9.6: Osteoporosis

Skills to Develop

• Describe osteoporosis, including its notable characteristics

There are several factors that lead to loss of bone quality during aging, including a reduction in hormone levels, decreased calcium absorption, and increased muscle deterioration. It is comparable to being charged with the task of maintaining and repairing the structure of your home without having all of the necessary materials to do so. However, you will learn that there are many ways to maximize your bone health at any age.

Osteoporosis is the excessive loss of bone over time. It leads to decreased bone strength and an increased susceptibility to bone fracture. The Office of the Surgeon General (OSG) reports that approximately ten million Americans over age fifty are living with osteoporosis, and an additional thirty-four million have osteopenia, which is lower-than-normal bone mineral density. Office of the Surgeon General. “Bone Health and Osteoporosis: A Report of the Surgeon General.” October 2004. http://www.surgeongeneral.gov/library/chapter_1.html. Osteoporosis is a debilitating disease that markedly increases the risks of suffering from bone fractures. A fracture in the hip causes the most serious consequences—and approximately 20 percent of senior citizens who have one will die in the year after the injury. Osteoporosis affects more women than men, but men are also at risk for developing osteoporosis, especially after the age of seventy. These statistics may appear grim, but many organizations—including the National Osteoporosis Foundation and the OSG—are disseminating information to the public and to health-care professionals on ways to prevent the disease, while at the same time, science is advancing in the prevention and treatment of this disease. International Osteoporosis Foundation. “Facts and Statistics about Osteoporosis and Its Impact.” © 2012 International Osteoporosis Foundation. Accessed http://www.iofbonehealth.org/facts-and-statistics.html.

As previously discussed, bones grow and mineralize predominately during infancy, childhood, and puberty. During this time, bone growth exceeds bone loss. By age twenty, bone growth is fairly complete and only a small amount (about 10
percent) of bone mass accumulates in the third decade of life. By age thirty, bone mass is at its greatest in both men and women and then gradually declines after age forty. Bone mass refers to the total weight of bone tissue in the human body. The greatest quantity of bone tissue a person develops during his or her lifetime is called peak bone mass. The decline in bone mass after age forty occurs because bone loss is greater than bone growth. On a cellular level, this means that the osteoclast-mediated bone degradation exceeds that of the bone building activity of osteoblasts. The increased bone degradation decreases the mineral content of bone tissue leading to a decrease in bone strength and increased fracture risk.

Osteoporosis is referred to as a silent disease, much like high blood pressure, because symptoms are rarely exhibited. A person with osteoporosis may not know he has the disease until he experiences a bone break or fracture. Detection and treatment of osteoporosis, before the occurrence of a fracture, can significantly improve the quality of life. To detect osteopenia or osteoporosis, BMD must be measured by the DEXA procedure. The results of a BMD scan are most often reported as T-scores. A T-score compares a person's BMD to an averaged BMD of a healthy thirty-year-old population of the same sex. According to the World Health Organization, a T-score of −1.0 or above indicates normal BMD. A person with a T-score between −1.0 and −2.5 has a low BMD, which is a condition referred to as osteopenia. A person with a T-score of −2.5 or below is diagnosed with osteoporosis. National Osteoporosis Foundation. “Having A Bone Density Test.” © 2011. http://www.nof.org/node/42 This classification of T-scores is based on studies of white postmenopausal women and does not apply to premenopausal women, nonwhite postmenopausal women, or men.

Osteoporosis is categorized into two types that differ by the age of onset and what type of bone tissue is most severely deteriorated. Type 1 osteoporosis, also called postmenopausal osteoporosis, most often develops in women between the ages of fifty and seventy. Between the ages of forty-five and fifty, women go through menopause and their ovaries stop producing estrogen. Because estrogen plays a role in maintaining bone mass, its rapid decline during menopause accelerates bone loss. This occurs mainly as a result of increased osteoclast activity. The trabecular tissue is more severely affected because it contains more osteoclasts cells than cortical tissue. Type 1 osteoporosis is commonly characterized by wrist and spine fractures. Type 2 osteoporosis is also called senile osteoporosis and typically occurs after the age of seventy. It affects women twice as much as men and is most often associated with hip and spine fractures. In Type 2 osteoporosis, both the trabecular and cortical bone tissues are significantly affected. Not everybody develops osteoporosis as they age. Other factors also contribute to the risk or likelihood of developing the disease.
During the course of both types of osteoporosis, BMD decreases and the bone tissue microarchitecture is compromised. Excessive bone resorption in the trabecular tissue increases the size of the holes in the lattice-like structure making it more porous and weaker. A disproportionate amount of resorption of the strong cortical bone causes it to become thinner. The deterioration of one or both types of bone tissue causes bones to weaken and, consequently, become more susceptible to fractures. The American Academy of Orthopaedic Surgeons reports that one in two women and one in five men older than sixty-five will experience a bone fracture caused by osteoporosis. American Academy of Orthopaedic Surgeons. “Osteoporosis.” © 1995–2012. Last reviewed August 2009. http://orthoinfo.aaos.org/topic.cfm?topic=a00232.

When the vertebral bone tissue is weakened, it can cause the spine to curve (Figure \(\PageIndex{1}\)). The increase in spine curvature not only causes pain, but also decreases a person’s height. Curvature of the upper spine produces what is called Dowager’s hump, also known as kyphosis. Severe upper-spine deformity can compress the chest cavity and cause difficulty breathing. It may also cause abdominal pain and loss of appetite because of the increased pressure on the abdomen.
Video \(\PageIndex{1}\): Osteoporosis Defined. See this 3D medical animation about osteoporosis (click to see video).

**Key Takeaways**

Bone mineral density (BMD) is an indicator of bone quality and correlates with bone strength. Excessive bone loss can lead to the development of osteopenia and eventually osteoporosis. Osteoporosis affects women more than men, but is a debilitating disease for either sex. Osteoporosis is often a silent disease that doesn’t manifest itself until a fracture is sustained.

**Discussion Starters**

1. Discuss how bone microarchitecture is changed in people with osteoporosis. How do these structural changes increase the risk of having a bone fracture?