

Concept Analysis of Geriatric Sarcopenia

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Abstract

A. Aim: This study aims to conduct a concept analysis of sarcopenia in the nursing profession.

B. Background: Older adults are prone to muscle loss and atrophy. They are likely to develop sarcopenia. Studies have indicated that the mortality rate of older adults with sarcopenia is one to five times higher than that of those without sarcopenia.

C. Introduction: The World Health Organization indicated that frailty prevention is a crucial indicator of successful aging. Frailty in older adults is determined primarily by mobility, which is expressed by the function of the muscular system. In addition, the annual medical expenditures caused by sarcopenia in the United States are estimated to be US\$11.8 billion to US\$26.2 billion. Thus, analysis and clarification of sarcopenia are required to assist nurses in deeply understanding this disease, allowing for the development of prevention strategies.

D. Methods: Walker and Avant's approach of concept analysis was used.

E. Results: This study confirmed the conceptual meaning and the signs and symptoms, introduced cases, identified causes and consequences, determined empirical indicators, reviewed the nursing literature, and investigated the practical aspects of sarcopenia for nursing.

F. Discussion: Through concept analysis, the difference between sarcopenia and other concepts was completely clarified by the nature of sarcopenia, the occurrence of sarcopenia, and the impact of sarcopenia.

G. Conclusion and Implications for Nursing and Health Policy

The objective of this study was to enhance nurses' understanding of sarcopenia and their ability to actively develop comprehensive nursing care plans, including regular exercise (particularly resistance exercise) and protein supplements. The ultimate goals are to reduce sarcopenia symptoms and prevent deaths caused by sarcopenia, which are critical to future older people care.

Keywords: sarcopenia, geriatric syndromes, concept

analysis, geriatric nursing

I. BACKGROUND

The World Health Organization (WHO) defined frailty prevention as a key indicator of successful aging (WHO 2002). Assessment of frailty in older adults is primarily based on mobility, which in turn is dependent on muscle functionality (Chen 2010). Adults' level of physical activity decreases with age. This causes gradual muscle loss and atrophy, which can result in sarcopenia. Because this condition is often found among older adults, sarcopenia has become an important and widely discussed issue in geriatric care in recent years.

Studies have shown that human muscle mass begins to decline around age 30 at a rate of 3%–8% every decade. This rate increases with age; around age 70, the rate is approximately 15% every decade (Melton et al., 2000). The gradual decrease in muscle strength and mobility among older adults increases the risk of falls and bone fractures. As a result, older adults may lose the ability to live independently. Studies have found that over half of adults aged 80 or older experience poor mobility, disability, or decreased quality of life as a result of sarcopenia (Cruz-Jentoft et al. 2010b). Studies have also found that mortality risk is higher among older adults with sarcopenia than adults without sarcopenia (Landi et al., 2013). In addition, medical expenses associated with sarcopenia are estimated to cost nearly US\$26.2 billion in the United States (Janssen et al., 2002). Thus, a thorough understanding of this issue and strategies to prevent sarcopenia in older adults can result in tremendous savings of annual health care costs.

Because of sarcopenia's substantial impact on older adult health, a concept analysis of sarcopenia to clarify its nature is necessary. Walker and Avant (2005) asserted that concept analysis could be used to examine how the target concept differs from other concepts and to obtain a complete clarification of the nature of the target concept. Determining the definition of sarcopenia and its defining attributes, case studies, antecedents and consequences, empirical referents, and theoretical and practical applications of the concept to nursing can enhance nurses' understanding of sarcopenia. This understanding can be implemented in the care of older adults to improve their health and quality of life.



II. THE DEFINITION OF SARCOPENIA

A. Dictionary Definition and Definition from Previous Literature

The Oxford Online Dictionary (2015) defines sarcopenia as loss of muscle mass or lack of muscle strength as a result of aging. The word sarcopenia was derived from Greek roots: sarx, meaning flesh, and penia, meaning poverty.

In 1989, Irwin Rosenberg coined the term “sarcopenia” to describe this condition of age-related loss of muscle mass. Baumgartner et al. (1998) were the first scholars to define cutoff values for sarcopenia, which they defined as muscle mass less than two standard deviations below the average muscle mass of younger adults aged 18–40 years.

B. Defining Attributes

According to previous studies and the dictionary (Baumgartner et al. 1998; Merriam-Webster Collegiate Dictionary 2015), the defining attributes of sarcopenia include the following: it is a progressive condition; its clinical definition includes loss of muscle mass as well as one other symptom, including inadequate muscle strength or poor physical functioning; and patients with sarcopenia are prone to injuries and other adverse outcomes, including falls, bone fractures, disability, hospitalization, placement in assisted living facilities, or death.

