Extension of weight-standardized bone mineral content in osteoporosis diagnosis

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To the Editor: We appreciate the attentive and interesting article “Efficacy of weight adjusted bone mineral content in osteoporosis diagnosis in Chinese female population” written by Liu et al[1]. The authors have nicely shown bones are three dimensional tissues, only volumetric bone mineral density (vBMD) can be regarded as completely standardized, since the areal bone mineral density (aBMD) is two-dimensional and could result in missed diagnosis in subjects with large bones and misdiagnosis in those with small bones. In addition, although vBMD has undeniable advantages, the most sophisticated dual-energy X-ray absorptiometry (DXA) instrument is not able to measure the bone volume in vivo. Therefore, they attempted to use weight-standardized bone mineral content (wBMC) to replace vBMD for osteoporosis diagnosis, such missed diagnosis or misdiagnosis may be avoided.

In this paper, the author mentioned that Wolff et al[2] proposed the law that bone function determines bone morphology, that is, bone mechanical load determines bone morphology and bone mass, and the basic mechanical load of bone is the gravity (the body weight). This study shows that people who are heavier have more bone mass than those who are lighter, and that a person who does not have bone mass in proportion to their body weight may be at risk for osteoporosis. In addition, through a large number of literature studies, the author also showed that body weight was an important factor affecting bone mass, the use of wBMC in the diagnosis of osteoporosis was completely in line with the biomechanical requirements. So does the “body weight” of the subjects mentioned in the literature refer only to the number on the scale? For example, if two subjects have the same body weight, one is muscular and the other is fatty, does body fat rate still need to be considered in wBMC?

What’s more, some researchers like Koh et al[3] collected samples of 4380 patients aged over 50 years from 21 medical centers in eight Asian countries (including China). Taking the T-score of aBMD of femoral neck as the dependent variable and 11 factors affecting aBMD as independent variables, multiple linear regression equation was established and evaluated by the prediction effect. Finally, the risk of osteoporosis was predicted by two variables, age and weight, which contributed the most. Based on the regression coefficient, the researchers proposed “analysis self-assessment tool for Asia (OSTA),” with the formula of OSTA score = (weight – age) × 0.2, and populations with an OSTA score less than or equal to 4 was considered high-risk for the osteoporosis, which has been applied in many Asian countries. However, Gu et al[1] wrote in the article that OSTA score less than or equal to 5 is considered as a high risk of osteoporosis, so the value of 5 in this sentence should be changed to 4 to be more appropriate. In addition, Koh et al[3] and some studies have also shown that age has a great correlation with bone mineral content (BMC), so should age be considered in wBMC?

The last thing I want to mention is that from a physical point of view bone size is three-dimensional volume rather than two-dimensional area, which varies with the direction of radiation projection. Only three-dimensional volume is not affected by the direction of radiation projection. Quantitative computed tomography (QCT) can be used to measure vBMD in three-dimensional space, and QCT has some advantages over DXA in clinical application, according to the guidelines for QCT measurement of bone mineral density recently issued by the American College of Radiology. For example, DXA measurement method is easily affected by receptor location. QCT measurement results are more accurate when measuring patients with obesity or low body mass index. Therefore, is it more clinically significant to select QCT to diagnose osteoporosis for people with special body shape?

In conclusion, the wBMC mentioned by the authors excluded the influence of body weight on BMC, which may
avoid the disadvantages of aBMD in diagnosing osteoporosis caused by misdiagnosis of small weight or small bone and missed diagnosis of osteoporosis in gross weight or large bone. In addition, although vBMD has undeniable advantages to eliminate the effect of bone size, the most sophisticated DXA instrument is not able to measure the overall bone volume in vivo. Therefore, the selection of wBMC for the diagnosis of osteoporosis has a good prospect.

Conflicts of interest

None.

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How to cite this article: Zhou L, Peng FL. Extension of weight-standardized bone mineral content in osteoporosis diagnosis. Chin Med J 2019;132:2501–2502. doi:10.1097/CMX9.000000000000471