

Osteoporosis

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Osteoporosis, or porous bone, is a disease characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased susceptibility to fractures of the hip, spine and wrist. Although often characterized as a woman's disease, men as well as women suffer from osteoporosis.

Osteoporosis makes the bones so fragile that the simplest things can cause them to break: stepping off a curb, a sneeze, a hug. The disease often causes such pain and disability that people afflicted by it must spend their last days in a nursing home.

Osteoporosis is preventable for most people!

According to the National Institute of Arthritis and Musculoskeletal and Skin Diseases, osteoporosis is a major public health threat for more than 44 million Americans, 68 percent of whom are women. In the U.S. today, 10 million individuals already have the disease and 34 million more have low bone mass, placing them at increased risk for osteoporosis.

According to the National Osteoporosis Foundation, thousands of people each year become dependent on others for basic tasks and have to rely on walkers, canes and other devices to move about due to hip fracture. At 6 months after a hip fracture, only 15 percent of hip fracture patients can

walk across a room unaided. One in five of those who were ambulatory before their hip fracture requires long-term care afterwards.

- An average of 24 percent of hip fracture patients age 50 and over die in the year following their fracture.
- More than 8 million women have osteoporosis.
- More than 2 million American men suffer from osteoporosis, and millions more are at risk. Each year, 80,000 men suffer a hip fracture and one-third of these men die within a year.
- One out of every two women and one in four men over 50 will have an osteoporosis-related fracture in their lifetime.
- Ten percent of African-American women over age 50 have osteoporosis; an additional 35 percent have low bone density that puts them at risk for developing osteoporosis.
- Ten percent of Hispanic women aged 50 and older are estimated to have osteoporosis, and 49 percent are estimated to have low bone mass.
- Significant risk has been reported in all ethnic backgrounds.



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- Osteoporosis is responsible for more than 2 million fractures annually, including 300,000 hip fractures, approximately 600,000 vertebral fractures, 400,000 wrist fractures and more than 675,000 fractures at other sites.
- Estimated national direct expenditure (hospitals and nursing homes) for osteoporosis and related fractures is \$19 billion each year. It is estimated that by 2025 the cost will rise to approximately \$25.3 billion.

Bone is living, growing tissue. It is made mostly of collagen, a protein that provides a soft framework, and calcium phosphate, a mineral that adds strength and hardens the framework. This combination of collagen and calcium makes bone strong yet flexible to withstand stress.

The two primary bone cells are the osteoclasts and the osteoblasts. The osteoclasts are the cells that resorb or break down bone, and the osteoblasts are the cells that build up bone.

Bone is built during fetal life, youth and adolescence. Once bones are formed, their shape and structure are continually renovated and modified by two processes known as modeling and remodeling. Both modeling and remodeling result in the replacement of old bone by new bone.

Modeling and remodeling begin with bone being eroded by osteoclasts, which is then followed by osteoblasts refilling the resorption sites. Bone resorption must occur to trigger bone formation.

Modeling takes place during an individual's growth and is the main process through which the skeleton increases its volume and mass. In modeling, new bone is formed at a different location than where the bone was broken down. This results in a change in the shape of the skeleton and also is the cause for the increase in bone size.

The remodeling process occurs in adults. In remodeling, the growth that increases bone shape and size is modified so that the newly formed bone replaces the broken down bone at the same site. Therefore, no change occurs in the shape of the bone. Bone remodeling is a continuous process consisting of a cycle of osteoclast activation, bone resorption, reversal, bone formation and resting stages. This constant bone turnover is critical to the overall health of the bone by repairing microfractures and remodeling the bony architecture in response to stress. A full cycle of bone remodeling takes about two to three months.

There are two types of bone in the body: cortical bone which comprises 85 percent of the bone in the body and trabecular bone which accounts for the

remaining 15 percent. Cortical bone forms the dense, ivory-like exterior shell that surrounds and protects each bone. Cortical bone comprises the shafts of the long bones, and a thin cortical shell caps the end of the bone. Trabecular bone has a spongy, honeycomb-like structure made up of calcium-containing crystals. These crystals give up calcium to the blood when the day's supply from the diet runs short, and they take up calcium again when the dietary supply is plentiful.

