Sarcopenia in hip fracture patients diagnosed by dual energy X-ray absorptiometry

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ABSTRACT

INTRODUCTION: As populations are aging worldwide, the number of patients with hip fracture is increasing. Because hip fracture patients consume much public resources for surgery, hospitalization, or nursing care, its prevention and treatment are the clue for saving overstressed medical finance. Sarcopenia, the deficiency of skeletal muscle due to aging, is known to increase the risk of fall. [1] But the impact in hip fracture has never been reported. This study is aimed to estimate the incidence of sarcopenia in hip fracture patients compared with normal subjects.

METHODS: A total of 357 patients with acute hip fracture who were at least 55 years of age were admitted in National Center for Geriatrics and Gerontology from June 2002 to January 2009. All patients underwent whole-body dual energy X-ray absorptiometry (DXA) on admission. These patients were assigned to the hip fracture (Fx) group (mean age ±SD: 82.3 years±9.4, female ratio: 85.2%). 2511 patients (mean age ±SD: 69.8 years±11.6, female ratio: 75.4%) in outpatient clinic in the same institute and period, who were suspected to have osteoporosis and underwent whole-body DXA, were assigned to the control group. Body composition was measured using whole-body DXA (DPX-NL; GE Medical Systems Lunar, Madison, WI). Bone mineral, fat, and fat-free soft-tissue masses were measured for the whole body, the arms, and the legs. The sum of the lean soft-tissue masses for the arms and the legs were considered to be the appendicular skeletal muscle mass (ASM). Since the absolute muscle mass is correlated with height, appendicular muscle mass index (ASMI) defined as ASM (kg)/height² (m²) is commonly used to assess sarcopenia. ASMI is directly analogous to body mass index (weight (kg)/ height² (m²)). Sarcopenia was defined according to the criteria of Baumgartner as below 5.45 kg/m² in women and below 7.26 kg/m² in men. [2] Bone mineral density (BMD) of the whole body was calculated at the same time. For statistical analyses, we used SPSS for WINDOWS software (version 11.0; SPSS Inc, Chicago, IL). We evaluate the ASMI value and incidence of sarcopenia on continuous variables by using a general linear model and then the Bonferroni test to adjust for covariates such as age and sex, which were highly correlated to ASMI or BMD. Results are expressed as means ± SEs. To determine a significant difference (p<0.05) was considered significant.

This study was approved by our Institutional Review Board, and all patients gave detailed informed consent in writing.

RESULTS

After Bonferroni correction, both the mean age was 71 years and the ratio of female was 77% in overall patients. Mean height was 152.5 cm in the Fx group and 152.3 cm in the control group. There was no significant difference (p=0.455). Mean body weight was 48.9 kg in the Fx group and 51.8 kg in the control group (P=0.001). Mean BMD of whole body was 0.93 g/cm² in the Fx group and 0.96 g/cm² in the control group (P=0.001).

The ASMI was 5.9 kg/m² in the Fx group and 6.1 kg/m² in the control group (P=0.01). The incidence of sarcopenia was 86% in the Fx group and 67% in the control group (P=0.01). In overall patients (n=2868), ASMI showed a positive correlation with the whole body BMD (Pearson’s correlation coefficient= 0.42 and P value of <0.001).

DISCUSSION

Muscle plays an essential role in elderly to maintain their functional performance preventing fall. The mass and strength of muscle decrease with age. Humans lose approximately 20-30% of their skeletal muscle, and the loss accelerates after 65 years of age. [3] Preferential loss of type II or fast twitch muscle fibres with ageing is identified. [4] This condition, called sarcopenia, has received wide attention in recent years. Sarcopenia is understood to be the significant factor in the development of frailty and loss of independence in the elderly. This study is the first to demonstrate the incidence of sarcopenia diagnosed with DXA in hip fracture patient. The prevalence of sarcopenia in hip fracture patients (86%) is much higher than in the control group, who is without hip fracture (67%). These are quite higher than those previously reported(23%). [5] The fact, severe muscle loss in hip fracture patient, indicates that sarcopenia is the key risk factor for hip fracture.

DXA is a method to determining skeletal muscle mass. Evaluation by computed tomography or magnetic resonance imaging is the criterion measurement of body composition. DXA has enough precision and reproducibility, and is more accessible, less invasive, and lower-cost alternative. Technical errors of DXA for computed tomography scan is reported to be only 2.5%. [6] Calf circumference is traditional and convenient way to measure skeletal muscle mass, but the accuracy is inadequate for screening of sarcopenia. [7] Bioelectrical impedance analysis for sarcopenia is also a non-invasive and easy-to-use method. The validity of bioelectrical impedance analysis, however, is not ascertained for the population whose hydration status alters, such as extremely elderly and fractured patient. [8] DXA is currently the standard for sarcopenia study.

This study also presents the correlation of ASMI and BMD. Muscle and bone mineral volume regulate by similar factors. [9] Possible causes of sarcopenia include decreased muscle protein synthesis due to dysfunction of sex-hormone, nervous system degeneration such as apoptosis of alpha motor neuron at anterior horn cell of spinal cord, malnutrition with chronic disease, or physical inactivity due to changes of lifestyle with ageing. Malnutrition, including insufficiency of vitamin D or protein, has been proposed as an important mechanism underlying sarcopenia as well as bone mineral loss. [10] Simultaneous muscle and bone loss causes severe instability in frail elderly, which leads to falls and fracture.

In conclusion, this study has revealed that 86% of patients with hip fracture have sarcopenia and that bone mineral density correlated with ASMI. Therefore the combination of sarcopenia and osteoporosis poses the potential risk for hip fracture. Simultaneous screening for sarcopenia and osteoporosis by DXA serves to determine the patients in need of nutrition support or strength-training.

REFERENCES