HEALTH

Osteoporosis no. 9.359

by P. Kendall[1]

Quick Facts...

Osteoporosis is a process of severe bone deterioration resulting in a high susceptibility to bone fractures.

It most often is seen in postmenopausal women, particularly light-skinned, small-framed women with a family history of osteoporosis.

The loss of calcium from bones is the major effect of aging on the skeletal system.

Therapies include estrogen replacement, prescriptive medications, exercise and calcium supplements with or without additional nutrients. Such treatments can slow the rate of bone loss but not form new bone.

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Occurrence and Cause

Americans spend more than 19 billion dollars each year repairing some 2 million fractures resulting from osteoporosis — the "brittle bones" disease. This complex condition is a major debilitating disease that affects 20 to 30 percent of women over age 60. Further, it is estimated that one in two women and one in four men over age 50 will eventually suffer an osteoporosis-related fracture at some point in their lifetime. Chances of surviving a broken hip or wrist are good, but many survivors are incapacitated and one in four dies within a year following the fracture.

Osteoporosis, which literally means "porous bones," occurs earlier and with greater frequency and severity in women than in men. It is seen most often in small-framed women, particularly white and Asian women, age 40 to 50. These women have lower initial bone mineral content and thus lighter bones at the onset of maturity than men or large-framed women. Not only are the bones of many women lighter than those of men, but loss of this bone accelerates at menopause, particularly the first three years after menopause.

Other factors associated with increased risk of osteoporosis include a family history of the disease, removal of the ovaries at an early age, cigarette smoking, excessive use of alcohol, inadequate intake of calcium, hormonal imbalances, certain medications (glucocorticoids and some anticonvulsants) and insufficient exercise.

Symptoms and Diagnosis

In recent years, we have seen dramatic advances in methods of diagnosing osteoporosis and assessing the risk of future fractures. Technology is now available to determine bone mass (or density) safely, conveniently, and at relatively low cost. A bone mineral density (BMD) test is considered the best way to check your bone health. In combination with biochemical measurements, it is used to guide osteoporosis treatment.

For women at high risk of osteoporosis, health care programs designed to detect early osteoporosis are well worth the investment. They do not, however, replace nutrition and physical activity programs designed to retard the disease by strengthening bone mass.

Treatment

Hormonal Replacement

Estrogen replacement therapy has been used to treat osteoporosis in postmenopausal women with variable results. The decrease in estrogen production signaling menopause causes an increase in the normal rate of bone loss. Treat-

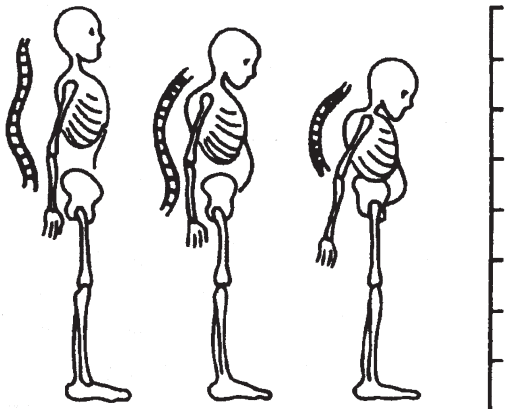

Figure 1: As the skeleton grows increasingly fragile, bone fractures, "dowager's hump," and loss of height may occur.

ment with estrogen tends to slow down but not reverse osteoporosis. Estrogen replacement therapy works by reducing bone resorption. Use of the hormone, however, is controversial because of the potential for increased risk of uterine cancer, breast cancer, stroke, heart attack and other complications. Taking progesterone in combination with estrogen does reduce the risk of uterine cancer. Because of the documented side effects, the US Food and Drug Administration (FDA) recommends that women consider using estrogen treatment only if they are at high risk of osteoporosis and can't take non-estrogen medications. It is also important that estrogen-treated women receive regular gynecologic and breast examinations, including mammography before and regularly during estrogen therapy.

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Nutrient Supplements

Several researchers have studied the effects of treatment with calcium supplements with and without vitamin D, again with variable results. As with estrogen therapy, results generally show that such treatments slow down but do not reverse osteoporosis once it develops. Further, hypercalcemia (high blood calcium) has been implicated in some studies using vitamin D to increase calcium absorption.

Exercise

Exercise is an important part of osteoporosis treatment. Movement that causes the body to work against gravity facilitates the flow of calcium to the bones and the maintenance of bone density. People deprived of physical activity, such as those immobilized in bed, have a dramatic loss of bone mineral. Likewise, physical activity that increases both gravitational and muscular stress in bone has been found effective both as a preventive and rehabilitative therapy for bone loss in people with osteoporosis.