Human muscle mass begins to decline around age 30 at a rate of 3%–8% every decade. This rate increases with age. Around age 70, the rate is approximately 15% every decade (Melton et al. 2000). Decreased muscle strength increases the risk of falls and fractures, which greatly increases the risk of disability among older adults. Foreign studies have shown that over 50% of adults aged 80 or older experience poor mobility, disability, or poor quality of life as a result of sarcopenia (Cruz-Jentoft et al., 2010b).

C. Case Study Analyses

Walker and Avant (2005) believed that concept analysis could be used to clarify the correlation between things or events when they are unclear. Walker and Avant (2005) classified case studies as model, borderline, related, and contrary cases. Based on their definitions and the defining attributes of sarcopenia, a case study of each type is presented to clarify the concept of sarcopenia.

D. Model Case

The model case demonstrates all of the defining attributes of the concept.

Mrs. Lin was 76 years old and lived alone. She had high blood pressure and diabetes. With poor nutritional status and underweight, she exhibited weak grip strength and slow gait speed. A few weeks ago, she fell during a mid-sleep trip to the bathroom. She was sent to the emergency room and underwent

surgery. During her subsequent hospitalization, dual-energy X-ray absorptiometry (DEXA) was ordered to assess bone density; results showed that Mrs. Lin’s muscle mass was more than two standard deviations lower than average muscle mass in younger adults.

In this case study, the patient experienced multiple chronic illnesses, inadequate nutritional intake, and fractures as a result of falling. She exhibited three symptoms of sarcopenia: reduced muscle mass (i.e., more than two standard deviations lower than the average muscle mass of younger adults), diminished muscle strength (i.e., low grip strength), and deficient physical functioning (i.e., slow gait). Because this case study met all of the defining attributes, it was a model case.

E. Borderline Case

The borderline case demonstrates some but not all of the defining attributes.

Mr. Wu was 76 years old and lived with his daughter. He had multiple chronic illnesses but was self-sufficient in daily tasks and self-care. He recently complained of sciatic nerve pain and difficulty sleeping. A physician at the orthopedic clinic suggested that Mr. Lin receive a bone density scan of the spine. Results showed spinal cord compression as well as muscle mass more than two standard deviations lower than the average muscle mass of younger adults. Mr. Wu walked to the park to exercise every day, and his gait speed was normal.

Although this patient’s muscle mass was more than two standard deviations lower than the average muscle mass of younger adults, he did not meet the European Union’s definition of sarcopenia because he did not conform to the other two key criteria (i.e., diminished muscle strength or slow gait). Because this case study met only some of the defining attributes, it was a borderline case.

F. Related Case

The related case demonstrates concepts that are related to but are not the target concept.

Ms. Wang was 69 years old. She reached menopause several years ago and has high blood pressure and diabetes. She exhibited allergy symptoms, including itchy and dry skin. Ms. Wang was capable of managing her conditions: She routinely takes her medications and attends follow-up appointments with her physicians; she maintains regular eating habits and pays attention to her nutrition and protein intake, and she has a physical examination annually. A DEXA scan showed that her muscle mass was within two standard deviations lower than the average muscle mass of younger adults. Ms. Wang regularly attends a folk dancing club and a walking club to improve her muscle strength and gait speed. She is capable of all daily tasks and self-care, and she participates in community volunteer work.

This example illustrates concepts that are related to but are not sarcopenia. Ms. Wang experienced hormonal imbalance, two chronic diseases, and inflammation. Because these describe comorbidities of sarcopenia, this case is a related one.

G. Contrary Case

The contrary case demonstrates attributes that are contrary to the defining attributes.

Ms. Chang was 68 years old. She is a retired teacher and lives with her husband and children. She has a physical examination annually. A DEXA scan showed that her muscle mass was within two standard deviations lower than the average muscle mass of younger adults. She has high blood pressure and is capable of managing her condition: She takes her medications as prescribed and pays attention to her diet. As a result, her blood pressure is currently controlled. She attends a daily community dancing class at the park and periodically socializes or hikes with other retired coworkers. She reports being quite satisfied with her life. Because this case does not demonstrate any of the defining attributes of sarcopenia, it is a contrary case.

