

TABLE 75-3 NATIONAL OSTEOPOROSIS FOUNDATION RECOMMENDATIONS FOR BONE MINERAL DENSITY TESTING

- Women age ≥ 65 yr and men ≥ 70 yr, regardless of clinical risk factors
- Younger postmenopausal women, women in the menopausal transition, and men age 50-69 yr with clinical risk factors for fracture
- Adults who have a fracture after age 50 yr
- Adults who have a condition (e.g., rheumatoid arthritis) or are taking a medication (e.g., glucocorticoids in a daily dose of ≥ 5 mg prednisone or equivalent for ≥ 3 mo) associated with low bone mass or bone loss

of trabecular bone, precision is poor, and monitoring should not be done at this site.

All patients with osteoporosis or low bone mass should have a work-up for secondary causes of bone loss. It should include a serum calcium level (corrected for albumin) to rule out hyperparathyroidism or malnutrition; a 25-hydroxyvitamin D level to assess for vitamin D deficiency or insufficiency; an alkaline phosphatase level to assess for Paget's disease, malignancy, cirrhosis, or vitamin D deficiency; liver and renal function tests to assess for abnormalities; a 24-hour urine calcium and creatinine assay to evaluate for hypercalciuria or malabsorption; a test for sprue in patients with anemia, malabsorption, or hypocalciuria; a thyrotropin level to rule out hyperthyroidism; and serum protein electrophoresis to rule out myeloma in older adults with anemia. Measurement of the parathyroid hormone (PTH) level often is needed to interpret the calcium and vitamin D levels. Total testosterone levels are recommended for men.

A more extensive work-up can be done in severe or unusual cases. A bone biopsy is rarely needed. Markers of bone turnover vary considerably in clinical practice, and these tests usually are reserved for research. However, they may be useful for assessing the rate of bone turnover after prolonged bisphosphonate use or a bisphosphonate holiday.

PREVENTION

General preventive measures for all patients include adequate calcium and vitamin D intake, exercise, and fall prevention techniques. The recommended daily allowance of calcium for adults, as reviewed by the Institute of Medicine, is 1200 mg. Calcium intake can be accomplished by dietary consumption, supplementation, or the combination of diet plus supplement. The supplements should be pure calcium carbonate or pure calcium citrate, taken in divided doses of about 500 to 600 mg twice daily. Calcium carbonate should be taken with meals for best absorption, whereas calcium citrate may be taken with or without food. Calcium supplements are available as tablets and in chewable and liquid forms. Foods such as orange juice, cereals, breads, and nutrition bars are calcium fortified. There is no benefit to taking more than 1200 mg per day, and excess intake may increase the risk of kidney stones and cardiovascular disease (although data are controversial).

Vitamin D is important for calcium absorption and bone mineralization. Vitamin D has nonskeletal benefits and has been associated with improvement in muscle strength and prevention of falls. Vitamin D comes from two sources: diet and photosynthesis. Because dietary sources of vitamin D are limited (e.g., fortified milk, yogurt) and patients are often advised to avoid sun

TABLE 75-4 NATIONAL OSTEOPOROSIS FOUNDATION GUIDELINES FOR TREATMENT

- An adult hip or vertebral fragility fracture
- Osteoporosis by DEXA T-score ≤ -2.5 SD for lumbar spine, total hip, or femoral neck after appropriate evaluation
- Low bone mass by DEXA T-scores between -1.0 and -2.5 SD at the lumbar spine or femoral neck and a WHO FRAX 10-year probability of a hip fracture $\geq 3\%$ or a 10-year probability of major osteoporosis-related fractures $\geq 20\%$ based on a WHO algorithm

DEXA, Dual-energy x-ray absorptiometry; FRAX, fracture risk assessment tool; SD, standard deviation; WHO, World Health Organization.

exposure for prevention of skin cancer and wrinkles, many studies have documented vitamin D deficiency and insufficiency in older adults. Older patients have a reduced ability to synthesize vitamin D in the skin. Low vitamin D levels can lead to secondary hyperparathyroidism.

Vitamin D can be taken in a multivitamin, in a calcium supplement, or in pure form and is available as cholecalciferol (D_3) or ergocalciferol (D_2). Based on data from noninstitutionalized patients without osteoporosis, the daily dose recommended by the Institute of Medicine is 600 IU per day for adults up to age 70 and 800 units for those older than 70 years to achieve a level of at least 20 ng/dL (50 nmol/L). However, the NOF suggests 800 to 1000 IU per day. Elderly patients, those with malabsorption, and obese patients may need greater amounts of vitamin D. Older patients with severe vitamin D deficiency may be given 50,000 IU of vitamin D once per week for 3 months to bring serum vitamin D into the normal range. Activated vitamin D is rarely needed and should not be given on a regular basis for postmenopausal osteoporosis.

Weight-bearing exercise is important for maintaining skeletal integrity. Study results are controversial concerning different types and durations of exercise by postmenopausal women and men. However, weight-bearing or resistance training exercises usually are suggested and have been shown to improve bone mass or maintain skeletal integrity. In patients with new vertebral fractures, physical therapy is important for improving posture and increasing the strength of back muscles.

Because 90% of hip fractures and a significant number of vertebral fractures occur during a fall, preventive measures are suggested for frail older patients at risk for falling. Fall-proofing the household includes installing grab bars in the bathroom and hand rails on stairways, avoiding loose throw rugs and cords, ensuring good lighting by the bedside, and moving objects within easy reach in the kitchen. Other fall prevention measures include eliminating medications that cause dizziness or postural hypotension (if possible), assessing the need for assistive devices (e.g., canes, walkers), and ensuring appropriate footwear and good vision. The benefits of hip protectors for hip fracture reduction are disappointing and controversial, and compliance with these products is often poor.

TREATMENT AND PROGNOSIS

The NOF developed treatment guidelines that incorporate a 10-year fracture risk prediction. The NOF suggests treatment for postmenopausal women and men 50 years old or older, as shown in [Table 75-4](#).

