46. Screening for Postmenopausal Osteoporosis

RECOMMENDATION

There is insufficient evidence to recommend for or against routine screening for osteoporosis with bone densitometry in postmenopausal women. Recommendations against routine screening may be made on other grounds (see ***Clinical Intervention***). All postmenopausal women should be counseled about hormone prophylaxis (see Chapter 68) and be advised of the importance of smoking cessation, regular exercise, and adequate calcium intake (see Chapters 54–56). For those high-risk women who would consider estrogen prophylaxis only to prevent osteoporosis, screening may be appropriate to assist treatment decisions (see ***Clinical Intervention***).

Burden of Suffering

An estimated 1.3 million osteoporosis-related fractures occur each year in the U.S.[1] About 70% of fractures in persons aged 45 or older are types that are related to osteoporosis.[2] Most of these injuries occur in postmenopausal women. Over half of all postmenopausal women will develop a spontaneous fracture as a result of osteoporosis.[3] It has been estimated that about one quarter of all women over age 60 develop vertebral deformities and about 15% of women sustain hip fractures during their lifetime.[4,5] The annual cost of osteoporosis-related fractures in the U.S. has been estimated to be over $8 billion in direct and indirect costs.[6] Most fractures in elderly women are due in part to low bone mass; osteoporosis-related fractures commonly involve the proximal femur, vertebral body, and distal forearm.[7] Of these sites, the proximal femur (hip) has the greatest effect on morbidity and mortality; there is a 15–20% reduction in expected survival in the first year following a hip fracture.[8] Hip fractures are also associated with significant pain, disability, and decreased functional independence.[9] Among persons living at home at the time of a hip fracture, about half experience a deterioration in social function within 2.5 years.[10]

Low bone density is strongly associated with an increased risk of fracture.[11] By one estimate, a 50-year-old woman in the 10th percentile of

bone density has a 25% lifetime risk of hip fracture (vs. 8% for those in the 90th percentile).[12] A World Health Organization study group has recommended that osteoporosis be defined as a bone density more than 2.5 standard deviations (SD) below the normal bone mass in young women, and that osteopenia (low bone mass) be defined as bone density 1–2.5 SD below the normal mean.[13] Risk of postmenopausal osteoporosis is a function of rate of bone loss as well as peak bone mass. The principal risk factors for osteoporosis are female sex, advanced age, Caucasian race, low body weight, and bilateral oophorectomy before menopause.[1,4] Other historical risk factors such as parity, lactation history, and caffeine intake have been shown to be poor predictors of bone mass.[14–16] Smoking is a probable risk factor for hip fracture, but it is a less reliable predictor of bone mass.[17] The lower weight and poorer health of smokers compared to nonsmokers may be responsible for the associations between smoking and bone mass and fracture risk.[18]

Accuracy of Screening Tests

A number of radiologic screening tests have been proposed for both clinical and research purposes to detect low bone mass in asymptomatic persons. These include conventional skeletal radiographs, quantitated computed tomography, single photon absorptiometry, dual photon absorptiometry, and dual energy x-ray absorptiometry. Although skeletal x-rays can detect focal bone disorders and fractures, they do not reliably detect bone loss of less than 20–30%, and they are of limited value in estimating bone mass.[19] The other techniques vary in their availability, cost, and convenience, and provide measures expressed as bone mineral content (BMC) in grams/cm, or as bone mineral density (BMD) in grams/cm^2.

Single photon absorptiometry (SPA), in which radioisotopes are the photon source, can measure BMC or BMD in cortical bone in the radius or calcaneus.[20] Dual photon absorptiometry (DPA), dual energy x-ray absorptiometry (DXA), and quantitative computed tomography (QCT) provide direct measures of BMD and are most useful in evaluating the trabecular bone density in locations beneath large amounts of soft tissue (e.g., lumbar vertebrae, proximal femur). DPA and DXA use radioisotopes (DPA) or x-rays (DXA) to emit photons at two different energy levels, thereby correcting for the effect produced by layers of soft tissues.[20–22] DXA is now widely used in the clinical setting, and provides more reproducible measures of bone density, with shorter examination times (5–10 vs. 20–40 minutes) than DPA.[20–22] The precision of DXA (variation in results on repeated measurement) is about 0.5–2%, compared to 1.5–4.0% for DPA.[23] Current data on the performance of these devices have been

obtained primarily at specialized research centers, however. Most experts agree that DXA is a safe, accurate, and precise modality for measuring bone density that may be useful in the clinical setting.[24] Reproducibility of SPA is similar to DPA and DXA, but the cost per scan is significantly lower than DXA. Evidence suggests that SPA of the radius or calcaneus is also predictive for future risk of nonspine fracture.[25]

