

# Osteoporosis Diagnosis and Screening

**ANDREA SINGER, MD**

Associate Professor of Medicine and Obstetrics and Gynecology  
Georgetown University Hospital  
Washington, DC

Osteoporosis and osteoporotic fracture are major causes of morbidity and mortality in the United States and worldwide. Nearly half of all women and one quarter of men >50 years of age will experience an osteoporosis-related fracture during their lifetime. The diagnosis of osteoporosis in postmenopausal women and older men can be made definitively by comparing bone mineral density (BMD) measurements from dual-energy x-ray absorptiometry (DXA) to mean peak bone mass in young adults. Efforts to increase access to DXA and improve the sensitivity and specificity of osteoporosis risk assessment instruments may help ensure that individuals with osteoporosis are diagnosed early. The early identification of individuals with low BMD and/or clinical risk factors, accurate diagnosis of osteoporosis and osteopenia, and initiation of appropriate treatment are crucial to reducing the incidence of vertebral and nonvertebral fractures. The World Health Organization is moving toward absolute risk assessment and this may help to better identify patients for screening and treatment in the future. (*Clinical Cornerstone*. 2006;8[1]:9–18) Copyright © 2006 Excerpta Medica, Inc.

Osteoporosis and osteoporotic fracture are major causes of morbidity and mortality and together represent a significant health care burden in the United States and worldwide. According to the National Osteoporosis Foundation (NOF), an estimated 1.5 million fractures occur annually in the United States as a result of osteoporosis.<sup>1</sup> Furthermore, 40% to 50% of women and 25% of men aged 50 years or older will suffer an osteoporosis-related fracture during their lifetime.<sup>1,2</sup> Currently, the bisphosphonates are recommended as first-line treatment for osteoporosis in postmenopausal women and older men. These agents have been shown to increase bone mineral density (BMD) and, more importantly, to reduce the incidence of vertebral and nonvertebral fractures.<sup>3–9</sup> Although osteoporosis can be effectively managed, it continues to be undertreated in part because of inadequacies in screening and diagnostic procedures. Indeed, more than two thirds of women remain undiagnosed after sustaining a fracture, and few are prescribed adequate therapy. The World Health Organization (WHO) has established diagnostic criteria for osteoporosis based on BMD T-scores.<sup>10</sup> However, even if a screening program were implemented to identify all individuals with BMD T-scores indicative of osteoporosis, the majority of fractures would be missed; that is, the majority of frac-

tures occur in those with T-scores outside the osteoporotic range.<sup>11</sup> Similarly, the NOF and other institutions have established guidelines on which patients should be screened for osteoporosis (eg, postmenopausal women aged ≥65 years),<sup>12</sup> but a significant proportion of osteoporotic fractures occur in patients who might not otherwise be screened. The early identification of individuals with low BMD and/or clinical risk factors, accurate diagnosis of osteoporosis and osteopenia, and initiation of appropriate treatment are crucial to reducing the incidence of vertebral and nonvertebral fractures. This paper discusses the current osteoporosis diagnostic and screening guidelines and their limitations.

## KEY POINT

**Although osteoporosis can be effectively managed, it continues to be undertreated in part because of inadequacies in screening and diagnostic procedures.**

## DIAGNOSIS OF OSTEOPOROSIS

The diagnosis of osteoporosis is based on BMD, as low BMD has been shown in epidemiologic studies to be a strong predictor of osteoporotic fracture. The WHO diagnostic criterion for osteoporosis in postmenopausal women is a BMD measurement that is  $\geq 2.5$  SD below the mean peak bone mass for young adult women (ie, T-score  $\leq -2.5$ ).<sup>10</sup> In men aged  $\geq 65$  years, a similar T-score threshold is used to diagnose osteoporosis using gender-specific mean peak bone mass values.<sup>13</sup> For men aged 50 to 65 years, a diagnosis of osteoporosis may be made only if T-scores are at or below  $-2.5$  and clinical risk factors for fracture are present. In premenopausal women and in men below the age of 50 years, the diagnosis of osteoporosis should not be made based on densitometry results alone.<sup>13</sup> In these populations, osteoporosis may be diagnosed if low BMD is accompanied by secondary causes (eg, glucocorticoid therapy, hyperparathyroidism, hypogonadism) or other risk factors for fracture (**Table I**).<sup>13</sup>

