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Comparison of different definitions of low muscle mass in prevalent hemodialysis patients and their relation to muscle strength

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Objectives : Loss of muscle strength or mass is independently associated with poor survival in maintenance hemodialysis patients. However, there are no uniform operational criteria for defining sarcopenia in hemodialysis patients. Skeletal muscle mass indexed to height-squared has been suggested, but this method does not properly reflect sarcopenia in the setting of obesity or old age. Aim of the study was to 1) compare prevalence of low muscle mass using muscle mass indexed with height-squared to other methods of normalization and 2) examine the relation between muscle mass assessed by different methods of normalization to muscle strength.

Methods : We enrolled 133 clinically stable adult hemodialysis patients from three dialysis centers between June 2016 and February 2017. The body composition, including skeletal muscle mass, was evaluated by multi-frequency bioelectrical impedance (BIA, Inbody S10), performed in supine position after a midweek dialysis session. Low muscle mass was defined as muscle mass of 2 standard deviation or more below the normal sex-specific means for young person. Hand grip strength (HGS) was evaluated on non-fistula hand using a Takei TKK 5401 digital handgrip dynamometer (Takei Scientific Instruments Co.) and low muscle strength was defined as HGS below 25 percentile. Skeletal muscle mass measured by BIA was indexed to height-squared, body weight (percentage), body surface area (BSA) by the DuBois formula, or body mass index (BMI) and their results were related to HGS.

Results : The average age of patients was 61.33+/-12.68 years(range 32 to 88years) and 56.4% of patients were men. The prevalence of low muscle mass indexed by weight(percentage), height-squared, BSA, and BMI was 14.3%(n=19), 8.3%(n=11), 15%(n=20), 12.8%(n=17), respectively. Prevalence of low muscle mass increased with aging in all indices. In particular, elderly patients, age over 70years, the prevalence increased to 31.7%(n=13),

14.6%(n=6), 26.8%(n=11), 22.0%(n=9), respectively. The prevalence of low muscle mass was lowest using height-squared index whereas it was highest using muscle mass indexed to weight(percentage). Furthermore, in patients with BMI>25 (N=30), none of patients were classified as low muscle mass by height-squared index. In contrast, weight (percentage), BSA and BMI index reported significant portion of subject have low muscle mass (43.3%, 16.7% and 26.7%, respectively). HGS was positively correlated with skeletal muscle mass normalized by weight (percentage), height-squared, BSA, and BMI ($p = 0.448$, $p = 0.593$, $p = 0.621$, and $p = 0.585$, $P<0.001$, respectively). After adjusting for age, sex and diabetes, patients with low muscle mass by only height-squared index were more likely to have low muscle strength compared to patient with normal muscle mass (OR 1.49, 95% CI 1.005 to 2.212, P=0.047).

Conclusions : Prevalence of low muscle mass in elderly hemodialysis patients is quite high and skeletal muscle mass normalized to height-squared index may underestimate the prevalence of low muscle mass in patients with larger BMI.

Keywords : Hemodialysis; Sarcopenia; Low muscle mass; Handgrip strength