

## **About Osteoporosis**

Osteoporosis is a condition of thin, fragile bones. Bone strength results from architecture that looks like a lattice of interconnecting 'I beams.' The word osteoporosis literally means porous bones. In osteoporosis, the bone loses calcium and phosphorus, the minerals that make it strong. The tissue becomes less dense and the bones become thinner. With sparse tissue, or fewer supporting 'I beams,' bones are fragile and fracture easily. It is often called the silent disease because fractures can occur without warning and with no preceding symptoms.

## **Bone Facts**

The human body is made up of more than two hundred bones that undergo a process of continuous renewal. The skeleton gives us strength and shape; it protects organs such as the heart and lungs. Bones such as the vertebrae, or bones of the spine, have an outer and inner layer. Cortical bone is a term used to describe the hard compact bone on the outside, while trabecular bone refers to the porous spongy bone inside. Both are affected by osteoporosis, but it is the trabecular bone that is most vulnerable.

There is constant activity inside the bone. When we take a closer look, we see that bone is made up of living cells, called osteocytes, that are surrounded by a hard mineral material. Blood vessels bring nourishment and minerals to the bone. Throughout our lives, scavenger cells called osteoclasts come along and eat away old bone. The eaten away areas are then repaired by osteoblasts, tiny 'construction worker' cells, whose job it is to build the new bone. Calcium and other minerals finish the job by hardening the area. This on-going process of breakdown and replacement is known as bone remodeling.

From infancy to early adulthood, more bone is built than removed. By the time we reach our mid twenties to mid thirties, our bones are as strong and dense as they will ever be; this is called the peak bone mass. During childhood and adolescence, the more one can build up his or her bone in order to achieve a greater peak bone mass, the better off he/she is. After early adulthood, more bone is taken away than is built or replaced.

Osteoporosis occurs when we lose too much bone. Healthy bone looks like a honeycomb, with strong interconnecting strands. In osteoporosis, these strands become thin and fragile. The once uniform holes of the trabecular bone become irregular and large, leaving them frail, brittle and susceptible to fracture. When osteoporosis is present in the spine, pressure from the normal body weight can cause what is known as a compression fracture. Over time, these fractures may lead to back pain, loss of height, and a rounded curvature of the spine known as dowager's hump. In long bones, such as those of the legs, the ends have a relatively large amount of porous trabecular bone. That is why people with osteoporosis are prone to breaking their hips.

## **Are you at Risk?**

The chance of developing osteoporosis depends partly on factors that we cannot control. The risk increases as we age. It is also higher for people who are slightly

built, for Caucasians or Asians, and for people whose close relatives have had the disease. In addition, certain medical conditions may increase the risk. Liver, kidney, or heart trouble, as well as conditions that necessitate prolonged bed rest, can increase the risk of osteoporosis.

Other possible causes include eating disorders, such as anorexia, and the consumption of certain medications, such as thyroid hormones and steroids. Lifestyle also plays a very important role. A diet low in calcium, lack of exercise, cigarette smoking, and excessive alcohol consumption can harm our bones. Bones are vulnerable because they are alive and subject to wear and tear. Our bones are in a constant state of remodeling; they continuously rebuild themselves by replacing old bone with new. While men can and do develop osteoporosis, women are four times more likely to get it. The higher incidence in women is due to the hormonal changes that happen during menopause. A key factor is estrogen, a hormone produced in the ovaries that protects bones from osteoporosis. Bone mass, or bone strength, is pretty stable until around the age of 50. In women, at the time of menopause, the loss of estrogen causes very rapid bone loss. In fact, women lose about half of all the bone mineral in their lifetime during the five-year period around menopause.

### **Physical Findings**

Since osteoporosis is a silent disease until there is a fracture, prevention and early recognition are vital. There are no physical findings of osteoporosis until there is fracture. However, height loss secondary to a vertebral compression fracture can be a clue to the diagnosis. Other clues can be a fracture caused by trivial trauma, such as falling and breaking a wrist. People with osteoporosis do fracture bones, especially the wrist, hip and vertebrae. Surgical intervention is almost always necessary for hip fractures and frequently for wrist fractures. Vertebral compression fractures are not amenable to surgical intervention and heal slowly on their own.