T-scores were originally based on BMD of the hip as measured by dual-energy x-ray absorptiometry (DXA). However, the scores are now applied to BMD at other skeletal sites and/or measured by different methods.<sup>14</sup> Thus, a woman may be classified as osteoporotic, osteopenic, or normal depending on the site and measurement technique used. Although low BMD is a strong predictor of osteoporotic fracture, the majority of fractures occur outside the WHO-defined osteoporotic T-score range. For example, in a longitudinal study of 140,000 women, new fractures during 1 year were reported in 2259 women, but only 6.4% had a T-score that indicated osteoporosis ( $-2.5$  SD).<sup>15</sup> Thus, a significant proportion of fractures occurs in the osteopenic T-score range. Accordingly, treatment may be initiated for high-risk patients with low BMD values that are not necessarily in the osteoporotic range.

## KEY POINT

**In premenopausal women and in men below the age of 50 years, the diagnosis of osteoporosis should not be made based on densitometry results alone.**

### Dual X-ray Absorptiometry

DXA is considered the gold standard of BMD measurement. DXA can be used to measure BMD at any site but is generally used at central sites such as the lumbar spine (posterior-anterior L1-L4) and the hip, the preferred measurement sites for a diagnosis of osteoporosis.<sup>13,14</sup> Hip BMD can be measured at the proximal femur, femoral neck, or trochanter, and the lowest value should be used for diagnostic purposes.<sup>13</sup> When spinal or hip BMD cannot be measured or interpreted correctly, BMD of the nondominant forearm (33% radius) may be used to diagnose osteoporosis.<sup>13</sup> In elderly patients, spinal BMD should be interpreted with caution since degenerative arthritis can cause artificial increases in the measured BMD.<sup>13</sup>

DXA measures areal density of bone ( $\text{kg}/\text{cm}^2$ ). This BMD measurement is then compared with the appropriate sex-matched young adult mean to yield a T-score and the age-sex-matched mean to yield a Z-score.<sup>13</sup> The advantage of DXA is that it exposes patients to only very low levels of radiation.<sup>14</sup> However, DXA is not available at all medical centers and is also expensive.<sup>16</sup> Central DXA is the measure used in most studies and has been the method used to follow treatment efficacy.

Peripheral DXA technology is more portable and less expensive than central DXA, and can be used to analyze

**TABLE I. DIAGNOSTIC CRITERIA FOR OSTEOPOROSIS IN SPECIFIC POPULATIONS.<sup>13</sup>**

Population	Diagnostic Criteria for Osteoporosis
Postmenopausal women	T-score of $-2.5$ or less (based on female reference values)
Men aged $\geq 65$ years	T-score of $-2.5$ or less (based on male reference values)
Men aged 50–65 years	T-score of $-2.5$ or less along with other risk factors for fracture

BMD at the distal radius and the calcaneus with high precision.<sup>14</sup> However, peripheral BMD measurements are less useful in predicting the risk of fractures than spinal and hip DXA measurements.<sup>14</sup> Peripheral DXA measurements that indicate low BMD are not sufficient to establish a diagnosis of osteoporosis but may be used to identify patients who require further assessment.<sup>13</sup> Peripheral DXA, along with a careful risk assessment, may be used for diagnostic purposes when central DXA is not available.<sup>17</sup>

There is some degree of discordance in the diagnosis of osteoporosis using a definition based on BMD of lumbar or femoral regions.<sup>18</sup> Moayyeri et al<sup>18</sup> found that the sensitivity of lumbar DXA for the diagnosis of osteoporosis was significantly higher than that of femoral DXA but the difference became nonsignificant in men aged  $\geq 60$  years and women aged  $\geq 70$  years. These results suggest that data from one anatomical site cannot necessarily predict the condition of the other site.<sup>18</sup> Based on these findings, the authors recommend that if a single BMD assessment needs to be used, lumbar DXA is preferable in men aged  $\leq 60$  years and women aged  $\leq 70$  years. For older patients, hip/femoral DXA may be used.

