CME CREDIT

ONE MINUTE CONSULT

BRIEF ANSWERS TO SPECIFIC CLINICAL QUESTIONS

Q: What is osteopenia, and what should be done about it?

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A: Consider the following patients:

A 35-year-old woman who is premenopausal and has no risk factors for osteoporosis. After being sedentary for most of her life, she began training for a marathon and sustained stress fractures in her left foot. Her orthopedist recommended a dual-energy x-ray absorptiometry (DXA) bone density study of the spine and hip. The diagnosis was osteopenia, lowest T score –1.1.

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A 52-year-old woman who just started menopause and has no other risk factors for osteoporosis. Her primary care physician recommended a DXA study "to be on top of things." The diagnosis was osteopenia, lowest T score –1.3.

A 57-year-old woman who went through natural menopause in her late 40s. She has no other risk factors for osteoporosis. She had an ultrasound test of the heel at a local health fair. The diagnosis was osteopenia, lowest T score –1.7.

A 66-year-old woman who went through natural menopause in her early 50s and has no other risk factors for osteoporosis. Her primary care physician recommended a DXA study based on the recommendations of the US Preventive Services Task Force[1] that healthy women without risk factors be screened for osteoporosis at age 65. The diagnosis was osteopenia, lowest T score –1.8.

A 76-year-old woman who went through natural menopause in her early 50s. She has lost 3.5 inches in height. Her primary care physician recommended a DXA study. The diagnosis was osteopenia, lowest T score –2.3.

OSTEOPENIA IS NOT A USEFUL DIAGNOSIS

What do these women have in common? They have all had bone density tests. Although the diagnosis is the same in all five, their risk of fracture and need for pharmacological intervention differ considerably.

Because the term "osteopenia" is not useful as a diagnosis and can actually be harmful, I am on a personal crusade to eliminate it from the bone density lexicon. (I am happy to let the radiologists use it to describe "washed out" bones seen on standard radiographs, but I realize that someone with washed-out bones has probably lost 30% of her or his young adult bone mass and therefore has osteoporosis.)

I am on a crusade to eliminate the term 'osteopenia'

What is a T score?

The unit of measure for bone mineral density (BMD) by DXA is grams per square centimeter. If there were only a single device for measuring bone density, and if only a single skeletal site were measured absolute BMD would be used clinically. However, few (if any) clinicians would be able to remember ideal or threshold cut-point values for multiple skeletal sites (spine, femoral neck, total hip) for a single machine, much less deal with machines from different manufacturers that are calibrated differently.

Thus, the unit for reporting bone density, at least for postmenopausal women, is the T score, in which the patient's BMD is compared with the young normal mean value and the difference expressed as a standard deviation score. For example, 0 is equal to the young adult mean value, +1 is 1 standard deviation above the young adult mean, –1 is 1 standard deviation below. In theory, the T

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TABLE 1

World Health Organization criteria for diagnosing osteoporosis using bone density measurements

CATEGORY	T SCORE
Normal	Not more than 1.0 standard deviations (SD) below the young adult mean
Osteopenia	Between 1.0 and 2.5 SD below the young adult mean
Osteoporosis	More than 2.5 SD below the young adult mean
Severe or established osteoporosis	More than 2.5 SD below the young adult mean with a fracture

score provides a way of using a single set of numbers for all devices and all skeletal sites.

T scores apply only to postmenopausal women

In 1994, a working group of the World Health Organization (WHO) put forth an operational definition of postmenopausal osteoporosis (TABLE 1).[2] The purpose was to have a common framework that would allow collection of epidemiological data in different countries to convince government and public health authorities that osteoporosis is a serious health problem.

Any system that sets an arbitrary cut point inevitably misclassifies some patients

The working group made it clear that their classification was to be applied only to postmenopausal women. The International Society for Clinical Densitometry (ISCD) recommends that T scores not be used in premenopausal women or in younger men, and certainly not in children.[3] Instead, Z scores should be used. The Z score compares a patient with age-matched, sex-matched, and race-matched norms and expresses the difference as a standard deviation score.

The working group also made it clear that their classification was applicable only to measurements made at the spine, hip, and forearm. The ISCD specifically states that patients should be classified based on the lowest T score of the posteroanterior spine, femoral neck, trochanter, or total hip[4] and that the WHO classification should not be used with peripheral measurements.[5]

The WHO working group selected a cut-point T score of –2.5 to define osteoporosis because "such a cutoff value identifies approximately 30% of postmenopausal women as having osteoporosis using measurements made at the spine, hip, or forearm. This is about the same as the lifetime risk of fracture at these sites. When measurements are made at the hip alone, then the prevalence is about one in five white women, comparable to the lifetime risk of a single osteoporotic fracture, such as a hip fracture."[2]

No threshold BMD for fracture risk

The relationship between BMD and fracture risk is continuous; there is no magic fracture threshold.