H. Antecedents and Consequences

Antecedents refer to current circumstances or conditions that existed prior to the occurrence of the concept (Walker & Avant 2005). The physical condition of older adults declines as they age, and the majority experience comorbidity conditions or physical impairment that result in immobility and increase the rate of muscle loss (Chen et al., 2014). Studies showed that because aging often results in decreased overall activity, older adults lose leg muscle mass three times faster than young adults during bed rest (Paddon-Jones et al. 2004).

In addition to skeletal muscle changes as a result of aging, the rate of muscle mass loss can increase as a result of nervous system imbalance, hormone deficiency, diabetes, cardiovascular disease, chronic obstructive pulmonary disease, chronic inflammation, nutritional or protein deficiency, and lack of exercise (Chang, 2014).

Consequences refer to the results produced by the occurrence of the concept (Walker & Avant 2005). As muscle mass decreases, reduced muscle strength and impaired physical functioning may eventually cause disability, increased risk of falls, placement in long-term care facilities, and increased mortality risk (Lang et al., 2010; Visser & Schaap 2011). Studies have found that the mortality rate is much higher among older adults with sarcopenia than among older adults without sarcopenia (Landi et al., 2013). In addition, Chang and Lin (2015) provided empirical evidence, through a systematic literature review and metaanalysis, that the mortality risk of older adults with sarcopenia is higher than older adults without sarcopenia. Researchers have estimated that the cost of direct and follow-up medical care for sarcopenia

in the US be between US\$11.8 billion to US\$26.2 billion (Janssen et al., 2002). Therefore, timely strategies to prevent sarcopenia can result in tremendous savings of health care costs (Chang, 2014). However, the antecedents, consequences, and pathogenesis of sarcopenia are unclear and require additional studies and examination.

Because sarcopenia has a substantial effect on mortality risk among older adults, the importance of sarcopenia cannot be overlooked, and appropriate nursing intervention plans must be developed to decrease its impact on the mortality of older adults.

I. Empirical Referents

Currently, the assessment of sarcopenia is primarily based on criterion-based measures together with assessment tools.

One criterion-based measure was proposed by the European Working Group on Sarcopenia in Older People (EWGSOP) in 2010. They developed consensus criteria for diagnosing sarcopenia as well as a clinical definition, diagnostic standards, an International Classification of Disease code, and treatment guidelines. According to EWGSOP definitions, presarcopenia refers to low muscle mass, sarcopenia refers to low muscle mass and either weak muscle strength or poor physical performance, and severe sarcopenia refers to the presence of all three criteria. The EWGSOP also suggested related parameters and cutoff values as referents for sarcopenia assessment (Cruz-Jentoft et al. 2010a)

Recently, the Asian Working Group for Sarcopenia (AWGS) developed a consensus for sarcopenia diagnoses in Asia. The AWGS defined sarcopenia as low muscle mass and weak muscle strength, with or without poor physical performance, and suggested cutoff values appropriate for Asians (Chen et al., 2014). The aforementioned papers indicate that low muscle mass is a necessary criteria of sarcopenia, but the slight difference in definition may be observed among scholars.

The most common assessment tools currently used for diagnosing sarcopenia or measuring muscle mass are computed tomography (CT), magnetic resonance imaging (MRI), DEXA, and bioelectrical impedance analysis (BIA; Cruz-Jentoft et al. 2010a). The use of CTs, MRIs, and DEXAs is limited because the machines are not portable and because of the risk of exposure to radiation and the high cost of the scans. By contrast, BIA is easy to administer, portable, and inexpensive. Studies have found a high correlation between BIA and MRI results (National Institutes of Health 1996). Therefore, BIAs are practical. The suggested cutoff values for BIA results are 7.0 kg/m² for men and 5.7 kg/m² for women (Chen et al., 2014).

Muscle strength is primarily based on handgrip strength. According to the AWGS consensus, the criteria of weak muscle strength are based on low grip strength, and the cutoff values for grip strength

are less than 26 kg for men and less than 18 kg for women. Poor physical performance, such as slow gait or slow times on the Timed Up and Go test, is typically assessed by the Short Physical Performance Battery. The suggested cutoff value for gait speed is 0.8m/s (Chen et al., 2014).

Older adults with sarcopenia are prone to dangerous injuries, including falls, which can result in disability, placement in assisted living facilities, or even death. Therefore, prevention and early detection of sarcopenia in older adults can mitigate its impact on health and are imperative in geriatric care.

