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Editorial Comment

Bioelectrical Impedance Analysis: Quo Vadis?

Bioelectrical impedance analysis (BIA) is a fast and non-invasive method for indirectly evaluating body composition with high reproducibility. While BIA is not recommended for diagnostic purposes, it provides an overview appraisal of health conditions. By measuring electrical conductivity, BIA can estimate muscle mass and is often used to assess sarcopenia in epidemiological studies. Sarcopenia, a condition characterized by a loss of muscle mass and function, can lead to reduced mobility and a decrease in the quality of life, especially among the elderly. BIA has been proven effective in identifying locomotive syndrome, malnutrition, and sarcopenia, either alone or coexisting, in community-dwelling elderly women.[1] Moreover, BIA is a useful tool for predicting the risk of perioperative complications following elective cancer surgery.[2]

It has long been recognized that sarcopenia can independently increase the risk of low bone mineral density.[3] Sarcopenia and osteoporosis often occur together, and the term osteosarcopenia is used to describe a combination of osteopenia or osteoporosis with sarcopenia.[4] The World Health Organization defines osteoporosis as either the presence of a low-traumatic fracture or a bone mineral density that is 2.5 standard deviations or more below the average value for young, healthy women.[5] Dual-energy X-ray absorptiometry (DEXA) is considered the gold standard test for osteoporosis and can provide information on the different compartments (lean, fat, and bone) of the body. However, DEXA has limitations in terms of radiation exposure, cost, and accessibility in routine clinical practice. As an alternative, BIA can be used to simultaneously obtain information on body composition and, potentially, bone mineral content.

In the July issue of the *International Journal of Gerontology*, Chu and colleagues conducted a study comparing whole-body bone density measured by BIA in the standing leg-to-leg mode and DEXA-gauged bone mineral density in 74 postmenopausal women.[6] The study found a modest correlation, with a correlation coefficient of 0.609. This correlation was slightly lower than the one observed in the authors' previous study, which examined the relationship between bone mineral density and the linear combination of BIA resistance and reactance measured in the hand-to-foot model.[7] The authors should be commended for their persistent efforts to explore different BIA modes and parameters to expand the assessment utility of BIA for bone mineral density. Additionally, the authors noted in this study that body mass index could affect the predictive power of BIA-measured whole-body bone density. However, the study did not further investigate the implicit interactions between these factors.

The BIA equipment is widely available and affordable, especially for single-frequency instruments. It offers several advantages for determining bone mineral density, including its low cost, accessibility, and the ability to safely take repeated measurements following disease processes or treatments. However, the accuracy of BIA readouts relies on standardized measurements and equation validation. Additionally, BIA can be influenced by hydration status and may need calibration for conditions with abnormalities in fluid status, such as heart, liver, and kidney diseases, which are common in the elderly. This study also suggests that tweaking BIA equations may be necessary for individuals who are underweight or overweight. It is important to note that bone mineral content does not necessarily reflect bone strength. Future research may explore the relationship between BIA estimates and indicators of micro-architecture quality, such as trabecular bone score.

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Shih-Ping Cheng
Department of Surgery, MacKay Memorial Hospital and MacKay Medical College, Taipei, Taiwan