Marshall and colleagues[6] performed a meta-analysis of 11 prospective cohort studies involving 90,000 person-years of observation and more than 2,000 fractures. The correlation between BMD at baseline and fractures occurring during prospective observation was remarkably consistent: for each standard deviation decrease in BMD, the risk of fracture increased approximately twofold. This was true whether the correlation was between forearm BMD and hip fracture risk or hip BMD and spine fracture risk.

Thus, any system that sets an arbitrary cut point will inevitably misclassify some patients. Nevertheless, it is helpful at times for clinicians to think categorically (ie, "normal" vs "osteoporosis").

Although it was not intended to be applied to individual patients, the WHO classification works well to define "normal" (T score –1.0 and above) and "osteoporosis" (T score –2.5 and below). Several large studies have shown a high risk of fracture in patients

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who have T scores of –2.5 and below and also a significant reduction in fracture risk with treatment in such patients, making this threshold a reasonable, evidence-based criterion for the diagnosis of osteoporosis and for starting treatment in patients without other risk factors for fracture.

Four problems with 'osteopenia'

Although it is sometimes useful to think categorically when dealing with a continuous variable, the category of "osteopenia" creates problems in at least four ways.

- The WHO classification was specifically meant to apply to postmenopausal white women; applying a medical label such as osteopenia to a healthy young person can create considerable anxiety that may last one's whole life.
- It was meant to be applied only with DXA and only to specific skeletal sites; using the WHO classification with peripheral measurements (eg, heel, finger, tibia) or other techniques (eg, quantitative computed tomography, quantitative ultrasonography) is not appropriate.
- Many postmenopausal women who are in the upper part of this borderline range are perfectly normal. After all, "normal" for most biological variables is defined as the mean plus or minus 2 standard deviations.
- Postmenopausal women who are in the lower part of this range are almost as likely to have fractures as patients on the lower side of the arbitrary cut point (or maybe more likely, depending on other risk factors for fracture).

I try to avoid using the term osteopenia in reporting DXA results and in patient care. For patients with T scores between –1.0 and –2.5, I use the term "low bone density," which does not sound like a medical problem in and of itself, and (I hope) is a nonjudgmental term that should force the clinician to think about the clinical context.

Postmenopausal women in the upper part of this range (–1.0 to –1.5) should usually be reassured and monitored, perhaps every 5 years or so. Patients in the middle part of this range (–1.5 to –2.0) rarely need pharmacologic treatment but should be monitored every 3 to 5 years. Patients in the lower part of the range (–2.0 to –2.5) should be monitored at least every year or two and may even be candidates for pharmacologic intervention, depending on how low their BMD is and if they have other risk factors for fracture.[7]

FRACTURES DEFINE SEVERE OSTEOPOROSIS

Often ignored is the WHO category of "severe" or "established" osteoporosis, meant to apply to patients who have already had a fracture. Although a fragility fracture, particularly a vertebral fracture, is a strong predictor of future fractures, this is true whether the T score is –2.6 or –2.4. In fact, there is an apparent paradox: most patients who have fragility fractures have T scores above –2.5![8,9] Patients without fractures but with T scores of –2.5 or below are clearly at high risk of fracture; however, that is a small percentage of the population.

Although the fracture rate is lower in the group with "low bone mass," there are so many more people with low bone mass than with osteoporosis (using the WHO classification) that the absolute number of fractures is greater in the group with low bone mass. It is possible that some clinicians would not diagnose osteoporosis in a patient with a fragility fracture but with a T score above –2.5! I am not in favor of adding a category of "severe osteopenia" for patients with borderline low bone mass and fragility fractures; in my view, these patients have osteoporosis. In fact, a patient with low bone mass and fragility fracture is much more likely to have a fracture in the future than a patient with WHO-defined osteoporosis but without a fragility fracture.[10]

Most patients who have fragility fractures have T scores above –2.5

IN SUMMARY

- The term "osteopenia" should be eliminated in the context of BMD testing and replaced with "low bone mass."
- Patients with low bone mass and fragility fractures have osteoporosis and should be treated.
- Apparently healthy patients in the upper range of low bone mass should be reassured and monitored periodically; those in the lower range deserve consideration of pharmacologic intervention.

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- T scores should not be used in premenopausal women or in young men or children.
- The WHO criteria should not be applied to sites other than the posteroanterior spine, proximal femur, or forearm.

WHAT ABOUT OUR FIVE PATIENTS?

