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February 2005 "Prevalence, Prevention, Diagnosis & Treatment of Osteoporosis" 707-000-05-002-H01

THIS MONTH
"Update on Osteoporosis"

FLORIDA PHARMACISTS….WE'RE AWARE OF THE NEW REPORTING REQUIREMENTS. WE ARE WORKING OUT DETAILS AND WILL COMPLY WITH ALL NECESSARY STEPS. WILL KEEP YOU INFORMED.ALL STATEMENTS OF CREDIT FOR 2004 HAVE BEEN MAILED. IF YOU HAVE QUESTIONS, PLEASE CONTACT US.MISSING A LESSON? IT'S EASY TO GO TO OUR WEBSITE, & DOWNLOAD WHAT YOU NEED. (www.wfprofessional.com)IT'S A NEW YEAR. WHEN YOU SEND IN QUIZZES, ALWAYS KEEP A COPY. YOU MAY EMAIL OR FAX THEM. FAX # IS 847-945-5037. OR SEND A CONVENTIONAL EMAIL WITH YOUR ANSWERS. (INFO@WFPROFESSIONAL.COM).

HAVE YOU RECENTLY MOVED? PLEASE NOTIFY US.

Osteoporosis, because of its impact, is a topic that we review, perhaps, more often than others. Our goals are to discuss the prevalence, prevention, diagnosis & treatment of the disease. This lesson provides 1.25 hours (0.125 CEUs) of credit, and is intended for pharmacists in all practice settings.

The program ID # for this lesson is 707-000-05-002-H01.

Pharmacists completing this lesson by February 28, 2008 may receive full credit.

To obtain continuing education credit for this lesson, you must answer the questions on the quiz (70% correct required), and return the quiz. Should you score less than 70%, you will be asked to repeat the quiz. Computerized records are maintained for each participant.

If you have any comments, suggestions or questions, contact us at the above address, or call toll free 1-800-323-4305. (In Alaska and Hawaii phone 1-847-945-8050). **Please write your ID Number (the number that is on the top of the mailing label) in the indicated space on the quiz page** (for continuous participants only).

The objectives of this lesson are such that upon completion the participant will be able to:

1. List the types of osteoporosis & their causes.
2. Describe the prevalence of osteoporosis.
3. State the significance of the intake of calcium & vitamin D as well as exercise for preventing osteoporosis.
4. List the techniques used in measuring BMD.
5. Evaluate the medications that are used for treating & preventing osteoporosis.
6. Explain the directions for use of FDA approved bisphosphonates.

Osteoporosis is a slow, progressive, systemic skeletal disease that is considered a major health threat. It is characterized by a gradual loss in bone density and mass, resulting in increased bone fragility, microarchitectural deterioration and susceptibility to fractures. It is the most common bone disease that leads to increased morbidity, excessive mortality and functional loss in the elderly. Osteoporosis is the major contributing factor for fractures. Bone strength depends largely on bone density, which is defined as the number of grams of minerals per area, and determined by peak mass and amount of bone loss. Weakened bones are vulnerable to fracture when traumatic forces are applied. Even though older men and women experience bone loss with advancing age, younger individuals who do not reach optimal bone growth during childhood and adolescence may suffer from osteoporosis.

Osteoporosis may be classified as **primary**, **secondary**, or **involuntary**. **Primary** osteoporosis occurs in people of all walks of life, but most commonly it develops in postmenopausal women, mainly as a result of diminished estrogen production. **Secondary** osteoporosis occurs as a consequence of intake of medications or the presence of systemic diseases. Drugs like aluminum compounds, anticonvulsants, cytotoxics, glucocorticoids, adrenocorticotropin, immunosuppressants, lithium, long-term heparin use, long-acting parenteral progesterone, thyroxin and premenopausal use of tamoxifen may precipitate secondary osteoporosis. Likewise, diseases such as chronic obstructive pulmonary disease, anorexia nervosa, hyperparathyroidism, hypogonadism, malnutrition, malabsorption syndromes, thyrotoxicosis, and rheumatoid arthritis, may be associated with increased risk of secondary osteoporosis. About 30% to 50% of osteoporotic cases result from secondary causes. Hypogonadism, alcoholism, and the intake of glucocorticoids are the most common predisposing factors. More than 50% of premenstrual women develop secondary osteoporosis as a consequence of hypoestrogenemia, the use of anticonvulsants, glucocorticoids and thyroid hormones. Individuals who suffer from chronic obstructive pulmonary disease and rheumatoid arthritis and who are placed on long-term administration of glucocorticoids may experience a high risk of fractures. Bone health should be taken into consideration in children and adolescents who are treated with glucocorticoids for inflammatory conditions. Diseases such as cystic fibrosis and inflammatory bowel disease, may lead to osteoporosis. **Involuntary** osteoporosis occurs with aging, resulting in decreased bone formation.