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### Quantitative Computed Tomography

Quantitative computed tomography (QCT) is an alternative to DXA that can be used to measure BMD of the lumbar spine or peripheral sites.<sup>14</sup> The advantage of QCT is that it allows the measurement of true volumetric BMD as opposed to areal BMD, as measured by DXA. QCT can also distinguish between cortical and trabecular bone.<sup>14</sup> However, due to the lower precision, higher cost, and increased radiation exposure with QCT, the American College of Obstetricians and Gynecologists does not recommend routine use of QCT.<sup>19</sup> Moreover, T-scores derived from QCT have not been correlated with fracture risk.<sup>20</sup>

Measures obtained from abdominal computed tomography (CT) images can be used in the diagnosis of osteoporosis. Nishihara et al<sup>21</sup> were able to calculate the central part of the vertebral body from abdominal x-ray CT images. Using these data, patients with osteoporosis could be identified with 100% sensitivity but low specificity.<sup>21</sup>

### Quantitative Ultrasound

Quantitative ultrasound (QUS) to measure BMD is an attractive option because it is less expensive, more portable, and more widely available than DXA.<sup>16</sup> Moreover, QUS does not expose patients to ionizing radiation. However, QUS parameters are usually found to correlate only moderately with BMD measurements by DXA. In addition, the T-score threshold for diagnosis of osteoporosis differs by skeletal site and instrument, making comparison of BMD measurements difficult.<sup>22</sup>

In a study by Gudmundsdottir et al,<sup>16</sup> among women aged 70 to 85 years who were classified as osteoporotic by DXA of the total hip or femoral neck, 71% to 96% were similarly identified by calcaneal QUS. For younger women (50–65 years), QUS identified 79% to 100% of those classified as osteopenic or osteoporotic by DXA depending on the cutoff value. For older men, the sensitivity of QUS was slightly higher at 82% to 100%. The authors of this study concluded that QUS can be used successfully in excluding osteoporosis in healthy men and women and spare them expensive DXA measurements, but it is not suitable as a diagnostic tool.<sup>16</sup>

In a meta-analysis by Nayak et al,<sup>23</sup> the authors calculated the sensitivity and specificity of QUS over a range of thresholds and determined that in patients with a DXA T-score of  $\leq -2.5$  at the hip or spine, QUS is not sufficient to make a determination of osteoporosis nor to rule it out.<sup>23</sup> For example, at a T-score cutoff of  $-1$ , sensitivity was 79% and specificity was 58%. At a cutoff of 0, sensitivity improved to 93%, but specificity decreased to 24%, and at a cutoff of  $-2.5$ , specificity improved to 93%, but at the expense of sensitivity (33%). The conclusions of this analysis are most relevant to women since most of the included studies exclusively enrolled women patients, and some included specifically postmenopausal women. Additional research needs to be conducted before consensus can be reached and recommendations can be made regarding the accuracy of QUS for identifying patients with osteoporosis.<sup>23</sup>

## Biomarkers of Bone Turnover

During bone formation and resorption, key biomarkers are released from osteoblast and osteoclast activity. Biomarkers of bone formation include osteocalcin and bone-specific alkaline phosphatase. Biomarkers of bone resorption include by-products of collagen metabolism, such as pyridinoline, deoxypyridinoline, and cross-linked C- and N-telopeptides.<sup>14</sup> While some of these biomarkers of bone turnover have been shown to be associated with increased incidence of vertebral and nonvertebral fractures, their value in predicting risk of fracture has not yet been elucidated.<sup>14</sup> There is large individual variability in bone turnover marker levels and the correlation with BMD is only modest. These biomarkers of bone turnover have not yet proved useful in osteoporosis diagnosis or screening.<sup>19</sup> Biomarkers may be useful for monitoring therapy in certain circumstances.