The two types of bone play different roles in calcium balance and osteoporosis. Trabecular bone is generally supplied with blood vessels and is metabolically active. It is sensitive to hormones that govern day-to-day deposits and withdrawals of calcium, and it readily gives up minerals whenever blood calcium needs replenishing. Losses of trabecular bone start becoming significant for men and women in their thirties, although losses can occur whenever calcium withdrawals exceed deposits.

Cortical bone also gives up calcium, but slowly and at a steady pace. Cortical bone losses typically begin at about 40 years of age and continue slowly but surely thereafter.

During childhood, more bone is produced than is removed, so the skeleton grows in both size and strength. The amount of tissue or bone mass in the skeleton reaches its maximum amount, or peak bone mass, in the twenties. By this age, men have accumulated more bone mass than women. After this point, the amount of bone in the skeleton typically begins to decline slowly as removal of old bone exceeds formation of new bone – about 0.3 percent to 0.5 percent a year.

Women can lose up to 20 percent of their bone mass in the 5 to 7 years after menopause. Although many consider osteoporosis a woman's disease, older adults – men and women alike – are at risk for developing osteoporosis. After age 60, 6 percent of all men will experience a hip fracture and 5 percent will have a vertebral fracture as a result of osteoporosis.

The risk of developing osteoporosis depends on how much bone mass is attained by age 25 years and how rapidly it is lost later. The higher the peak bone mass, the more bone deposited "in the bank" and the less likely an individual is to develop osteoporosis as bone is lost during normal aging. The significance of attaining optimal bone mass should not be underestimated: higher peak bone mass early in life is associated with greater fracture protection later in life.

Risk factors that cannot be changed:

- Sex – The risk of developing osteoporosis is greater if you are a woman. Women have less

bone tissue and lose bone more rapidly than men because of the changes involved in menopause.

- Age – The older you are, the greater your risk of osteoporosis. Your bones become less dense and weaker as you age.
- Body size – Small, thin-boned women are at greater risk.
- Ethnicity – Caucasian and Asian women are at highest risk. African-American and Latino women have a lower but significant risk.
- Family history – Susceptibility to fracture may be, in part, hereditary. People whose parents have a history of fractures also seem to have reduced bone mass and may be at risk for fractures.

Risk factors that can be changed:

- Sex hormones – Absence of menstrual periods (amenorrhea), low estrogen level (menopause) and low testosterone level in men. Early estrogen deficiency in women who experience menopause before age 45, either naturally or resulting from surgical removal of the ovaries.
- Eating disorders – Anorexia nervosa or bulimia.
- Abnormal absence of menstrual periods (amenorrhea) – Estrogen deficiency due to abnormal absence of menstruation that may accompany excessive exercise or excessive weight loss.
- Lifetime diet low in calcium and vitamin D – The body's demand for calcium is greater during childhood and adolescence, when the skeleton is growing rapidly, and during pregnancy and breastfeeding. Adequate amounts of vitamin D are necessary for intestinal absorption of calcium.
- Medications (corticosteroids and anticonvulsants) – Common treatments for chronic conditions such as asthma, rheumatoid arthritis and psoriasis can be damaging to bone.
- Excessive amounts of thyroid hormone can also cause bone loss. This condition can occur with hyperthyroidism (overactive thyroid) or when too much medication is taken for the treatment of hypothyroidism (underactive thyroid).
- Some diuretics (drugs that prevent buildup of fluids) can also cause the kidneys to excrete more calcium. Diuretics that cause your kidneys to release more calcium include furosemide, bumetanide, ethacrynic acid and torsemide.
- Long-term use of blood-thinners, some antiseizure medications and aluminum-containing antacids can also cause bone loss.
- Gastrointestinal disorders – These can include stomach surgery or diseases involving the digestive

system. Diseases such as Crohn's disease, celiac disease and ulcerative colitis interfere with the absorption of calcium and other nutrients.