BONE ANATOMY

There are two basic types of bone (osseous) tissue: compact and **spongy.**

Compact (cortical, lamellar) bones appear dense and smooth to the naked eye, but a microscopic examination reveals the presence of tiny plates of lamellae, organized about canals that contain nerves and blood vessels.

Spongy (**trabecular, cancellous**) bones are porous and consist of a honeycomb of vertical and horizontal, needle-like bones filled with red marrow and fat. All bones of the body consist of both types of osseous tissue, with the spongy trabecular tissue surrounded by a thin shell of dense cortical tissue. The vertebrae, the pelvis, and the proximal femur are composed mostly of spongy, trabecular tissue that is more prone to osteoporotic changes and bone mass loss than the solid cortical tissue. This accounts for the fact that osteoporosis occurs earlier and far more severely in the spine and pelvis than other parts of the skeleton.

Chemically, bones consist of about 50% water, and the remainder of solid substances made of both organic and inorganic compounds. The organic components consist chiefly of cells such as osteoblasts,

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osteocytes, and osteoclasts. The osteoblasts produce organic matter such as collagen, proteoglycans, and glycoprotein that are hardened by inorganic minerals like calcium phosphate, calcium hydroxide, calcium carbonate, fluoride, sodium, potassium and manganese. Osteoclasts are responsible for bone resorption.

Bone tissue is an active one and participates in three major activities: 1) **modeling** is a process that deals with establishing the characteristic shape of each bone; 2) **repair** refers to the regenerative response (self-repair) of a bone to the presence of a fracture; and, 3) **remodeling** is an ever-present cycle of destruction (resorption, breakdown, removal) and renewal (formation, replacement deposit) of osseous tissue that is coordinated by an independent packet of osteoblasts and osteoclasts referred to as, "bone remodeling units." In a healthy adult skeleton, the rate of formation basically equals the rate of resorption, and thus no bone loss. However, the remodeling process does not occur uniformly. There are certain bones such as the hip (distal portion of the femur) that are replaced every five to six months, whereas the shaft of this bone undergoes remodeling at a slower rate. Bone surface is covered with inactive cells. The process of bone resorption, which is the first step of bone remodeling, is carried out by the bone remodeling units that may be activated by either hormonal or physical signals. These signals cause the inactive cells that cover the bone surface to be replaced by mononuclear phagocytes that form clusters and eventually fuse to become multinucleated osteoclasts, each of which, over a period of about two weeks, excavates a resorption microscopic cavity on the surface of cancellous bones or a tunnel-like structure within the cortical bone. The process of bone renewal takes place when a local release of a chemical factor attracts bone-building osteoblasts into the resorption cavity where they begin to replace the missing portion of the bone by first secreting collagen matrix, followed by mineral (calcium and phosphorus) deposition. Remodeling is complete within 8 – 12 weeks after the onset of the cycle. Because bone replacement by the remodeling cycle is not entirely efficient, a small bone deficit exists at the end of each cycle. This deficit accounts for age-related bone mass loss. In a repeating cycle of these processes, bone resorption is closely coupled to bone formation.

Bone remodeling is regulated mainly by negative feedback hormonal mechanisms involving parathyroid hormone (PTH) and calcitonin, a hormone released by the perifollicular cells of the thyroid glands. Low calcium blood level acts as a stimulus for release of PTH. This hormone causes stimulation of the activity of the osteoclasts, and resorption of bone matrix and subsequent release of calcium ions into circulation. The resultant elevation of calcium blood level acts as a stimulus for ending PTH release and for the release of calcitonin. Calcitonin inhibits bone resorption and enhances bone replacement by causing deposition of blood calcium back into the bone matrix. The decline in calcium blood signals the end of calcitonin release.

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PREVALENCE

Osteoporosis is prevalent worldwide, and its incidence will increase as life expectancy increases and the population ages. It is estimated that there are 10 million Americans who are osteoporotic and an additional 22 million women who suffer from low bone density of the hip. About 50% of postmenopausal white women will have osteoporotic fracture during their lifetime, including 25% who will experience spine deformity and 15% who will suffer from hip fracture. Eight to 15 million men over 50 years of age have osteoporosis or osteopenia (decreased bone density). The main difference between progression of osteoporosis between men and women is due to the following:

1) Women undergo a phase of rapid bone loss at and after menopause, while men exhibit an exponential increase in the development of osteoporosis about 5 to 10 years later;
2) Women live significantly longer than men;
3) Most healthy men before the age of 50 have approximately 33% more bone mass than women; and,
4) Men have the tendency to be more active physically than women of the same age.