## SCREENING FOR OSTEOPOROSIS

The International Society for Clinical Densitometry recommends BMD testing for all women aged  $\geq 65$  years, postmenopausal women aged  $< 65$  years with additional risk factors, adults with a fragility fracture, adults with medical conditions associated with low bone mass or bone loss (eg, hypogonadism, hypothyroidism), adults taking medications associated with low bone mass or bone loss (eg, corticosteroids), and men aged  $> 70$  years.<sup>24</sup> The NOF recommends BMD testing for postmenopausal women  $> 65$  years, as well as younger postmenopausal women with an additional risk factor or factors. Nonmodifiable risk factors for osteoporosis-related fractures include personal history of fracture as an adult, history of fracture in a first-degree relative, white race, advanced age, female gender, dementia, and poor health/frailty. Modifiable risk factors include cigarette smoking, low body weight, estrogen deficiency, early menopause, prolonged premenopausal amenorrhea, low calcium intake, alcohol abuse, impaired eyesight despite adequate correction, poor health/frailty, recurrent falls, and inadequate physical activity.<sup>12</sup>

The lack of universal access to DXA bone densitometry and its high cost make widespread screening of postmenopausal women and men impractical. This has led to alternative approaches to identify patients within these subpopulations that may be at higher risk for fracture and therefore would be suitable candidates for DXA bone densitometry. One approach to screening is case-finding;

that is, to use risk factors that are easily identifiable and highly prevalent in the target population to identify potential candidates for BMD testing.<sup>11</sup> For example, body weight and body mass index have been shown to correlate well with BMD. These parameters are easily measured and can be used as surrogates for BMD.<sup>11</sup> Age can also serve as a surrogate marker for various other risk factors for fractures, such as changes in bone remodeling and bone quality, increased fall tendency, and general comorbidity.<sup>11</sup>

### KEY POINT

**One approach to screening is case-finding; that is, to use risk factors that are easily identifiable and highly prevalent in the target population to identify potential candidates for BMD testing.**

Several risk assessment questionnaires that incorporate body weight and/or age have been developed to help better identify individuals who should undergo bone densitometry, including the Osteoporosis Risk Assessment Instrument (ORAI), the Simple Calculated Osteoporosis Risk Estimation (SCORE), Age, Body Size, No Estrogen (ABONE), the Osteoporosis Self-Assessment Tool (OST), and the Osteoporosis Index of Risk (OSIRIS). These instruments are used primarily to identify postmenopausal women who may be at increased risk for osteoporotic fracture (**Table II**).

The ORAI is a 3-item risk assessment instrument that consists of age, body weight, and current estrogen use.<sup>25</sup> These 3 factors were found to be independent correlates of low BMD at both the femoral neck and lumbar spine. A point value is assigned for each risk factor. In validation studies of the ORAI, a score of  $\geq 9$  on this instrument identified 90% of women with a BMD T-score of 2 or more SDs below the mean.<sup>25</sup> The ORAI supports selective DXA testing in women aged  $\geq 65$  years, in women aged  $\geq 45$  years weighing  $< 60$  kg, and in women aged 55 to 64 years who weigh 60 to 70 kg and are not taking estrogen.<sup>25</sup>

ABONE is a similar but simpler instrument that uses age, body weight, and estrogen use to quantify risk and need for bone densitometry testing.<sup>26</sup> In ABONE, age  $> 65$  years, body weight  $< 63.5$  kg, and lack of estrogen or

TABLE II. OSTEOPOROSIS RISK ASSESSMENT INSTRUMENTS.

Instrument Name	Items	Threshold Score for Bone Densitometry Referral
Osteoporosis Risk Assessment Instrument (ORAI)	Age ≥75 y = 15 points 65–74 y = 9 points 55–64 y = 5 points Weight <60 kg = 9 points 60.0–69.9 = 3 points Estrogen use No current use = 2 points	≥8–9
Age, Body Size, No Estrogen (ABONE)	Age >65 y = 1 point Weight <63.5 kg = 1 point Estrogen use Never used estrogen or oral contraceptives = 1 point	≥2
Osteoporosis Self-Assessment Tool (OST)	0.2(body weight – age)	<2
Simple Calculated Osteoporosis Risk Estimation (SCORE)	Race Nonblack = 5 points Rheumatoid arthritis present = 4 points History of minimal trauma fracture after age 45 = 3 points for each fracture Age = 3 points per decade No estrogen use = 1 point Weight = –1 for each 10 lbs	≥6–7
Osteoporosis Index of Risk (OSIRIS)	Weight = 0.2 point per kg body weight Age = –0.2 per year History of low impact fracture = –2 points Estrogen use = 2 points	<1

Adapted with permission.<sup>25,26</sup>

oral contraceptive use are each assigned a point value of 1. The presence of 2 of these factors supports referral for bone densitometry.

