Lancet Diabetes Endocrinol. Author manuscript; available in PMC 2016 November 03.

Published in final edited form as:
Lancet Diabetes Endocrinol. 2015 April ; 3(4): 234–236. doi:10.1016/S2213-8587(15)00049-2.

Diagnostic criteria for osteoporosis should be expanded

Alexandra Papaioannou and **Courtney Kennedy**
Division of Geriatric Medicine, McMaster University, St Peter's Hospital, GERAS Centre, Hamilton, ON L8M 1W9, Canada

As a relatively newly classified chronic disease, scientific enquiry about pathophysiology, diagnosis, and treatment for osteoporosis has rapidly increased in the past three decades. Under the direction of the National Bone Health Alliance, a working group has proposed expansion of the diagnostic criteria for osteoporosis in men and postmenopausal women aged 50 years and older to include individuals with any of the following: a hip fracture (with or without bone mineral density [BMD] testing); low bone mass as determined by BMD and a vertebral, proximal humeral, pelvic, or, in some cases, distal forearm fracture; or raised fracture risk based on the WHO fracture risk algorithm, FRAX. We propose that this is a prudent approach and that it reflects the present understanding of bone fragility and fracture-risk prediction.

With the emergence of bone densitometry as a reliable measure, in 1994 WHO proposed the first operational definition of osteoporosis based on BMD T-scores.[1] These criteria were established based on dual-energy X-ray absorptiometry (DXA) as the technique to quantify bone mass.[2] Given that the diagnostic cut-point for osteoporosis (more than 2·5 standard deviations below the young average value) is based on a statistical distribution, the absolute BMD values for osteoporosis diagnosed in this way differ according to the site measured, technique, equipment, and reference population.

In the past decade, there have been at least two paradigm shifts in the diagnosis and management of osteoporosis. The first major shift was the incorporation of clinical risk factors into fracture risk prediction. The FRAX tool developed by WHO, which can be used to predict fracture risk with or without BMD values, has been validated worldwide. Since 2010, Canadian osteoporosis guidelines have incorporated clinical risk factors for diagnosis of osteoporosis in addition to BMD,[3] similar to other countries.[4] Individuals at high risk of fractures are those with previous fracture of the hip or spine, more than one previous non-vertebral fracture (excluding hands, feet, and ankles), or those who have recently used glucocorticoids and have had one previous fracture. Numbers needed to treat to prevent further fractures are low and intervention is cost-effective in these high-risk individuals.[3]

The second shift has been recognition of the importance of bone quality, in addition to density, as a key component of bone strength. Bone quality can be thought of as a complex set of interdependent factors that affect bone strength, including structural (eg, geometry and

Correspondence to: Alexandra Papaioannou.
CK declares no competing interests.

microarchitecture) and material (eg, mineral crystal size, quality of collagen, and microdamage or microfracture) properties of bone.[5] Although the use of bone quality measures in clinical diagnosis of osteoporosis is still being investigated, several techniques can be used to estimate bone quality.

These shifts are based on the concept that BMD alone does not adequately predict fracture risk. Relatively small increases in BMD with treatment can substantially reduce fracture risk. More than half of fractures occur in the non-osteoporotic range, indicating relatively poor sensitivity of BMD.[6,7] Fracture prediction in women with low bone mass (T-score between –2·5 and –2·0) is improved when previous fracture and bone turnover markers are used in addition to low BMD.[7] In the FIT trial, bisphosphonates decreased vertebral fracture risk in patients with low bone mass.[8]

Clinical predictors of fracture have powerful case-finding potential, particularly when used in older individuals. The FRAX tool, in addition to using clinical risk factors, recommends input of BMD to establish the 10 year probability of a major fracture. However, FRAX alone has comparable predictive ability as FRAX with BMD and identifies patients at risk who are responsive to pharmaceutical intervention.[9] A model involving FRAX scores without BMD input has not been validated in residents in nursing homes. Thus, in contexts in which obtaining of a BMD measurement is not possible for fracture risk assessment, clinical risk factors might be sufficient, especially in frail elderly people.