From the 2000 National Census, the National Osteoporosis Foundation (NOF) has estimated that 20% of postmenopausal white American Women have osteoporosis and 52% have diminished bone density at the hip. About 80% of the cases of osteoporosis in the USA are encountered in postmenopausal white women. However, osteoporosis may occur in all groups, in both sexes, and in any ethnic group. About 75% of hip fractures are experienced by white women. Starting in midlife, both men and women develop age-related reduction in bone mineral density (BMD). African-American postmenopausal women have a higher BMD than that of white, non-Hispanic women, and have lower risk of hip fractures, whereas Japanese women have lower optimal BMD than white, non-Hispanic women, and are more vulnerable to hip fractures. The BMD of Hispanic-American women falls between white women and African-American women. A total of 1.5 million fractures occur in the USA annually. About 25% of these fractures occur in the vertebrae, 25% in the wrist, 25% in the hips, and 25% in other parts of the skeleton. Fractures may heal, resulting in full recovery, or may lead to chronic pain, handicap and mortality. A consequence of hip fractures is a 10% - 20% increase in mortality rate within a year of the incident. It is estimated that 33% of the patients whose hip was fractured will fracture the other hip. Over 25% of persons with hip fractures end up in long-term nursing home care, and 4% may maintain their pre-fracture status of mobility and activity. Vertebral fractures may result in height loss, kyphosis (humpback), and movement limitation. Depending on their severity, fractures may cause depression, hopelessness, loss of self-esteem, fear, anger and frustration, mainly due to the presence of pain and lack of physical independence. Such symptoms strain the relationship between the patient and their families and increase the cost of patient care. The economic burden caused by osteoporosis fractures is enormous. The total annual cost to the health care system in the USA exceeded $17 billion. The cost of a single hip fracture is estimated to be over $40,000.

PREVENTION

Even though osteoporosis is a silent disease, it is preventable if diagnosed in the early stages of its progression. Prevention measures should start early in life. Healthy nutrition is of utmost importance for growth, including bone development. This should be a lifelong process that begins early in life. The bones gradually increase in size and strength as the person becomes older. However, optimal bone mass is usually reached in the third decade of life at which time cessation of linear growth takes place. Elimination, reducing or avoiding risk factors are important steps in the prevention of osteoporosis. Risk and predisposing factors for low bone mass include: gender (female), aging, estrogen deficiency, race, low body weight, family and personal history of fractures as an adult, alcohol abuse, excessive intake of caffeine in coffee and soft drink, cigarette smoking and lack of exercise. Other factors such as impaired hearing and vision, unsafe living environment, (i.e., poor lighting, slippery bathtubs, presence of throw rugs, lack of handrails in some stairways,) dementia, lifelong inadequate intake of calcium and vitamin D, presence of disease such as eating disorders, malabsorption syndromes, malignancies, hyperthyroidism, and intake of medications such as glucocorticoids, play an important role in contributing to fracture. The risk of falling is an important risk factor that usually increases with age. It is estimated that about 90% of all hip fractures result from a fall. Thus, prevention

of falls and the use of hip protectors are useful in decreasing the incidence of hip and other fractures. The risk of falling include: advanced age, female gender, impaired cognition, impaired hearing and vision, muscle, joint and balance disorders, the use of sedatives and antidepressants, low body weight, low level of physical activity and malnutrition.

The following are measures that are recommended to improve bone health.