SCORE uses an index based on age, race, rheumatoid arthritis, history of nontraumatic fracture after age 45 years, estrogen use, and body weight.<sup>27</sup> SCORE has also been validated in postmenopausal women aged >45 years, demonstrating a high sensitivity of 90% but low specificity on the order of 32%.<sup>27</sup>

The diagnostic properties of the ORAI, SCORE, ABONE, and a simple body weight criterion were compared with the NOF guidelines with respect to their ability to select younger postmenopausal women (>45 years) for DXA bone densitometry.<sup>28</sup> Use of the

NOF guidelines, SCORE, and ORAI resulted in >96% of women with osteoporosis being referred for testing; the use of SCORE criteria resulted in the highest sensitivity. However, the SCORE instrument also had poor specificity, identifying ~70% of women with normal BMD as requiring DXA testing. The specificity of the ORAI was slightly better, identifying 56% of women with normal BMD as requiring testing. The ABONE and the simple weight criterion resulted in fewer women with normal BMD being recommended for testing (<40%); however, sensitivity of these instruments was inadequate—only 80% of women with a BMD T-score of –2.0 would be identified as candidates for DXA testing.<sup>27</sup>

The OST uses body weight and age to calculate risk (ie,  $0.2[\text{body weight} - \text{age}]$ ), with a score of  $<2$  indicating need for bone densitometry testing.<sup>29</sup> OSIRIS, in addition to body weight and age, includes history of low impact fracture and use of estrogen therapy to calculate risk for low BMD.<sup>29</sup> In a comparison of SCORE, ORAI, OSIRIS, and OST, the OST was found to be the most useful in identifying osteoporotic BMD T-scores, with a sensitivity of 85% for lumbar spine BMD and 97% for hip BMD.<sup>29</sup> The OST also had a high negative predictive value (89%–99%), suggesting that use of this instrument could effectively identify women with normal BMD, sparing them the expense of DXA densitometry.<sup>29</sup> Of all these validated instruments, the OST appears to be the most useful, with high sensitivity and good specificity. Moreover, the data (age and body weight) can be easily obtained during a routine physical examination.

## SUMMARY

The diagnosis of osteoporosis in postmenopausal women and older men can be made definitively by comparing BMD measurements from DXA to mean peak bone mass in young adults. However, DXA technology is expensive and not universally available, and it can make widespread screening for osteoporosis difficult and impractical. Screening recommendations call for bone densitometry testing in postmenopausal women  $\geq 65$  years as well as younger postmenopausal women with additional risk factors for fracture, but compliance with these recommendations would involve testing millions of women, not all of whom have access to DXA. Several simple risk assessment instruments that include surrogate markers for BMD (eg, body weight, age) have been used to identify more specific populations for whom DXA is warranted. Most of these instruments have high sensitivity and are able to identify patients with low BMD in the osteopenic and osteoporotic ranges. However, few are able to accurately identify patients with normal BMD who could be spared the expense of DXA testing. The WHO is moving toward absolute risk assessment and this may help to better identify patients for screening and treatment in the future. Efforts to increase access to DXA and improve the sensitivity and specificity of osteoporosis risk assessment instruments may help ensure that individuals with osteoporosis are diagnosed early and receive appropriate treatment to help prevent vertebral and nonvertebral fracture.

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## Dialogue Box

### EDITORIAL BOARD

Although a T-score of  $\leq -2.5$  SD defines osteoporosis and is indicative of a group of women at high risk for fracture, you make the point that the absolute number of fractures in this group is lower than in other segments of the population. Is this primarily because of the low number of patients at risk who meet this densitometric criteria?