With a rapidly ageing society, it is crucial to consider the effect of management of osteoporosis and ultimately prevention of fractures in a group that is already at higher risk due to age-related bone loss. For a resident of a nursing home or a housebound elderly person, obtaining a BMD result is often impractical or unattainable. Thus, history taking and physical examination to identify previous fractures is of even more importance in this population.[10] The Ontario Osteoporosis Strategy for long-term care has recently completed guidelines specific for frail elderly residents These guidelines specify that residents identified as being at high risk for fractures and receiving osteoporosis treatments before admission into long-term care should continue to have this classification applied at admission.

The absolute risk reduction of an intervention is greatest for patients with more severe underlying disease (ie, at high risk of the adverse event).[11] Previous fracture is a powerful predictor of a future fracture;[12] however, a substantial care gap has been created in treatment of individuals with fracture in part due to an overemphasis on BMD values. Previous fracture, particularly hip or vertebral fracture, should undoubtedly be sufficient criteria for the diagnosis of osteoporosis in the absence of BMD, particularly in frail elderly individuals.

Acknowledgments

AP reports grants and personal fees from Amgen, grants and personal fees from Eli Lilly, grants from Merck Canada, and grants from Werner Chilcott, outside the submitted work.

References

1. Kanis JA. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: synopsis of a WHO report. WHO Study Group. Osteoporos Int. 1994; 4:368–81. [PubMed: 7696835]
2. Kanis JA. An update on the diagnosis of osteoporosis. Curr Rheumatol Rep. 2000; 2:62–66. [PubMed: 11123041]
3. Papaioannou A, Morin S, Cheung AM, et al. for the Scientific Advisory Council of Osteoporosis Canada. 2010 clinical practice guidelines for the diagnosis and management of osteoporosis in Canada: summary. CMAJ. 2010; 182:1864–73. [PubMed: 20940232]
4. National Institute for Health and Care Excellence. [accessed Jan 20, 2015] Osteoporosis: assessing the risk of fragility fracture. NICE guidelines CG146. 2012. http://www.nice.org.uk/guidance/cg146
5. Felsenberg D, Boonen S. The bone quality framework: determinants of bone strength and their interrelationships, and implications for osteoporosis management. Clin Ther. 2005; 27:1–11. [PubMed: 15763602]
6. Schuit S, Van der Klift M, Weel A, et al. Fracture incidence and association with bone mineral density in elderly men and women: the Rotterdam Study. Bone. 2004; 34:195–202. [PubMed: 14751578]
7. Sornay-Rendu E, Munoz F, Duboeuf F, Delmas PD. Rate of forearm bone loss is associated with an increased risk of fracture independently of bone mass in postmenopausal women: the OFELY study. J Bone Miner Res. 2005; 20:1929–35. [PubMed: 16234965]
8. Quandt SA, Thompson DE, Schneider DL, Nevitt MC, Black DM. for the Fracture Intervention Trial Research Group. Effect of alendronate on vertebral fracture risk in women with bone mineral density T scores of −1.6 to −2. 5 at the femoral neck: the Fracture Intervention Trial. Mayo Clin Proc. 2005; 80:343–49. [PubMed: 15757015]
9. Kanis JA, McCloskey E, Johansson H, Oden A, Leslie WD. FRAX(®) with and without bone mineral density. Calcif Tissue Int. 2012; 90:1–13. [PubMed: 22057815]
10. Greenspan SL, Perera S, Nace D, et al. FRAX or fiction: determining optimal screening strategies for treatment of osteoporosis in residents in long-term care facilities. J Am Geriatr Soc. 2012; 60:684–90. [PubMed: 22316237]
11. Barratt A, Wyer PC, Hatala R, et al. for the Evidence-Based Medicine Teaching Tips Working Group. Tips for learners of evidence-based medicine: 1. Relative risk reduction, absolute risk reduction and number needed to treat. CMAJ. 2004; 171:353–58. [PubMed: 15313996]
12. Gehlbach S1, Saag KG, Adachi JD, et al. Previous fractures at multiple sites increase the risk for subsequent fractures: the Global Longitudinal Study of Osteoporosis in Women. J Bone Miner Res. 2012; 27:645–53. [PubMed: 22113888]