Osteoporosis in the Oncology Setting

Joyce Marrs, MS, APRN-BC, OCN®, AOCNP

As an advanced practice nurse, you care for patients who have a variety of chronic conditions, and you are expected to handle them all. How do you keep up with all the advances in cardiology, endocrinology, gastroenterology, and infectious disease? You read this column, dedicated to managing a variety of primary care disorders in conjunction with cancer treatment. If you have developed expertise in management of one or more chronic diseases, consider writing for this column. Contact Associate Editor Joyce Marrs, MS, APRN-BC, OCN®, AOCNP, via e-mail at joycemrn@sbcglobal.net.

Case Presentation

Betty is a 67-year-old woman originally diagnosed in 1992 with a tumor 1C, node 0, metastasis 0 infiltrating ductal carcinoma that was estrogen and progesterone receptor positive. She was treated with a right modified radical mastectomy followed by five years of tamoxifen. In October 2001, she had a local recurrence that required radiation, chemotherapy with an excision of a 0.5 cm diameter lesion she had a local recurrence that required radiation, chemotherapy with an excision of a 0.5 cm diameter lesion that was estrogen and progesterone receptor negative. She was treated with letrozole (Femara®, Novartis Pharmaceuticals, East Hanover, NJ).

Betty’s personal medical history includes two pregnancies, menopause at the age of 55, and hormone replacement therapy with estrogen for one year following menopause. Betty also has a history of hyperlipidemia and nephrolithiasis. She denies any alcohol, tobacco, or illicit drug use. Significant family history includes her mother having an unidentifiable gynecologic cancer.

Betty had a routine screening bone densitometry test done in November 2004. At that point, she had been on letrozole for 37 months. The left hip T score was –2.47 with a corresponding –0.39 Z score. She was diagnosed with severe osteopenia of the left hip, which has a medium risk for fracture. The lumbar spine scores were normal. Betty was placed on alendronate (Fosamax®, Merck & Co., Inc., Whitehouse Station, NJ) 35 mg by mouth weekly in addition to calcium 1,500 mg and vitamin D 800 IU daily.

Case Discussion

Betty was 55 years old when originally diagnosed with breast cancer. Menopause occurred with the administration of adjuvant chemotherapy. With the care she has received, Betty has survived her cancer for 12 years with a good quality of life. However, like many other women surviving breast cancer today, treatment options can produce other long-term disorders, such as osteoporosis (Twiss et al., 2001).

Osteoporosis is a disease that occurs with aging as a result of estrogen loss. Approximately 28 million Americans have osteoporosis or osteopenia (Malabanan, 2003; Mourad, 1998). The process of remodeling for one cycle takes four months in a healthy adult, whereas the process may take up to two years in a person with osteoporosis (Mourad). The rate of bone resorption and bone formation is generally in constant equilibrium in healthy individuals. Osteoporosis occurs when the remodeling cycle is out of balance.

In osteoporosis, bone replacement is slower than bone resorption, causing a net loss of bone (Malabanan, 2003). Bone resorption occurs when osteoclasts, cells that originate from monocytes and macrophages, remove old or damaged bone. Bone formation occurs when osteoblasts set down the organic matrix by depositing calcium and phosphorus into the osteoid.

Risk Factors

The imbalance in bone remodeling can begin slowly at age 40 with an acceleration at the time of menopause (Twiss et al., 2001). Premenopausal female cancer survivors treated with chemotherapy may experience chemotherapy-induced menopause. Earlier osteoporosis can lead to osteoporosis. Osteopenia is defined as a decreased bone density mass when compared to a healthy, 30-year-old adult (Slovik, 2002).

Pathophysiology

Bone mass is laid down by age 20. However, throughout life, the bone continually completes a remodeling cycle. The cycle occurs in two phases: bone resorption and bone formation (Malabanan, 2003; Mourad, 1998). The process of remodeling for one cycle takes four months in a healthy adult, whereas the process may take up to two years in a person with osteoporosis (Mourad). The rate of bone resorption and bone formation is generally in constant equilibrium in healthy individuals. Osteoporosis occurs when the remodeling cycle is out of balance.