J. Implications for Nursing and Health Policy

Statistics have shown that sarcopenia currently affects more than 50 million people worldwide; this number is estimated to grow to 200 million in 40 years (Cruz-Jentoft et al., 2010a). Compared with the general population, the risk of osteoporosis is three times higher in men with sarcopenia and 12.9 times higher in women. Chang and Lin (2015) performed a systematic literature review and meta-analysis of the relationship between sarcopenia and death. Their empirical results showed that the mortality risk of older adults with sarcopenia is higher than that of older adults without sarcopenia (summary HR = 1.87, 95% CI = 1.61–2.18). However, limited nursing intervention plans have been designed for older patients with sarcopenia. The active development of comprehensive nursing care plans that include regular exercise (particularly resistance exercise), additional protein intake, increasing muscle mass, muscle strength, and dynamic balance training, and improving stamina and activity levels through exercise (Chang & Lin 2015) can ameliorate the symptoms of sarcopenia, thereby preventing death. Therefore, the development of these plans is a critical topic in future geriatric care.

REFERENCE

- [1] Baumgartner, R.N., et al., Epidemiology of sarcopenia among the elderly in New Mexico. *American Journal of Epidemiology*, 147 (1998) 755-763.
- [2] Chang, S.F., Sarcopenia in the elderly: Diagnosis and treatment. *The Journal of Nursing*, 52 (2014) 1362-1374.
- [3] Chang, S.F. & Lin, P.L., Frail phenotype and mortality prediction: a systematic review and meta-analysis of prospective cohort studies. *International journal of nursing studies*, 52 (2015) 1362-1374.
- [4] Chen, C.Y., NHRI researchers report thigh muscle volume predicted by anthropometric measurement correlates with physical function in older adults. *National Health Research Institutes Newsletter*, (2010) 372.
- [5] Chen, L.K., et al., Sarcopenia in Asia: Consensus report of the asian working group for sarcopenia. *Journal of the American Medical Directors Association*, 15 (2014) 95-101.
- [6] Cruz-Jentoft, A.J., et al., Sarcopenia: European consensus on definition and diagnosis Report of the European Working Group on Sarcopenia in Older People. *Age and Ageing*, 39 (2010a) 412-423.
- [7] Cruz-Jentoft, A.J., Landi, F., Topinková, E. & Michel, J.P. Understanding sarcopenia as a geriatric syndrome, *Current Opinion in Clinical Nutrition & Metabolic Care*, 13 (2010b) 1–7.
- [8] Janssen, I., Heymsfield, S.B. & Ross, R., Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability, *Journal of the American Geriatrics Society*, 50 (2002) 889–896.
- [9] Landi, F., et al., Sarcopenia and mortality risk in frail older persons aged 80 years and older: Results from the SIRENTE study. *Age and Ageing*, 42 (2013) 203–209.
- [10] Lang, T., et al., Sarcopenia: etiology, clinical consequences, intervention, and assessment. *Osteoporosis International*, 21 (2010) 543-559.
- [11] Melton, L.J., et al., Epidemiology of sarcopenia. *Journal of the American Geriatrics Society*, 48 (2000) 625–630.
- [12] Merriam-Webster Collegiate Dictionary (2015) Medical definition of sarcopenia. Retrieved from <http://www.merriam-webster.com/medical/sarcopenia>
- [13] National Institutes of Health, Bioelectrical impedance analysis in body composition measurement: National Institutes of Health Technology Assessment Conference Statement. *The American Journal of Clinical Nutrition*, 64 (1996) 524S–532S.
- [14] Oxford Online Dictionary, (2015). Oxford English Dictionary New words list <http://public.oed.com/the-oed-today/recent-updates-to-the-oed/june-2015-update/new-words-list-june-2015/>
- [15] Paddon-Jones, D., Sheffield-Moore, M., Zhang, X. J., Volpi, E., Wolf, S. E., Aarsland, A., ... & Wolfe, R. R., Amino acid ingestion improves muscle protein synthesis in the young and elderly. *American Journal of Physiology-Endocrinology and Metabolism*, 286(3) (2004) E321-E328.
- [16] Rosenberg, I.H., Summary comments: Epidemiological and methodological problems in determining nutritional status of older persons, *The American Journal of Clinical Nutrition*, 50 (1989) 1231–1233.
- [17] Visser, M. & Schaap, L.A., Consequences of sarcopenia. *Clinics in Geriatric Medicine*, 27 (2011) 387-399.
- [18] Walker, L. & Avant, K.C., Strategies for theory construction in nursing (4th ed.). Upper Saddle River, NJ: Pearson Education, (2005).
- [19] World Health Organization., Active aging: A policy framework, (2002). Retrieved from http://whqlibdoc.who.int/hq/2002/WHO_NMH_NPH_02.8.pdf