1. Adequate Intake of Calcium and Vitamin D: Studies have shown that a reduction in the incidence of fractures, as well as improvement of BMD, have occurred following adequate intake of calcium and vitamin D. The recommended dose for an individual 50 years of age and older is at least 1200 mg of calcium daily, with an upper limit of 2500 mg. This can be achieved through consumption of calcium-rich food, along with supplements. A typical post-menopausal American woman consumes about 600 mg of calcium daily from her diet. The major source of calcium (75% to 80%) in an American's diet is dairy products. For example, an 8 oz. glass of milk provides 300 mg of calcium; an 8oz. cup of yogurt provides 400 mg of calcium; 1 oz. of cheese contains 200 mg of calcium. Persons at risk of vitamin D deficiency should take 400 – 600 IU per day. To achieve optimal bone mass and maintain healthy bones, individuals should realize that this intake should be a lifelong goal and process. Inadequate intake of calcium may result in migration of calcium from the skeleton to maintain adequate levels of calcium in the blood stream. This process of migration can lead to weaker bones. The role of vitamin D is to enhance calcium absorption and ultimately enhance the function of healthy bones. Vitamin D is found in abundance in vitamin D fortified milk, cereals, egg yolks, fish and liver. The recommended daily intake of vitamin D from diet and supplements is 400 – 600 IU daily for persons 50 years of age and over, with a safe upper limit of 2000 IU per day. Calcium carbonate is a widely used source of calcium supplement. Its main side effects are gastrointestinal disturbances and constipation. These adverse effects can be minimized if the drug is taken with food. Calcium citrate has lesser adverse effects than calcium carbonate and may be better absorbed.

2. Weight-Bearing Exercises: Physical exercises are beneficial for the health and well being of persons of all ages. Regular physical activity (especially high impact exercises) early in life may result in increased optimal bone mass. However, in middle years of life there is no clear evidence to show that exercises may improve BMD. It is clear, however, that weight bearing exercises such as walking, jogging, tennis and low-impact aerobics are advisable. Such exercises are not only useful for the overall health of the individual, but may lead to strengthening of the muscles and improvement of balance and ultimately reduction in fall incidences and fractures. Patients should walk for at least 40 minutes per day, four times a week, while carrying weights ranging from 1 – 2 pounds. A study of postmenopausal women revealed that those who walked at least 4 hours per week, experienced a 41% lower risk of hip fracture than in those who walked one hour a week or less. Weight bearing and muscle strengthening exercises may result in an increase in BMD. Vigorous exercise has failed to show an advantage over low-intensity exercise. However, medical advice should be sought if the person intends to engage in vigorous exercise such as running and weight lifting. Precautions such as correction of impaired vision and hearing, improving environmental conditions at home, compliance with direction for use of medications that cause drowsiness, and avoiding activities that exert undesirable pressure on the skeleton such as pushing, pulling, bending, and lifting are important steps that may lead to reduction in falling incidences.

3. Smoking Cessation and Refrain from Excessive Alcohol Use: Cigarette smoking, which usually begins in adolescence, may accelerate bone loss as a result of accelerated estrogen metabolism. Women smokers may experience early menopause. Thus, avoidance of cigarette smoking is recommended. Consumption of alcohol is inconsistently linked with decreased bone mass. It has been indicated that moderate alcohol use may contribute slightly to a higher bone density. However, excessive intake (more than 2 drinks per day) adversely affects bone health. In addition, such consumption may be detrimental to balance and may increase the risk of falling.

DIAGNOSIS

Since osteoporotic patients' skeletons are characterized by low BMD, evaluation of BMD will indicate the presence or absence of osteoporosis or osteopenia. In cases of the presence of the disease, BMD measurement will reveal the extent of progression of the disease. BMD is the most commonly used method for diagnosing osteoporosis.

The NOF publishes a guideline for BMD testing in women:

1) All women 65 years of age and older, regardless of the presence or absence of risk factors;
2) Younger postmenopausal female; and,
3) Postmenopausal women who experienced fragility fracture to confirm diagnosis and determine disease severity. For BMD testing in men, the World Health Organization (WHO) and the International Society of Clinical Densitometry, recommend that men who experienced low-trauma fracture, exhibit radiographic osteopenia, suffer from hypogonadism and/or hypothyroidism, abuse alcohol, or take corticosteroids, should take the BMD test.

BMD measurement can confirm or rule out the presence of osteoporosis. The lower the BMD, the greater the severity of the disease, and the higher the risk of fractures. The T-score compares the patient with the young-adult mean and expresses the difference as a standard deviation score. WHO has published the following definitions based on bone mass measurement at the spine, hip or wrist:

1) A person has a normal BMD if the measurement is within 1 SD of a young normal adult (T-score of –1.0 and greater);
2) The presence of low bone mass (osteopenia) is confirmed if the BMD is between 1.0 and 2.5 SD below that of a young normal adult (T-score between -1.0 and -2.5);
3) Osteoporosis is diagnosed if BMD is 2.5 SD or more below that of a young, normal adult (T-score at or below –2.5); and,
4) Established or severe osteoporosis is confirmed in women whose T-score is at or below –2.5 and who already suffered from one or more fractures.