### SINGER

That is correct and there are several studies with large databases that demonstrate this. As one would expect, as bone density drops, there is an increased risk of fracture. If you look at the absolute number of fractures, however, the actual number of fractures is greater in the group of patients that would not meet the criteria for osteoporosis based on T-score alone because there are greater numbers of women with T-scores in the osteopenic range than in the osteoporotic range. Therefore, if you base your intervention only on T-scores, you will be overlooking a significant number of women at risk for fracture.

### EDITORIAL BOARD

If that's the case, why such an emphasis on a T-score of  $-2.5$  SD?

### SINGER

When defining something, you have to start somewhere. Although less than perfect, the best surrogate marker that we have in terms of looking at increased risk for fracture is determination of bone mineral density (BMD) and the T-score. It is a noninvasive, easy measure to obtain, and in longitudinal studies, it has been shown to correlate with increased fracture risk. As a surrogate marker, BMD is just as good, if not better, than some of the other surrogate markers we commonly use for other conditions (ie, blood pressure for stroke and increased cholesterol levels for heart disease). Nevertheless, there are many people who feel that the T-score is overemphasized and that we really should also be paying attention to other markers of risk so that we don't overlook part of the population that is at risk.

### EDITORIAL BOARD

If patients aged  $>65$  years require a T-score of  $\leq -2.5$  SD, why do patients aged  $<50$  years require an additional risk factor to make the diagnosis?

### SINGER

The bottom line is that for premenopausal women and men, one really needs to be more cautious in making a diagnosis—that is, you need to have another reason besides a low T-score before giving them the diagnosis of osteoporosis. In fact, it is arguable whether or not a bone density study should even be ordered for patients in those 2 groups. I generally will not order a BMD in such patients unless there is a clinical scenario or secondary disease associated with an increased risk for osteoporosis that would then allow you to diagnose a patient with osteoporosis if indeed the T-score is low.

### EDITORIAL BOARD

Since the real objective is to avoid fracture, shouldn't clinicians be less focused on a BMD value and place more emphasis on assessing and managing risk factors for fracture such as fall risk?

### SINGER

Yes, certainly. Osteoporosis risk assessment should really be viewed more as an art as opposed to being an absolute science in terms of looking at numbers. Instead of just relying on the BMD, it is important to take a step back and do a more global assessment of the patient. What risk factors are present? What is the patient's overall health like? What factors are present that may contribute to the risk of falling or the inability to comply with the medications or preventive strategies recommended? All of these factors play a significant role in assessing the patient's risk for osteoporosis.

### EDITORIAL BOARD

Isn't the finding of a fragility fracture (ie, a vertebral collapse, hip fracture, or Colles' fracture occurring without major trauma) indicative of osteoporosis?

## Dialogue Box

### SINGER

It is, and I think that is a really important point because I think most people miss the boat on that. A postmenopausal woman who sustains such a fracture clearly warrants the diagnosis of osteoporosis regardless of her T-score and there are groups who advocate the diagnosis of osteoporosis be given to women as young as 45 to 50 years of age who sustain a fragility fracture as well. The bottom line is that fragility fracture equals osteoporosis until proven otherwise. These patients need to be identified and treated because clearly, the risk of a subsequent fracture increases significantly in anyone who has had such a previous fracture.

### EDITORIAL BOARD

**Since the occurrence of a fragility fracture in a postmenopausal woman justifies the diagnosis of osteoporosis no matter what the T-score, is there any reason to even bother to order a dual-energy x-ray absorptiometry (DXA) scan in such a patient?**

### SINGER

It's debatable, particularly in Europe where they scan a lot less freely than we do and they really look seriously at a lot of these clinical risk factors in terms of stratifying and identifying a high-risk population who should be screened. Some people would say, "If you have a very high-risk patient, you should just treat them; why do you even need to get a DXA scan as the results will not really change your management?" On the other hand, most people like to have something to follow, and without a baseline, you don't know where you started and where you are going. Having said that, from a cost-effectiveness point of view, one could make the argument that since such patients would appropriately be regarded as high risk, and regardless of what the BMD reveals, you are not going to take them off treatment, and so why spend the money for a scan.

