Thus, gait speed or walking capacity should be assessed. If reduced it is fairly simple to combine with information on weight loss (from the short form of the Mini Nutritional Assessment) and anamnestic information on fatigue and low activity, which are integral parts of any frailty screening model [7, 12, 13]. Perhaps this could be information enough to start treatment for muscle anabolism, i.e. to provide adequate proteins and vitamin D, and to start resistance exercise.

For those younger than 70 years where the risk of frailty is not yet imminent, a more focused sarcopenia screening could be advised. Step one is as for frailty screening to register gait speed or hand grip strength. If reduced it could be advised to do a body composition measurement, most likely by bioimpedance analysis or dual-energy X-ray absorptiometry, to decide on the sarcopenia diagnosis. A questionnaire alternative has been proposed by Malmstrom and Morley [14]; i.e. the SARC-F questionnaire for a rapid diagnosis of sarcopenia. The SARC-F screening tool provides responses (from 0 to 2 points) to 5 questions related to strength, assistance in walking, rising from a chair, climbing stairs, and fall frequency. This simple approach is validated [15].

Treatment for the sarcopenic somewhat younger individual would still be the same as for the frail older individual; i.e. adequate protein and vitamin D supplementation, and resistance exercise.

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