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Osteoporosis is a common metabolic bone disease. The characteristic finding in osteoporosis is a low bone mass and a degeneration of the microarchitecture of bone tissue (Slovik, 2002). These changes result in an increased risk for fractures resulting from bone fragility. Common sites for fractures are the vertebrae, hips, wrists, forearms, feet, and toes (Bennett, 2003).
occurrence of menopause will subject the survivors to longer periods of estrogen deficit, increasing the risk of osteoporosis. In addition to breast cancer survivors, women who receive chemotherapy for lymphoma and Hodgkin disease prior to menopause are at an increased risk for the development of osteoporosis.

Additional risk factors identified for those without a cancer diagnosis are categorized as modifiable or nonmodifiable (Malabanan, 2003). Nonmodifiable risk factors include family history, Caucasian or Asian race, female gender, menopausal status, and advanced age. Modifiable risk factors include environment and social issues such as smoking, excessive alcohol use, lack of exercise, decreased intake of calcium, and low body weight (Eastell, 1998). Various diseases, such as endocrine disorders, hematologic disorders, rheumatoid arthritis, and gastrointestinal disorders, increase the risk factor for osteoporosis (Eastell). Several drugs have been identified that increase the risk of osteoporosis, such as glucocorticosteroids, phenytoin, thyroxine, heparin, warfarin, and aromatase inhibitors.

Signs and Symptoms

Osteoporosis is generally a silent disease (Malabanan, 2003). The problem is identified through routine screening or with the occurrence of a fracture. Common sites for fractures from osteoporosis involve the wrist, vertebrae, ribs, and proximal femur.

Physical Examination

The physical changes from osteoporosis found on examination are secondary to severe cases (Malabanan, 2003). Kyphosis, or dowager’s hump, of the thoracic spine is a result of many vertebral compression fractures. Bone loss and vertebral compression fractures will decrease an individual’s height over a number of years. Physical examination includes regular measurement of height. Along with a physical assessment, specific diagnostic tests are used to determine the extent of osteoporosis.

Diagnostic Testing

Routine laboratory tests, such as a chemistry profile and urinalysis, generally are normal in those with uncomplicated osteoporosis (Malabanan, 2003; Slovik, 2002). However, screening should include a chemistry profile, complete blood count, erythrocyte sedimentation rate, protein electrophoresis, and thyroid stimulating hormone level to determine the presence of secondary causes for osteoporosis, such as osteomalacia.

Further testing for a possible vitamin D deficiency should be included in the workup using a serum 25-hydroxyvitamin D level test (Malabanan, 2003; Slovik, 2002). Being an older adult, living in a northern climate, having malabsorption, or using phenytoin increases the risk for vitamin D deficiency (Slovik). A low serum 25-hydroxyvitamin D test accompanied by an elevated alkaline phosphatase indicates that osteomalacia may be present (Pfeilschifter & Diel, 2000).

In women with breast cancer and osteoporosis, monitoring the alkaline phosphatase level is important. This level may be elevated following a fracture or with bone metastasis (Slovik, 2002). Further monitoring may be done with biochemical markers.

Biochemical markers that evaluate the remodeling of bone may be useful in the differential diagnosis (Malabanan, 2003; Slovik, 2002). Although several specific tests measure bone formation and bone resorption, these tests generally are not completed in the primary care setting. However, urine N-telopeptide, a marker for bone turn-over, may be useful in assessing response to therapy (Slovik). Radiographic testing also should be used to establish the presence of osteoporosis.

Radiology examinations are useful for identifying fractures. Three types of vertebral fractures are seen (Slovik, 2002). The loss of anterior height of the vertebrae will result in an anterior wedge fracture. Changes in the intervertebral disc cause a biconcave fracture, and compression fractures are a result of a loss of anterior and posterior vertebral height.

Bone density measurement is used more often to determine osteoporosis because x-rays will not identify osteoporosis until 30%–50% of bone is lost (Malabanan, 2003; Pfeilschifter & Diel, 2000). Bone density results are reported using T and Z scores. The T score compares a patient’s density to the density of a healthy young adult. The Z score is a comparison to an individual of the same age. The T score is the number used to diagnose osteopenia and osteoporosis. The numbers are reported in standard deviations from the norm. A deviation of –1 represents a 10%–12% decrease in bone density (National Institutes of Health, 2000). For osteopenia, the T score ranges from –1 and –2.4. Osteoporosis is defined as a T score less than or equal to –2.5 (Malabanan, 2003).

Once osteoporosis or osteopenia is diagnosed, several treatment options are available. The choice of which treatment to offer Betty was driven by the fact that she had a hormone-dependent tumor.