### EDITORIAL BOARD

**Many clinicians find it confusing when the DXA scan reports 3 different measurements for the hip,**

**particularly if they are discrepant. How should such a report be interpreted?**

### SINGER

First of all, if one of those measurements is for Ward's triangle, it is best to disregard it since nobody uses this number for diagnosis anymore. What it boils down to then is 3 measurements: the total hip, the femoral neck, and the trochanter. While intuitively you might expect them to all be the same, at various sites of the hip there are slightly different proportions of trabecular and cortical bone that likely account for the site differences seen. Since we don't tend to average things, and since not every bone is representative of what is going on elsewhere in the body, I think it is prudent to simply take the lowest value and base the diagnosis on this measurement. In other words, the DXA report should never come back and say the patient has normal BMD at the femoral neck but osteoporosis at the total hip or at the spine. Such a patient should be given the diagnosis of osteoporosis.

### EDITORIAL BOARD

**What factors need to be considered when interpreting the results of a follow-up DXA scan?**

### SINGER

The first thing you need to do is make sure that the DXA comparisons are being interpreted correctly. Even at the most reputable and busy sites with excellent technicians and the same machine being used, clearly there is a certain degree of precision error that needs to be taken into account. In general, anything less than a 3% change at the spine, and certainly 3% at the hip, should not be regarded as a significant change. Anything less than that should be viewed as stable or no significant change. So, if you get a report back that says the BMD of the hip has decreased by 2.1% and increased by 2.3% at the spine, there has been no significant change at either site. The second thing you need to consider are differences in trabecular and cortical bone composition. Since bone remodeling and turnover is greater in trabecu-

## Dialogue Box

lar bone, the suppressant action of drugs commonly used is more noticeable early on in vertebral bodies (which contain more of this type of bone) than the hip. As a result, the change in BMD may seem discordant early on, but if you follow the patient over a longer period of time, the impact becomes more concordant.

### EDITORIAL BOARD

**What factors should be considered if a significant loss of BMD is seen on a follow-up scan in a patient treated with bisphosphonate?**

#### SINGER

If there is loss on an agent, one should first look into issues of compliance and issues of absorption. In this situation, I may take a look at bone turnover markers to make sure that a patient is truly being suppressed in terms of bone turnover. Following this, I would look at underlying secondary causes to make sure there is not another contributing factor that would render the treatment less effective.

### EDITORIAL BOARD

**What are your thoughts regarding qualitative or quantitative ultrasound?**

#### SINGER

They hold excellent potential as screening tools and offer several advantages including lower cost, portability of the units, ease of access for patients, and lack of radiation. I foresee them being used as a screening method in greater numbers in the future, especially in areas where DXA is not readily available. However, since ultrasound has not been used as a method for making an absolute diagnosis or for monitoring therapy, a positive result should be followed by a central DXA scan.

### EDITORIAL BOARD

**Does plain film radiography play any role in stratifying the patient's risk for osteoporosis?**

#### SINGER

I think it is a source of helpful information if you have gotten the plain film for some other reason, such as following an injury or a suspected fracture. I don't think there is any role for it in terms of utility as a screening or diagnostic method. The problem lies in its qualitative nature—roughly a 30% reduction in BMD from "normal" has to be present for a radiologist to make a call of severe osteopenia, but you can't really quantitate loss beyond that. Suffice it to say, the finding of osteopenia on x-ray mandates confirmation and further evaluation with a DXA scan.

### EDITORIAL BOARD

**Is it possible to compare DXA scan results obtained from 2 different machines?**

#### SINGER

It is very difficult to compare scan results between machines. If you attempt to make a comparison, you need to see at least an 8% to 9% change to be able to legitimately call it a significant change. Since we are talking about different machines and technicians, it is really more appropriate to comment in terms of "trends" as opposed to commenting on an absolute decrease or increase with confidence. Unless large differences are present, what you really should do is reestablish a baseline and then rescan on the same machine if at all possible after 1 to 2 years.