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LOCOMOTIVE SYNDROME

Sarcopenia as a Cause of Locomotive Syndrome: The Influence on Functional Mobility and Activities of Daily Living

Toru Akune[1]

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Abstract Locomotive syndrome refers to conditions under which the elderly have been receiving support or long-term care, or high-risk conditions under which they might soon require support or long-term care, which are caused by musculoskeletal disorders. The concept of locomotive syndrome was proposed by the Japanese Orthopedic Association in 2007 for the promotion of preventive health care of locomotive organs to reduce its risk and decrease the number of disabled elderly requiring care in their activities of daily living. Sarcopenia is among the causes of locomotive syndrome since it is characterized by generalized loss of skeletal muscle mass and muscle strength or function and is associated with physical disability and poor quality of life. Consensus definition of sarcopenia was provided by the European Working Group on Sarcopenia in Older People (EWGSOP) and the International Working Group on Sarcopenia (IWGS). Prevalence of sarcopenia defined by the EWGSOP or the IWGS criteria and its associated factors have been reported in many studies. It might be difficult for people to recognize functional declines in locomotive organs, including muscle strength and physical performance, since they usually progress slowly and gradually. Therefore, it is of particular importance to raise awareness of the growing risk and to take action to improve and maintain the health of locomotive organs for prevention of sarcopenia and other diseases in locomotive syndrome.

✉ Toru Akune
akune-tky@umin.ac.jp

[1] National Rehabilitation Center for Persons with Disabilities, Namiki 4-1, Tokorozawa, Saitama 359-8555, Japan

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A Super-Aged Society and Locomotive Syndrome

The concept of locomotive syndrome was proposed by the Japanese Orthopedic Association in 2007 for the promotion of preventive health care of locomotive organs [1–3]. Locomotive syndrome refers to conditions under which the elderly have been receiving support or long-term care, or high-risk conditions under which they might soon require support or long-term care that are caused by musculoskeletal disorders [1–3].

Japan is a super-aged society experiencing an unprecedented aging of the population. The proportion of the population aged 65 years or older was 23 % in 2010 and is expected to reach 39 % in 2051 [4]. This leads to an increasing proportion of disabled elderly requiring support or long-term care, imposing enormous economic and social burdens on the country. It is urgently required to reduce its risk and decrease the number of disabled elderly requiring care in their activities of daily living (ADL).

The Japanese Government started the national long-term care insurance (LTCI) system in 2000 based on the Long-Term Care Insurance Act [5]. The total number of certified in need of care level elderly was reported to be 5 million in 2011. The top five leading causes were cerebral stroke, dementia, asthenia as a result of older age, joint disease and fall-related fracture, comprising 71.6 % of all causes in 2010 [6]. Since sarcopenia is inferred to be included in the category ‘asthenia’, the three major musculoskeletal diseases of locomotive syndrome, osteoporosis, osteoarthritis

and sarcopenia are among leading causes of certified in need of care level elderly in the LTCI system.

Sarcopenia as a Cause of Locomotive Syndrome

Sarcopenia is among the causes of locomotive syndrome since it is characterized by generalized loss of skeletal muscle mass and muscle strength or function [7], and is associated with physical disability and poor quality of life [7–12]. The term 'sarcopenia' was proposed by Irwin Rosenberg in 1989 to describe age-related decrease of muscle mass [8, 9]. Although sarcopenia is a common musculoskeletal disease in the elderly [7–12], there appears to be insufficient recognition of sarcopenia in daily clinical practice and society, leading to the disease being undiagnosed and untreated. One of the reasons may be the lack of a broadly accepted definition of sarcopenia until recently.

Operational Definitions of Sarcopenia

The European Working Group on Sarcopenia in Older People (EWGSOP) developed a practical clinical definition and consensus diagnostic criteria for this disease in 2010 [10]. The algorithm for the diagnosis of sarcopenia uses gait speed to measure physical performance in elderly individuals [10]. Subjects are defined as having low gait speed if it is =<0.8 m/s. If gait speed is >0.8 m/s, hand grip strength is further measured to define whether subjects have low grip strength or not. Subjects having low gait speed or low hand grip strength are candidates for sarcopenia. If they have low muscle volume, they are defined as having sarcopenia [10].