QCT is highly accurate in examining the anatomy and density of transverse sections and trabecular regions within the spine, but it is less practical as a routine screening test due to cost and higher radiation exposure. Ultrasound technology for assessing bone density and architecture is under development and may be of value in the future. Other screening tests under investigation include biochemical markers of bone turnover, which may be able to identify those women who will develop more significant bone loss.[26]

Effectiveness of Early Detection

There is little evidence from controlled trials that women who receive bone density screening have better outcomes (improved bone density or fewer fractures) than women who are not screened. The primary argument for screening is based on evidence that postmenopausal women with low bone density are at increased risk for subsequent fractures of the hip, vertebrae, and wrist,[27–35] and that interventions can slow the decline in bone density after menopause.

Prospective cohort studies have demonstrated the dose-response relationship between BMD and fracture risk.[11,36,37] In 2-year follow-up of 8,134 women over 65, annual risk of hip fracture for women in the lowest quartile of femoral neck BMD was approximately 1%, almost twice that of women in the second lowest quartile and more than 8 times that of women in the highest quartile.[11] Various studies have estimated that each standard deviation decrease in BMC or BMD is associated with a 1.5–2.8-fold increase in risk of fracture.[38] There are no studies, however, determining how well perimenopausal bone density predicts long-term risk of fracture. Because the rate of postmenopausal bone loss varies among women, bone mass at menopause correlates only moderately with bone mass 10–20 years later, when most fractures occur.[39]

Randomized trials have demonstrated that calcium supplementation and estrogen are effective in preserving bone density in postmenopausal women.[40–43] Due to the long delay between menopause and fracture, few prospective studies have been able to demonstrate directly that these interventions reduce fractures. Calcium plus vitamin D reduced hip fractures among very elderly women in France (mean age 84).[43] In a randomized trial in healthy postmenopausal women, calcium supplementation slowed bone loss and significantly reduced symptomatic fractures

over 4 years.[43a] Numerous observational and nonrandomized experimental studies suggest that risk of fracture can be reduced 25–50% by estrogen replacement therapy (see Chapter 68). The benefits of hormone prophylaxis on bone mass and fracture risk appear greatest with treatment begun close to menopause (before the period of rapid bone loss), and continued for longer periods (>5 years). Benefits appear to wane after stopping estrogen.[44] As a result, preventing fractures in older postmenopausal women may require continuing hormone therapy indefinitely. Other agents that inhibit bone resorption (e.g., calcitonin, bisphosphonates) or stimulate bone formation (e.g., sodium fluoride) can preserve or increase bone mass, but their use in asymptomatic persons remains investigational.[40]

There is limited evidence that screening influences treatment decisions, and that women appreciate the more precise estimates of risk provided by BMD measurement. Women who had below average bone density were more likely to take calcium, vitamins, or estrogen than those with above average values (84% vs. 38%) in one study.[45] Compared to the low rates of compliance with hormone therapy in average women (see Chapter 68), 60% of women with low bone density detected by screening were still taking hormone therapy 8 months after screening.[46] The effect of BMD screening on long-term compliance is not known.

There are several important limitations to screening as a means of preventing fractures. In a single measure of bone density, there is a small risk of inaccurate values, and there is no value of BMD that discriminates well between patients who develop a fracture and those who do not.[44] Other risk factors that independently influence falls or bone strength may be more important than low BMD for identifying older women at high risk of fracture. In a prospective study of over 9,500 women over 65, the presence of multiple risk factors (e.g., age ≥80, fair/poor health, limited physical activity, poor vision, prior postmenopausal fracture, psychotropic drug use, among others) was a much stronger predictor of hip fracture than low bone density: incidence of first hip fracture in women with 5 or more risk factors was 19/1,000 woman-years versus 1.1/1,000 in women with two or fewer risk factors.[18] Screening perimenopausal women is less predictive of risk later in life, and even women with "normal" bone density are likely to benefit from measures to prevent postmenopausal bone loss. Equally important, there is no consensus on what interventions are indicated for any particular level of bone density. Hygienic measures such as adequate calcium and vitamin D intake, exercise, and smoking cessation can be recommended irrespective of bone density. The decision to begin estrogen, in contrast, often depends on factors other than risk of osteoporosis (see Chapter 68).