- Inactive lifestyle – Weight-bearing exercise is important in building and maintaining bone mass.
- Bed rest and immobilization – Prolonged bed rest (following fractures, surgery, spinal cord injuries, illness, stroke or complications of pregnancy) or immobilization of some part of the body often results in significant bone loss.
- Cigarette smoking – Smoking is thought to have an anti-estrogenic effect that reduces absorption of calcium and is likely to result in an increase in bone resorption.
- Excessive alcohol use – Alcohol appears to have a direct toxic effect on osteoblasts, which are the cells directly responsible for bone formation. Regular consumption of 2 to 3 ounces a day of alcohol may be damaging to the skeleton, even in young women and men. Those who drink heavily are more prone to bone loss and fractures, both because of poor nutrition as well as increased risk of falling.



Symptoms

Osteoporosis is often called the “silent disease” because bone loss occurs without symptoms. People may not know that they have osteoporosis until their bones become so weak that a sudden strain, bump or fall causes a fracture or vertebra to collapse. Collapsed vertebra may initially be felt or seen in the form of severe back pain, loss of height or spinal deformities such as kyphosis or stooped posture. Fracture of the wrists, hips or other bones is also caused by osteoporosis.

Diagnosis

Specialized tests called bone mineral density (BMD) tests measure bone density in various sites in the body. Experts recommend a type of BMD test using a central DXA (which stands for dual energy x-ray absorptiometry). A BMD test performed by a central DXA can:

- Tell if a person has low bone density before a fracture occurs.

- Tell if a person's bones are losing bone density or staying the same when the test is repeated at intervals of one year or more.
- Predict the chances of a person having a fracture in the future.
- Help a person and their health care provider decide if treatment is needed.

A new methodology called absolute fracture risk takes into account a person's BMD and other risk factors to estimate the likelihood of breaking a bone due to low bone mass or osteoporosis over a period of 10 years. This new tool helps health care providers and patients make better treatment decisions, and assures that people with the highest fracture risk get treated.

Complications

Because osteoporosis progresses without symptoms, falls are especially dangerous for people who are unaware that they have low bone density. Many falls result in fractures of the spine and hips, which are the bones that directly support the body. It is also common to suffer wrist fractures from falls.

Fractures of the spine can occur without any fall or injury. The bones in the back (vertebrae) become so weakened that they begin to compress. Compression fractures can cause severe pain and require a long recovery. Such fractures cause loss of height, and individuals can lose several inches as their posture becomes stooped. Hip fractures are the second most common type of osteoporotic fracture and usually result from a fall.

Medications Used to Treat Osteoporosis

Although there is no cure for osteoporosis, it can be treated. The following medications are approved by the FDA to prevent and/or treat osteoporosis.

- Alendronate and alendronate plus vitamin D3 (brand names Fosamax® and Fosamax plus D™). Alendronate is approved for the prevention and treatment of osteoporosis in postmenopausal women and for the treatment of osteoporosis in men. It is also approved for the treatment of glucocorticoid-induced osteoporosis in men and women as a result of long-term use of steroid medications.
- Ibandronate (brand name Boniva®). Ibandronate is approved for the prevention and treatment of osteoporosis in postmenopausal women.
- Zoledronic acid (brand name Reclast®). Zoledronic acid is approved for the treatment of osteoporosis in postmenopausal women.
- Risedronate sodium (brand names Actonel® and Actonel® With Calcium) is approved for the prevention and treatment of osteoporosis in postmenopausal women and for treatment of osteoporosis in men. It is also approved for the prevention and treatment of glucocorticoid-induced osteoporosis in men and women as a result of long-term use of steroid medications.
- Calcitonin (brand names Fortical® and Miacalcin®). Calcitonin is approved for the treatment of osteoporosis in postmenopausal women who are at least five years beyond menopause.
- Estrogen (multiple brand names available). Estrogen therapy (ET) and estrogen with progesterone hormone therapy (HT) are approved for the prevention of osteoporosis in postmenopausal women. According to the FDA, postmenopausal women should consider other medications before taking ET or HT to prevent osteoporosis due to risks associated with these medications. They should also be used in the lowest dose for the shortest period of time to meet treatment goals.
- Estrogen Agonists/Antagonists, also known as Selective Estrogen Receptor Modulators (SERMs) – Raloxifene (brand name Evista®). Raloxifene is approved for the prevention and treatment of osteoporosis in postmenopausal women.