The 35-year-old premenopausal woman. Her stress fractures are almost certainly due to repeated mechanical forces rather than a systemic skeletal disease. A bone density study is not indicated for her. When DXA studies are done in young women, Z scores rather than T scores should be reported, to discourage inappropriate application of the WHO classification. This woman's lowest Z score is –1.2, which is below average but still normal (within 2 standard deviations of the age-adjusted mean value). This woman should have a DXA study repeated at age 65 or sooner if there is some new indication. She does not need pharmacologic therapy for bone health.

The 52-year-old woman who has just started menopause. Bone density testing is recommended for women 65 and older without risk factors and for younger postmenopausal women who have risk factors, and so is not indicated in this case. Her lowest T score of –1.3 is borderline low, indicating a low risk of fracture in the next 5 to 10 years. She does not need pharmacological therapy for bone health. She should have a DXA scan repeated at age 65 or sooner if there is some new indication.

The 57-year-old postmenopausal woman. She had an ultrasound test of the heel at a local health fair, but the WHO criteria cannot be used with peripheral measurements, so the diagnosis of osteopenia is not appropriate with the data at hand. In many cases, T scores are lower in the spine and hip than in the heel. With a T score of –1.7 in the heel, she could have a much lower score in the spine or hip. False-negative peripheral tests can also be seen. She needs a central DXA scan to be done now if there is concern about the implications of the abnormal ultrasound test, or, because she has no risk factors for osteoporosis, she could wait until age 65.

The 66-year-old postmenopausal woman. Bone density testing is appropriate. Her lowest T score of –1.8 is in the middle of the borderline range. With no other risk factors for osteoporosis, her likelihood of fracture in the next 5 to 10 years is fairly low, so pharmacologic therapy is not indicated. Age-related bone loss occurs at a rate of about 0.5% to 1.0% per year, and the minimum change measurable with DXA is about 3%, so she should have a repeat DXA in 3 to 5 years.

The 76-year-old woman. Her lowest T score is –2.3, and she has lost 3.5 inches in height. Spine x-rays or vertebral fracture assessment with DXA equipment should be done. If she does have vertebral fractures, then she has osteoporosis and is a definite candidate for pharmacological treatment. If she does not have vertebral fractures, treatment may still be appropriate, as her age is an independent risk factor for fracture.

REFERENCES

1. **US Preventive Services Task Force.** Screening for osteoporosis in postmenopausal women: recommendations and rationale. Ann Intern Med 2002; 137:526–528.
2. **Kanis JA, Melton LJ III, Christiansen C, Johnston CC, Khaltaev N.** The diagnosis of osteoporosis. J Bone Miner Res 1994; 9:1137–1141.
3. **Writing Group for the ISCD Position Development Conference.** Diagnosis of osteoporosis in men, premenopausal women, and children. J Clin Densitom 2004; 7:17–26.
4. **Hamdy RC, Petak SM, Lenchik L; International Society for Clinical Densitometry Position Development Panel and Scientific Advisory Committee.** Which central dual X-ray absorptiometry skeletal sites and regions of interest should be used to determine the diagnosis of osteoporosis? J Clin Densitom 2002; 5(suppl):S11–S18.
5. **Miller PD, Njeh CF, Jankowski LG, Lenchik L; International Society for Clinical Densitometry Position Development Panel and Scientific Advisory Committee.** What are the standards by which bone mass measurement at peripheral skeletal sites should be used in the diagnosis of osteoporosis? J Clin Densitom 2002; 5(suppl):S39–S45.
6. **Marshall D, Johnell O, Wedel H.** Meta-analysis of how well measures of bone mineral density predict occurrence of osteoporotic fractures. BMJ 1996; 312:1254–1259.
7. **Hodgson SF, Watts NB, Bilezikian JP; American Association of Clinical Endocrinologists.** American Association of Clinical Endocrinologists 2001 Medical Guidelines for Clinical Practice for the Prevention and Management of Postmenopausal Osteoporosis. Endocr Pract 2001; 7:293–312.
8. **Wainwright SA, Marshall LM, Ensrud KE, et al; Study of Osteoporotic Fractures Research Group.** Hip fracture in women without osteoporosis. J Clin Endocrinol Metab 2005; 90:2787–2793.
9. **Schuit SC, van der Klift M, Weel AE, et al.** Fracture incidence and association with bone mineral density in men and women: the Rotterdam Study. Bone 2004; 34:195–202.
10. **Ross PD, Davis JW, Epstein RS, Wasnich RD.** Pre-existing fractures and bone mass predict vertebral fracture incidence in women. Ann Intern Med 1991; 114:919–923.

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