Overview of sarcopenia

Background

Sarcopenia is age related disease with symptoms of loss of muscle mass, strength and function. Elderly over the age of 65 years are vulnerable to sarcopenia [6]. It is estimated that approximated 5-13% of older people aged 60–70 years are suffered from sarcopenia [8]. The proportion is about twice higher among elderly at the age of 80 or above [8]. Studies also found that sarcopenia is more likely seen in older men than older women [16, 26]. Sarcopenia gains intensive attention from public and increasing researches indicated that it is a major clinical problem for older people.

Risk factors of sarcopenia

Current research found that lifestyle factors, including physical inactivity, smoking and alcohol consuming [3]; and biological factors, including older age, gender, decreased hormone level, motor unit remodeling and reduced protein synthesis [3, 25], contribute to development of sarcopenia.

Motor unit remodeling comes up of age and leads to replacement of fast twitch motor neuron[22, 25] which results in less precise control of movements, less force production and slowing of muscle mechanics[22, 23, 25] as remodeled motor unit are smaller in size and slower to contract. Therefore, loss of fast twitch fibers increases risk of having sarcopenia.

In addition, protein synthesis, growth hormone (GH), testosterone (T) and insulin-like growth factor (IGF-1) are considered to be associated with sarcopenia as well [25]. It is well known that protein is important in muscle repairmen. And GH, T and IGF-1 are involved in protein metabolism and

maintenance [23]. Different studies agreed that protein synthesis rate decreases throughout the natural aging process [24] and leads to loss of muscle mass. Thus, low protein synthesis rate, along with decrease in these hormones level provide possible occurrence of sarcopenia [25].

Consequences of sarcopenia

Sarcopenia causes serious consequences not only at individual level but also at societal level. On the one hand, loss of muscle mass, strength and function lead to adverse health outcome in terms of frailty, disability, morbidity and mortality [8]. Essentially, sarcopenia is about twice as common as frailty [9]. Also, sarcopenia occurs with other morbidity in some times. Some of the co-morbidity are obesity [4, 13], hypertension, osteoporosis [12] and type II diabetes [5, 14, 15]. Moreover, research suggests that loss of skeletal muscle strength may predict future mortality in middle-aged and elderly [2]. On the other hand, sarcopenia is linked with increased healthcare expenditure. In United States, the estimated direct healthcare attributable to sarcopenia represented about 1. 5% of total healthcare expenditure in 2000 [21].

Diagnosis of sarcopenia according to different consensus panels

Although research working in the area of sarcopenia is expanding exponentially, a universal definition is still under development. On average, current definitions are including muscle mass, muscle strength or even physical function.

In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) published guidelines to help identify sarcopenia [1, 9]. According to the EWGSOP, a person will be classified as having sarcopenia when two of three follow criteria were statisfied: (A) low muscle mass and (B) low muscle strength and/or (C) low physical performance [1]. Low muscle mass is defined as muscle mass ≥2 standard deviations below the mean of reference population [8], calculating by equipment such as DEXA-scanners. Low physical performance is defined as gait speed ≤ 0. 8 m/s in the 4 meters walk test for both males and females [8].

International Working Group on Sarcopenia (IWGS) suggested diagnosing sarcopenia when the following criteria are fulfilled: (a) gait speed was < 1 m/s and (b) low muscle mass (cutoff value is similar to EWGSOP) [8].

The European Society of Parenteral and Enteral Nutrition Special Interest Groups carried out that the cut off values for low muscle mass is defined as percentage of muscle mass > 2 SDs below the mean of reference individuals; for walking speed is < 0. 8 m/s in the 4 meters walk test [1] .

Measurement of muscle mass and muscle strength

Muscle strength is mainly assessed by handgrip. While physical performance can be measured using simple tests such as the short physical performance battery test, usual gait speed or the timed get-up-and-go test; it is difficult to assess muscle mass in practice. Dual-energy X-ray absorptiometry (DEXA) is recently proposed as the gold standard for muscle mass measurement. Other methods include bioelectrical impedance, computed tomography, magnetic resonance imaging, urinary excretion of creatinine, anthropometric

assessments, and neutron activation assessments can be used for measurement of muscle mass as well [8] . The process is complicated and need participation of professionals. Prevalence of sarcopenia varies as use of cut-off points relies on different instruments used for assessing muscle mass and strength and function.

SARC-F, a newly developed simple questionnaire, has been regarded as rapid diagnosis test for sarcopenia. It contains five components: strength, assistance in walking, rise from a chair, climb stairs and falls. A question will be asked to assess each component variable. Scores range from 0-10, with 0-2 for each component [7] . Details of SARC-F are shown in table 1. Cut-off score

A research conducted in Hong Kong tests the validation of SARC-F as a screening tool for sarcopenia in community. It found that SARC-F is able to predict future adverse outcomes with comparable power to other criteria. It also found that SARC-F has excellent specificity (94. 4%) and negative predictive value but poor sensitivity. With high specificity, SARC-F is useful for screening out older adults with sarcopenia. Poor sensitivity may due to the number of participants classified as having sarcopenia represent only a small proportion of the total population studied [10] .

Another research applied SARC-F in mainland China to screen sarcopenia and physical disability. It published that poor physical performance and grip strength were associated with SARC-F defined sarcopenia. But there was a very weak correlation to muscle mass in physically active outpatients. It

pointed out potential explanation that the weak correlation may partly due to only small sample measured by DXA or BIA [11] .

Relevance to Public Health

Sarcopenia is coming of age. Elderly population is expected to remain on a rising trend in most of developed countries. In Hong Kong the proportion of the population aged 65 and over is projected to rise markedly from 13% in 2012 to 30% in 2041 []. It means that increasing population will suffer from sarcopenia.

It is not surprise that sarcopenia increase the risk of physical disability. The risk of disability is 1. 5 to 4. 6 times higher in older persons with sarcopenia than in older persons with normal muscle. Men are at greater risk of sarcopenia related disability than women [16] . Recent estimates indicate that approximately 45% of the older U. S. population is sarcopenic and that approximately 20% of the older U. S. population is functionally disabled [21] . It is important to note that physical disability is associated with an increased risk of nursing home placement, home healthcare and hospital use [21] . And these healthcare services need extra healthcare expenditure to support. To sum up with information above, sarcopenia is becoming big challenge in public along with the rise of older population. It is cause serious health consequences in persons and make economic burden in countries.