Measurement of BMD can be done at any skeletal site. However, hip BMD is the best predictor of hip fracture. Several techniques can be utilized for BMD measurement.

Dual X-Ray Absorptiometry (DXA): This technique can be employed for measuring BMD in the hip, wrist and spine. DXA emits a beam of X-ray photons that penetrate the bones to be tested. The test is safe and can be completed in a few minutes. It gives radiation exposure per site approximately one-tenth that of a standard chest X-ray. Central DXA usually provides definitive diagnosis.

Peripheral dual X-ray Absorptiometry (pDXA) and Simple-energy X-ray Absorptiometry (SXA): This method measures bone density in the forearm, wrist, finger and heel.

Quantitative Computed Tomography (QCT): QCT is capable of revealing signs of loss in both cortical and trabecular bones, especially in the spine.

Peripheral ACT (pQCT): This technique may be used to detect bone density in the periphery.

Ultrasound Densitometry: Ultrasound is used to evaluate bone density in the heel, tibia, patella or other peripheral sites. It is not as accurate as DXA or SXA.

TREATMENT

Osteoporosis is a preventable and treatable disease. Treatment should be initiated to reduce fracture risk in women with:

1. BMD T-score below –2.0, by hip DXA with no risk factors
2. BMD T-score below –1.5, by hip DXA with one or more risk factors
3. Prior vertebral or hip fracture

Prior to initiation of therapy, patients should be evaluated for the presence of secondary osteoporosis. Regardless of the therapy, patients should be counseled to reduce the risk factors and adhere to regular exercise and intake of calcium and vitamin D. There are FDA-approved medications for the prevention and/or treatment of postmenopausal osteoporosis. The list includes the following: **bisphosphonates (alendronate, risedronate), calcitonin, estrogens and/or hormone therapy, parathyroid hormone, and selective estrogen receptor modulators (SERMs).**

BISPHOSPHONATES

The bisphosphonates are compounds that inhibit osteoclast activity by binding to hydroxyapatite crystals on the bone surface, thereby inhibiting bone resorption and increasing bone density. The available bisphosphonates are: alendronate and risedronate.

Alendronate was approved by the FDA for treatment and prevention of osteoporosis in 1995. A 5 mg daily dose or a 35 mg once a week dose of alendronate is approved for the prevention of osteoporosis, especially in early menopause. For the treatment of osteoporosis in postmenopausal women, the FDA recommends a daily dose of 10 mg or a weekly dose of 70 mg. It has been shown that alendronate increases spinal bone density and reduces the frequency of vertebral, wrist and hip fractures by about 50% over 3 years in patients with prior spine fracture, and about 48% over 3 years in patients without a prior spine fracture.

Adverse reactions associated with alendronate have been mild and discontinuation of therapy was not required. Adverse reactions such as GI disturbances, esophageal irritation, dysphagia or gastric ulcers, musculoskeletal pain, headache, and dizziness have been reported. Alendronate is not recommended for patients with renal dysfunction, and should be used with caution in persons with active upper GI diseases. No adverse effects were noticed when alendronate was administered concurrently with estrogens. Concurrent administration with antacids may reduce absorption. Alendronate must be taken with a full glass of plain water (no other liquid) at least one-half hour before breakfast. Taking with meals or along with orange juice or coffee tends to markedly reduce drug absorption. Moreover, patients should take the medication with a full glass of water to facilitate delivery to the stomach, and they should not lie down for at least one-half hour after intake of the medication.

The FDA approved Risedronate sodium in 2000 for the treatment and prevention of osteoporosis in postmenopausal women, in a dose of 5 mg daily or 35 mg weekly. It has been reported that risedronate reduces the incidence of spine fracture by 41% - 49%, and non-spine fractures by 36% over 3 years in patients with a prior spine fracture. The adverse effects of risedronate and its administration are similar to those of alendronate.

CALCITONIN

Nasal salmon calcitonin has been shown to prevent bone loss and decrease vertebral fracture by 54%, but has no effect on the rate of non-vertebral fractures. It is approved by the FDA for the treatment of osteoporosis in women who are at least 5 years postmenopausal. The drug is administered intra-nasally, in the form of a spray that delivers 200 IU of salmon calcitonin. Since calcitonin is an amino acid peptide hormone, it breaks down in the GI tract if taken orally, and consequently it may be administered subcutaneously. The drug is safe, although some patients may experience rhinitis.