Screening could have adverse effects, if it leads to "labeling" in patients diagnosed with osteopenia or osteoporosis, or false reassurance in those

with normal bone density. In one study of women referred for screening, women with low bone density were more likely to restrict their activities, and those with normal bone density were less likely to follow routine hygienic measures to prevent osteoporosis (e.g., calcium or vitamin D).[45] Interpreting and explaining the values obtained is complex and may require considerable time for patient counseling about the significance of an abnormal bone density. Although the absolute benefit of preserving bone mass may be greatest in women with low bone density, the overall balance of risks and benefits of hormone therapy in an individual patient is likely to depend on other factors.[39] If estrogen therapy is likely to be recommended on other grounds, the clinical usefulness of routine screening is limited.[47] If other more specific and expensive therapeutic modalities (e.g., bisphosphonates, calcitonin) are shown to be effective in reducing fractures in asymptomatic high-risk women, however, this may increase the role of screening to identify appropriate candidates for treatment.

Recommendations of Other Groups

Recommendations against routine radiologic screening for osteoporosis have been issued by the Canadian Task Force on the Periodic Health Examination[18] and the American College of Physicians (ACP)[48]; updated ACP guidelines are due out in 1996. Both of these organizations and a World Health Organization study group[49] concluded, however, that bone density measurements may be useful to guide treatment decisions in selected postmenopausal women considering hormone replacement therapy. The American Academy of Family Physicians recommends measuring BMC in women 40–64 years old with risk factors for osteoporosis (e.g., Caucasians, bilateral oophorectomy before menopause, slender build) and in women for whom estrogen replacement therapy would otherwise not be recommended; these recommendations are under review.[50] The American College of Obstetricians and Gynecologists does not recommend routine screening for osteoporosis.[51] The National Osteoporosis Foundation is in the process of revising its guidelines for screening for osteoporosis.[20]

Discussion

Routine bone densitometry of all postmenopausal women is likely to be time-consuming and very expensive. Screening times vary from 5–15 minutes for SPA and DXA to 20–45 minutes for QCT and DPA.[24] Average costs of screening have been estimated to be $75 with SPA, $75–100 with DXA, $100–150 with DPA, and $100–200 with QCT.[23,24] The costs and inconvenience of screening may be justified if screening reduces the burden of osteoporosis, but further research is necessary to demonstrate both the

clinical effectiveness and cost-effectiveness of different screening and treatment strategies.[40,52]

Although routine screening may not be appropriate for asymptomatic women, measurement of bone density may be useful for identifying persons at high risk of fracture who might not otherwise consider effective treatments such as estrogen. Measures of bone density provide more reliable estimates of risk than clinical assessment, and they may help both the patient and the clinician make more informed decisions about the potential benefits and risks of therapies such as estrogen.[45] Women who have been identified as having low bone density may be more likely to take estrogen and comply with other preventive measures, but the effect of screening on long-term outcomes (compliance with therapy, bone density, or fracture) has not been adequately studied. The net benefit of screening may be small if high-risk women do not continue long-term therapy, or if screening causes those with normal BMD to forego preventive measures. There is little reason for screening if the information is not likely to influence decisions by the patient or provider. For most women, osteoporosis prevention is only one of many factors that go into the decision whether or not to take estrogen.

CLINICAL INTERVENTION

There is insufficient evidence to recommend for or against screening for osteoporosis or decreased bone density in asymptomatic, postmenopausal women ("C" recommendation). Recommendations against routine screening may be made on the grounds of the inconvenience and high cost of bone densitometry, and lack of universally accepted criteria for initiating treatment based on bone density measurements. All perimenopausal and postmenopausal women should be counseled about the potential benefits and risks of hormone prophylaxis (see Chapter 68). Although direct evidence of benefit is not available, selective screening may be appropriate for high-risk women who would consider hormone prophylaxis only if they knew they were at high risk for osteoporosis or fracture.

All women should also receive counseling regarding universal preventive measures related to fracture risk, such as dietary calcium and vitamin D intake (Chapter 56), weight-bearing exercise (Chapter 55), and smoking cessation (Chapter 54). Elderly persons should also receive counseling regarding preventive measures to reduce the risk of falls and the severity of fall-related injuries (Chapter 58).

The draft update of this chapter was prepared for the U.S. Preventive Services Task Force by Robert B. Wallace, MD, MPH, Denise Tonner, MD, and David Atkins, MD, MPH.

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