### **Making a Diagnosis**

To make a diagnosis of osteoporosis, doctors usually perform a test known as a "bone density scan." There are many different kinds of bone densitometers (machines that test bone density), but the one most commonly used is the DEXA Scan. Although this machine can scan all of the bones in the human body, it is typically used to examine areas most likely to break: the vertebrae of the spine, the hip, and the wrist. It is really a very simple, non-invasive test. It is very low radiation, about the same radiation one would receive in a plane flight from Boston to San Francisco. The Bone Density Scan is plotted on a graph in order to compare the density of a patient's bones to the peak bone mass. A dotted line on the graph demonstrates the fracture threshold. Although this is a theoretical number, it does give the doctor an idea of the risk of future fracture. People below the line are at an increased risk for future fracture.

When bone mineral density is measured, there is a value of the average bone density expressed as a standard deviation from peak bone mineral density. For

every standard deviation below the peak bone mineral density, there is a two-fold risk of fracture. If the bone mineral density is between -1 and -2.5 standard deviations below the peak bone mineral density, the patient has osteopenia (thin bones). If the bone mineral density is less than -2.5 standard deviations below the peak bone mineral density, the patient has osteoporosis (very thin bones). Doctors may also order other laboratory blood tests to exclude treatable causes of osteoporosis, such as thyroid disease. They may order a 24-hour urine test to assess the body's calcium absorption or to measure markers of bone turnover.

### **Treatment and Management**

Diet, exercise and sometimes medications are used to slow the rate of bone loss. The most important goal of the nutrition program is receiving adequate calcium. As described later, in the Wellness and Prevention part of this report, calcium and vitamin D are essential to the health of bones. If the body is not getting enough calcium, it will draw the calcium out of the bones. Vitamin D is essential to properly absorb calcium and incorporate it into bone. Calcium, vitamin D, and exercise will reduce bone loss in many people. However, it will not prevent bone loss in everyone. There are medications called 'antiresorptive agents' that help promote improvement in bone mineral density. And, once a patient receives the diagnosis of osteoporosis, it is important to start on treatment with an antiresorptive agent to prevent fracture.

Prior, we talked about the role of the osteoclast and the osteoblast. Think of the "c" in osteoclast for chewing up the bone. And, think of the "b" in osteoblast for building new bone. Antiresorptive agents block osteoclastic activity, thereby allowing unrestricted osteoblastic activity and eventual bone build up.

Antiresorptive agents can be used for the prevention of osteoporosis, as well as for treatment. Some have FDA (Federal Drug Administration) approval only for prevention, some only for treatment, and some have approval for both. The choice of treatment is a decision between the patient and doctor, but it is important to be well informed about the many different classes of drugs.

One treatment is estrogen or hormone replacement therapy. As we explained earlier, lower levels of estrogen after menopause can lead to rapid bone loss. That loss can be slowed by taking estrogen alone or estrogen with the hormone progesterone. Studies show that women who take estrogen for many years have fewer hip fractures than those who do not. It has other benefits as well, such as decreasing symptoms of hot flashes or mood swings in menopause. Estrogen also has beneficial effects on the heart and decreases the risk of death from heart attacks and strokes. In addition, estrogen has been shown to decrease the risk of Alzheimer's disease.