Prevention

About 85 to 90 percent of adult bone mass is acquired by age 18 for girls and age 20 for boys. The best defense against developing osteoporosis is to build strong bones during childhood and adolescence. There are five elements which together can improve bone health and help prevent osteoporosis later in life. They are:

- A balanced diet rich in calcium and vitamin D.
- Inadequate calcium intake during the lifetime of an individual is thought to be a significant factor in the development of osteoporosis. Most studies show that low calcium intake is associated with low bone mass, bone loss and higher fracture rates. Getting enough calcium is one of the many things people can do to help reduce bone loss. The National Osteoporosis Foundation recommends that adults under 50 need 1,000 mg of calcium daily, and adults 50 and over need 1,200 mg of calcium daily.

Vitamin D plays an important role in calcium absorption and in bone health. There are three ways to get vitamin D:

- Sunlight
- Food
- Supplements

The National Osteoporosis Foundation recommends that adults 50 and under get 400 to 800 IU of vitamin D daily, and adults 50 and over get 800 to 1,000 IU of vitamin D daily. Vitamin D production is lower in the elderly, in people who are housebound and in people with very dark skin. These individuals may require vitamin D supplementation to insure an adequate daily intake. Massive doses are not recommended.

- Weight-bearing exercise and muscle-strengthening exercise.

Bone is living tissue and like muscle responds to exercise by becoming stronger. The best exercises for bones are weight-bearing. These exercises include walking, hiking, jogging, stair-climbing, weight training, tennis and dancing.

- A healthy lifestyle with no smoking and limited alcohol intake.

Women who smoke have lower levels of estrogen compared to nonsmokers and frequently go through menopause earlier.

- Talking to your health care provider about bone health.
- Bone density testing and medication, when appropriate.

Reducing the Risk of Falling

Preventing falls is a special concern for people with osteoporosis. Falls can increase the likelihood of fracturing a bone in the hip, wrist, spine or other part of the skeleton. Falls can be caused by impaired vision and/or balance, chronic diseases that impair mental or physical functioning and certain medications, such as sedatives and antidepressants. It is important that individuals with osteoporosis be aware of any physical changes they may be experiencing that affect their balance or gait and that they discuss these changes with their health care provider.

Some tips to help eliminate the environmental factors that lead to falls include:

- Living room – Keep electrical and phone cords tucked out of the way. Arrange furniture so you can move around it easily. Get rid of throw rugs, and make sure carpeting is secured to the

floor. Buy chairs and couches you can get up from easily.

- Kitchen – Get rid of throw rugs. Use a step stool when you need something from a high shelf, or consider moving items to a lower shelf. Make sure phone and electrical cords are out of the way.
- Bathroom – Install grab bars on walls around the tub and beside the toilet. Use nonskid mats, adhesive strips or carpet on surfaces that may get wet.
- Bedroom – Place light switches within reach of the bed, and install a night light between the bedroom and bathroom. Make sure the telephone can be reached from the bed. Get up slowly from the bed to avoid dizziness. Nightwear should be short enough to avoid tripping.
- Stairways, hallways and pathways – Keep free of clutter and make sure that areas are well lit. Make sure that carpet is secure, and get rid of throw rugs. Install handrails on both sides of stairs. Apply brightly colored tape to the face of the steps to make them more visible.
- Wear rubber-soled or low-heeled shoes to prevent slips.
- Purchase a cordless phone to prevent the need to hurry to answer the phone.

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