It is important to take care when walking or participating in other physical activity to avoid unsafe situations that may lead to fractures.

Prescriptive Medicines

Along with proper nutrition and weight bearing exercise, your physician may prescribe medications to help prevent and/or treat osteoporosis. Currently, bisphosphonates (alendronate, risedronate, and zoledronic acid), calcitonin, estrogens, parathyroid hormone and raloxifene are all approved by the FDA for the prevention and/or treatment of osteoporosis.

Prevention

Because of the difficulty in finding a therapy to effectively treat or cure osteoporosis without risk or adverse side effects, a growing emphasis has been placed on its prevention. The goal is to prevent undue bone loss. Exercise and certain dietary measures can help.

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Physical Activity

Bones, like muscles, need to be stressed. They must be regularly subjected to weight-bearing and/or weight-resistance exercises and activities such as walking, hiking, jogging, dancing, weight lifting, or playing a racquet sport. Thirty minutes of weight bearing or weight-resistant physical activity most days of the week will help build strong bones, as well as improve heart health, coordination, and balance. Before starting any exercise program, do consult with a knowledgeable physician about your fracture risk. Also, start slowly and build up to the desired level of daily activity.

Diet

Balancing calorie and nutrient requirements becomes more of a challenge with age. Because of slowed metabolism, nutrient-to-calorie needs increase after menopause. Recommended energy intakes for women over age 50 range from 1,600 to 2,200 kilocalories daily; the mean recommended daily level is 1,800 kilocalories for women between 51 and 75 and 1,600 kilocalories for women over 75. Within these levels of calorie intake, certain nutrients must be included if the risk of osteoporosis is to be reduced.

Calcium

One of the most important nutrients in reducing risk of osteoporosis is calcium. Surveys of patients with osteoporosis generally indicate a lifelong diet lower in calcium than seen in age-matched populations without bone demineralization. Metabolic balance studies show that such patients are in negative calcium balance.

When dietary calcium is increased, calcium balance eventually becomes positive, indicating retention of calcium. For maximum calcium retention and to build strong bones, children aged 4 through 8 should get 800 milligrams of calcium a day. Children ages 9 to 18 require 1,300 milligrams of calcium per day. For people 19 through 50, 1,000 mg of calcium is recommended daily to maintain calcium balance and reduce the risk of osteoporosis. After age 50, recommended intake increases to 1,200 mg daily.

Unfortunately, these recommendations are well below the average 500 to 600 mg of calcium consumed daily by Americans. While the body can generally adapt to some reduction by increasing the efficiency of absorption, often this is not enough. Also, the ability to compensate decreases with age. This makes getting enough calcium even more important in later years.

Table 1: Calcium-rich foods.

	Calcium, mg
1 c. Buttermilk	284
1 c. Milk, whole, low-fat or fat free	300
1/2 c. Cottage cheese, 2% fat	78
1 oz. American, process cheese	175
1 oz. Mozzarella, part skim, low moisture	207
1 oz. Cheddar cheese	204
1 oz. Monterey Jack cheese	211
1 oz. Swiss cheese	272
1/2 c. Ricotta, part skim	337
1/2 c. Ice cream, vanilla, regular	92
1/2 c. frozen yogurt, soft serve, vanilla	103
1 c. Fruit yogurt, low fat	384
1 c. Plain yogurt, low fat	415
1/2 c. Chocolate pudding, instant mix w/ lowfat milk	153
1 c. Pinto beans, cooked	82
3 oz. Salmon w/ bones, cnd	180
3.75 oz. Sardines w/bones, cnd	382
1/2 c. Tofu, calcium added	204
1 c. Shredded Chinese cabbage, boiled	158
1 c. Collards, cooked	226
1 c. Kale, cooked	94
1 c. Mustard greens, cooked	104
1 c. Turnip greens, cooked	197
1 c. Broccoli, chopped, frzn, cooked	94

Best Bets for Calcium

Milk, yogurt, cheese, and other dairy products are major sources of calcium (Table 1). An 8-ounce glass of milk, for instance, contains approximately 300 milligrams of calcium. That's one-fourth to one-third of the daily requirement -- just from one glass of milk.

To promote heart health along with preventing osteoporosis, choose fat-free or low-fat milk and dairy products. If milk isn't a favorite in your household, try disguising it in puddings, custard, soups and sauces. Or use nonfat dry milk powder in meatloaf, casseroles and mashed potatoes. Each tablespoon of nonfat dry milk provides 50 milligrams of calcium.