Estrogen replacement therapy increases the risk of cancer of the endometrium (cancer of the lining of the uterus), but this risk can be offset with the hormone progesterone. The combined use of estrogen and progesterone, intermittently or continuously not only reduce the risk of endometrial cancer, but also reduces it much below expected levels. Some studies also show a slightly higher risk of breast cancer for women taking hormones for more than ten years. Studies are in progress to further delineate the risk of breast cancer from estrogen therapy. It is

important for women on estrogen to have regular mammograms and doing self-exams of the breast. Women should understand the risks and benefits of estrogen replacement therapy so that the patient and doctor can determine the best options for treatment

Selective Estrogen Receptor Modulators (SERMs), sometimes called designer estrogens, are hormones that stimulate some cells with estrogen receptors, but not others. Risidronate (Evista) was the first SERM to be approved for the prevention of osteoporosis and there are others that will arrive on the market in the not too distant future. These hormones have beneficial effects on bone, without adversely affecting the reproductive organs such as the uterus and breasts. Although the benefit to the bone is only about one half that of estrogen, these new SERMs may be the treatment of the future for postmenopausal women. There are not enough data about these agents to make definite conclusions at this time.

Another class of antiresorptive agents is the bisphosphonates. These agents also inhibit osteoclastic activity and thereby improve bone mineral density. The only bisphosphonate currently approved by the FDA for the prevention and treatment of osteoporosis is alendronate (Fosamax). Some doctors may use other bisphosphonates to treat osteoporosis even though these drugs do not have a FDA indication for treatment of osteoporosis. Since the bisphosphonates are poorly absorbed by the gastrointestinal tract, they need to be taken on an empty stomach with plenty of water. Some of the bisphosphonates can cause nausea and heartburn, but systemic side effects of these agents are unusual. Rarely they may cause diffuse bony pain that may be self-limited or result in discontinuation of medication.

Another treatment is Calcitonin, which can be given by injection or by nasal spray. Calcitonin is a hormone that also blocks osteoclastic activity, similar to the bisphosphonates and estrogen. Although the effect on bone mineral density is not as powerful as the other two classes of drugs, it is frequently used as an alternative therapy for the treatment of osteoporosis

## **Prevention**

The skeleton is really a large bank or reservoir for calcium. Calcium is very important for a variety of things that the body does. So, if someone does not receive enough calcium in his or her diet or through dietary supplements, then the blood takes it out of the body's "skeleton bank," extracting more and more as they grow older. However, if one is receiving enough calcium, then the blood will not have to take it out of the skeleton. Generally, postmenopausal women, men older than 65 years of age, and any person taking corticosteroids need 1500 mg of calcium each day. Women taking hormone replacement and men under the age of 65 need about 1000 mg. One way to get the required amount is through low fat or skim dairy products such as milk, yogurt, or cheese. The dairy section is not the only section in which to find calcium rich foods. Calcium rich foods can also be found in the produce section, for example, broccoli, kale, bok choy, and

collards. Other calcium rich foods include: salmon, sardines packed with bones in the can, calcium fortified orange juice and tofu.

With greater awareness of osteoporosis, a number of calcium-fortified products are now available. Still, most people find it difficult to find enough calcium directly from their diet. So doctors often recommend a supplement. There are many different supplement compounds. The most common is calcium carbonate; others are calcium citrate and calcium phosphate. Calcium supplements can be found in the vitamin section of the supermarket or pharmacy. Doctors advise against taking some other compounds such as bone meal or dolomite because they contain lead and other impurities. It is a good idea to check with the pharmacist if there are doubts about what to select.

Getting plenty of vitamin D in your diet is also critical because it helps your body absorb calcium. Vitamin D is found in fortified milk and egg products. Also, the skin actually produces vitamin D when it is exposed to the sun. Ten minutes of sunshine is all the body needs per day. The Recommended Daily Allowance (RDA) of Vitamin D for premenopausal women and men under the age of 65 is 400 IU (international units). Postmenopausal women, men over the age of 65, and people taking corticosteroids should take 800 IU per day.

Another way to slow down bone loss is by exercise. Weight bearing activities such as walking, aerobics, jogging, and tennis make the skeleton stronger. Exercising also improves flexibility and muscle strength. If one is more physically fit, he/she tends to resist falling, thereby reducing one's risk of fracture. Doctors often recommend exercise to people even in their 70's, 80's, and 90's. At that age, people should proceed slowly, under the supervision of a physician.

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