Pharmacologic Treatment

Pharmacologic measures used to treat osteoporosis will depend on whether the condition is treatment induced, the age of patient, and whether the tumor is hormone dependent (Pfeilschifter & Diel, 2000). Because Betty has a diagnosis of osteopenia with hormone-driven breast cancer and is being treated with an aromatase inhibitor, pharmacologic measures are directed at treating the osteoporosis. The treatment for Betty’s osteoporosis includes calcium and vitamin D supplements (Malabanan, 2003; Pfeilschifter & Diel). The recommended calcium dose is 1,000–1,300 mg daily with vitamin D 200–600 units daily (Malabanan). Another source for vitamin D is exposure of the hands, face, and arms to sunlight for 10–15 minutes on a regular basis.

Bisphosphonates are used to treat osteoporosis by a reduction in bone loss by inhibiting osteoclast activity (Twiss et al., 2001). Alendronate is given at a dose of 35 mg per week for prevention of osteoporosis and 70 mg per week for treatment of osteoporosis. With risedronate (Actonel®, Procter & Gamble, Cincinnati, OH), the dose is 35 mg per week for prevention and treatment. Patients with gastroesophageal bleeding, problems with esophageal motility, hypocalcemia, or renal disease should not receive either drug.

For patients who are unable to take bisphosphonates, calcitonin (Miacalcin®, Novartis Pharmaceuticals) may be an alternative in patients with mild osteopenia (Pfeilschifter & Diel, 2000). However, calcitonin use is not as effective as bisphosphonates. Another choice used in the prevention and treatment of osteoporosis is raloxifene (Evista®, Eli Lilly and Company, Indianapolis, IN). Raloxifene does provide bone protection, but its use for osteoporosis in the presence of breast cancer is still investigational.

Osteoporosis caused by early menopause can be prevented or treated with hormone replacement as long as the tumor is not hormone dependent. Patients who would benefit from hormone replacement could be those with a history of lymphoma or Hodgkin disease (Pfeilschifter & Diel, 2000).

Nonpharmacologic Treatment

Exercise in conjunction with pharmacologic treatment may improve bone density (Malabanan, 2003). Exercise that includes weight training and weight bearing is more beneficial than high-impact exercise.
High-impact exercise should be avoided to reduce the risk of fragility fractures.

**Nursing Interventions**

Because osteoporosis increases the risk for fractures occurring with minimal trauma, a fall risk assessment should be completed. An increased risk for falls is associated with diminished hearing, poor vision, sluggish reflexes, and decreased flexibility and strength.

**Patient Education**

Patient and family education is directed toward knowledge of disease, nutritional education, understanding of proper pharmaceutical use, and reducing the risk of injuries.

- Educational information from the National Osteoporosis Foundation can be found at www.nof.org.
- The National Institutes of Health’s osteoporosis Web site, www.osteo.org, has additional patient education information.
- Dietary sources of calcium include skim milk, sardines, beans, green leafy vegetables, nuts, and fortified orange juice (Moyad, 2002).
- Sources of vitamin D include fish, sunlight, and vitamin supplement.
- Divide the daily amount of calcium needed into two or three separate doses because the body can only absorb about 500 mg of elemental calcium at a time.
- Reduction of fall risk involves evaluation of environment. Provide for adequate light, remove throw rugs, and install grab bars in the bathroom.

**Follow-Up**

Advanced practice nurses (APNs) can play an intricate role in monitoring patients with osteoporosis and cancer in the oncology setting. Patients should be evaluated at regular intervals. Height should be measured yearly and compared to baseline. A decline in height may indicate vertebral fractures. A bone density test should be performed to establish a baseline within one year from the onset of menopause. Nurses should obtain baseline bone density scans, especially when aromatase inhibitors will be used. Follow-up bone density tests should be performed every three to five years to monitor for early changes (Twiss et al., 2001). APNs can provide ongoing health promotion regarding medication management, exercise, and dietary measures.

**Conclusion**

Osteoporosis can be a debilitating disease. As healthcare providers aggressively treat breast cancer in ways that initiate the process of early menopause, they need to be concerned about the long-term effects that the lack of estrogen has in developing osteoporosis. In addition to the onset of early menopause, the use of aromatase inhibitors can compound the development of osteoporosis. Many patients with breast cancer are surviving longer while developing other health problems after life-saving therapy. APNs can be active in the prevention and treatment of such patients to promote a higher quality of life.

**References**