Getting enough calcium can be of special concern for people who are lactose intolerant. This condition occurs in people that have low levels of lactase, the enzyme that digests milk sugar in the intestine. Among dairy products, aged cheeses and yogurt with active cultures often are well tolerated. Lactase enzymes can be added to milk products or taken orally before eating a meal that contains milk or dairy products. Specialty products such as low-lactose milk, ice cream and cottage cheese also are available.

Nondairy sources of calcium include dry beans and fish with edible bones such as sardines and canned salmon. Buy fish packed in water to save calories. If you are monitoring salt intake, rinse canned fish well with water to remove excess salt. Other good sources of calcium include broccoli and green leafy vegetables like collards, kale, mustard greens and turnip greens. Tofu or soybean curd may be a good calcium source if made with a calcium coagulant such as calcium sulfate. Foods fortified with calcium, such as some orange juices, breads, and cereals, may also help provide your body with the calcium it needs.

Many people view butter, cream and cream cheese as calcium-rich. Actually, they are mostly fat and contain little if any calcium.

References

Food and Nutrition Board. Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride. National Academy of Sciences, National Research Council. Washington, D.C., 1997.

U.S. Departments of Health and Human Services and Agriculture. Dietary Guidelines for Americans*, 2005. Available at: www.health.gov/dietaryguidelines/dga2005/document/.*

Pennington, J. and Douglass, J. Bowes & Church's Food Values of Portions Commonly Used. *18th ed., Baltimore, MD: Lippincott Williams & Wilkins, 2005.*

Recommended websites

National Institutes of Health Osteoporosis and Related Bone Diseases National Resouce Center: www.osteo.org

Medlineplus Health Information: www.nlm.nih.gov/medlineplus

National Osteoporosis Foundation: www.nof.org

Dietary Interactions That Affect Calcium Absorption

It's important to note that calcium values given for foods don't reflect factors, such as fiber and oxalate, which may impair the absorption of calcium. Unfortunately, there is little current information on how much of the calcium in foods high in fiber or oxalates actually is available. We do know that only a small percentage of the calcium in spinach, which is high in oxalates, is available to the body. Calcium availability is less of an issue when overall calcium intake is liberal.

Other dietary factors that increase calcium loss include high intakes of phosphorus, protein, vitamin A, alcohol and caffeine. Protein is an important nutrient, essential for the growth and repair of body cells. But diets high in protein can cause increased calcium excretion. For adult women, 46 grams of protein per day is sufficient; for men, 56 grams. Cigarette smoking, a nondietary factor, also increases calcium loss and may promote the development of osteoporosis.

Vitamin D is needed for proper absorption of calcium. Regular exposure to sunlight, along with drinking vitamin D-fortified milk, will meet the vitamin D needs of most young people. This may not be sufficient for some older people. Supplementation of vitamin D_3 (cholecalciferol) to provide vitamin D intakes of 800 to 1,000 IU per day has been shown to improve calcium balance in elderly people. It is important to take vitamin D supplements under the supervision of a physician or dietitian. Excessive levels (above 2,000 IU per day) can be toxic. Minerals such as magnesium, phosphorus and vitamin K are also important for bone health and usually can be obtained by eating a well-balanced diet.

Calcium Supplements

If you are not able to consume sufficient levels of calcium through diet, your doctor or dietitian may recommend calcium supplements. If so, keep these tips in mind.

First, it's best to avoid bone meal and dolomite preparations. Some brands contain excessive levels of lead.

Calcium supplements vary widely in percentage of calcium and thus so do the number of tablets needed daily to achieve the recommended dosage. For example, calcium carbonate is 40 percent calcium, dicalcium phosphate 30 percent calcium, calcium citrate 21 percent calcium, calcium lactate 13 percent calcium, and calcium gluconate 9 percent calcium. The label on the bottle should tell you how many tablets you'll need to take to meet your calcium needs. If not, contact the manufacturer.

If you don't want to swallow many pills, calcium carbonate is the best choice. A few antacids, such as Tums™, contain calcium carbonate and may be less expensive than other preparations. Each tablet contains 200 milligrams of calcium, 3 calories and a tiny amount (3 mg) of sodium. Paradoxically, although calcium carbonate is used to neutralize acid, it can, over time, cause the stomach to produce more acid. Therefore, it may be better tolerated if taken with meals. Also, high doses of calcium carbonate may cause constipation or flatulence in some people. Calcium gluconate is less constipating but much more expensive per milligram.

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