The International Working Group on Sarcopenia (IWGS) provided a consensus definition of sarcopenia [13]. The diagnosis of sarcopenia should be considered in all older patients who present with observed declines in physical function, strength, or overall health [13]. A diagnosis of sarcopenia is consistent with a gait speed <1.0 m/s and an objectively measured low muscle mass [13].

Prevalence of Sarcopenia and Associated Factors

Prevalence of sarcopenia defined by the EWGSOP or the IWGS criteria and its associated factors have been reported in many studies. Volpato et al. [14] investigated prevalence of sarcopenia according to the EWGSOP criteria in 730 Italian community-dwelling individuals (age range 27–97 years) in the InCHIANTI study. Prevalence of sarcopenia was 7.5 % in the overall population, which tended to be higher according to age-strata [14]. It was 1.2 and 2.6 %, respectively, in men and women aged 70–74 years, and 17.4 and 31.6 % in men and women older than 80 years [14]. Lee et al. [15] investigated prevalence of sarcopenia defined by the IWGS and the EWGSOP criteria among 408 elderly people in Taiwan and reported that it was 5.8–14.9 % in men and 4.1–16.6 % in women, respectively. Tanimoto et al. [16] reported that prevalence of sarcopenia defined by the EWGSOP criteria was 13.4 and 14.9 % in men and women, respectively, in 1110 Japanese community-dwelling individuals aged 65 or older and that it was associated with a history of fall. Patel et al. [17] reported prevalence of sarcopenia according to the EWGSOP criteria was 6.8 % among 103 community-dwelling men participating in the Hertfordshire Sarcopenia Study in United Kingdom. They reported that the participants with sarcopenia had worse physical performance [17]. Legrand et al. [18] investigated 288 participants aged 80 years or older of population-based cohort study of the BELFRAIL in Belgium and reported that prevalence of sarcopenia defined by the EWGSOP criteria was 12.5 %. Landi et al. [19] reported prevalence of sarcopenia was 32.8 % among 122 nursing home residents aged 70 years or older defined by the EWGSOP criteria and that sarcopenia was less likely to be present among residents involved in leisure physical activities for 1 h or more per day.

Sarcopenia and Risk Factors in Longitudinal Studies

It is critically important to elucidate risk factors of sarcopenia in longitudinal studies and establish effective programs for prevention of sarcopenia and adverse outcomes. Landi et al. [20] analyzed data from the Aging and Longevity Study in Italy. One hundred and ninety-seven participants who were between 80 and 85 years at baseline were followed up over 7 years [20]. Forty-three individuals with sarcopenia (21.8 %) defined by the EWGSOP criteria were identified at baseline [20]. Participants with sarcopenia had a higher risk of death for all causes compared with non-sarcopenia subjects [20]. Murphy et al. [21] examined the natural time course of transitions between sarcopenia stages and determined risk factors in the Heath, Aging, and Body Composition Study in USA. A total of 2928 participants aged 70–79 years at baseline were followed up over 9 years [21]. Sarcopenia was defined as low appendicular lean mass with gait speed <1.0 m/s or grip strength <30 kg in men and <20 kg in women. Presarcopenia was defined as low appendicular lean mass. 7 % of participants with presarcopenia transited to sarcopenia, whereas none with normal appendicular lean mass transited to sarcopenia [21]. Higher body mass index and pain predicted transition toward sarcopenia, whereas moderate activity predicted transition from presarcopenia to more normal state [21].

Prevention of Sarcopenia and Other Diseases in Locomotive Syndrome

It might be difficult for people to recognize functional declines in locomotive organs, including muscle strength and physical performance, since they usually progress slowly and gradually. Therefore, it is of particular importance to raise awareness of the growing risk and to take action to improve and maintain the health of locomotive organs for prevention of sarcopenia and other diseases in locomotive syndrome. Physical performance measures can be used as screening tools to identify high-risk individuals. Those who are classified as having muscle dysfunction are at high risk of loss of independence in addition to sarcopenia. Screened individuals with muscle dysfunction by the EWGSOP algorithm are recommended to receive early intervention programs for prevention of ADL disabilities and subsequent deterioration. Further studies are necessary to elucidate risk factors of sarcopenia and develop effective programs to prevent sarcopenia and reduce the social and economic burdens associated with this condition.

Compliance with Ethical Standards

Conflicts of interest Toru Akune declares no conflict of interest.

Animal/Human Studies This article does not contain any studies with human or animal subjects performed by any of the authors.

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