ESTROGEN/HORMONE THERAPY

During menopause, estrogen production is diminished. Menopause does not occur abruptly. A transitional period of 2 to 3 years may occur during which an irregular menstrual cycle may be experienced. These pre-menstrual years signal the beginning of diminishing estrogen production and increased risk of development of osteoporosis. It has been shown that starting estrogen replacement therapy (ERT) within the first 5 years of menopause and continued for at least 10 years, causes a 50% reduction in incidence of hip fractures. To prevent bone loss it is recommended that ERT be initiated immediately after menopause because there is an increase in the rate of bone loss in the first 3 – 6 years following menopause. Cessation in ERT may result in a rapid bone loss. In spite of the benefits to be gained from ERT, many women discontinue the therapy within one year due to side effects such as vaginal bleeding, thrombosis, and increased risk of cancer. The maximum duration of therapeutic efficiency as well as how late after menopause one can start ERT and still maintain a therapeutic effect are not known.

Estrogens are usually administered in a cycle or according to continuous schedules. An optimal dose of 0.625 mg to 1.25 mg daily of conjugated estrogen is effective in reducing bone loss. Estrogen may be administered orally, parenterally, intravaginally or as transdermal patches.

PARATHYROID HORMONE (pTH)

Parathyroid hormone is approved by the FDA for treating osteoporosis in postmenopausal women who are at high risk of fracture. When parathyroid hormone is administered by daily subcutaneous injection in doses from 20 mg to 40 mg, it stimulates bone mass and volume (anabolic). It has been shown that after an average use of 18 months, parathyroid hormone resulted in increase in BMD of the spine and femoral neck and decreased the risk of vertebral fractures by 64% and non-vertebral fractures by 53%. The drug is well tolerated although the parenteral route of administration is inconvenient. Some patients experienced cramping and dizziness.

RALOXIFENE

Raloxifene is a selective estrogen receptor modulator (SERM) that is approved by the FDA for the prevention and treatment of osteoporosis in postmenopausal women. The drug is an osteoclastic inhibitor and causes an increase in BMD and a reduction in vertebral fracture by 40%, but there is no confirmation that it achieves a significant positive result in non-vertebral fractures. Like estrogen, raloxifene may increase the risk of deep vein thrombosis. The drug may cause a significant reduction in invasive breast cancer.

NON-FDA APPROVED DRUGS

There are a number of medications for the prevention or treatment of osteoporosis that have not been approved by the FDA. These medications include:

Calcitriol: Calcitriol is a synthetic vitamin D analogue that enhances calcium absorption. The drug has been approved by the FDA for the treatment of hypocalcemia, metabolic bone disease that occurs in renal dialysis patients, hypoparathyroidism and pseudohypoparathyroidism. The drug does not appear to have a positive effect on BMD and failed to show any reduction in risk for osteoporotic fracture.

Other Bisphosphonates: Etidronate, ibandronate, pamidronate, tiludronate, and zoledronic acid are bisphosphonates that are currently approved for Padgett's disease, hypercalcemia of malignancy and myositis ossificans, but not for the prevention and treatment of osteoporosis.

Sodium Fluoride: The use of sodium fluoride in doses of 1 mg per kg per day has resulted in an increase of 3% to 6% per year in bone mass of the trabecular bone (the spine), but appears to have detrimental effects on cortical bone. It has been postulated that sodium fluoride may cause a transfer of minerals from the cortical to the trabecular bones. Because there is no confirmation as to its value for reduction of fracture risk, sodium fluoride use is limited in clinical trials.

Tibolone: Tibolone is an estrogen-like agent that is approved in Europe for the treatment of vasomotor symptoms of menopause and for the prevention of osteoporosis. At this time, the use of this medication in the U.S. has not been approved.

CONCLUSION

Osteoporosis is a common disease that affects individuals of all ages, gender and races, but is mostly encountered in postmenopausal women. The disease is preventable and can be treated. A measure such as adequate exercise and intake of calcium and vitamin D is essential. Supplements should be included if the patient is not receiving the required amounts. FDA-approved medications have been shown to be effective in reducing hip and vertebral fractures. The bisphosphonates should be considered the drugs of choice, due to their effectiveness and low incidence of side effects. Even though raloxifene has not been shown to be effective in reducing hip fractures, it is effective in the reduction of vertebral fractures. Recombinant parathyroid is a drug that has potential for men and women with prior fractures, or osteoporosis that did not respond to other therapies. Because of its side effects, it should be reserved for patients at high risk of fractures. Calcitonin and estrogen are used mainly for acute vertebral fractures and severe postmenopausal osteoporosis.

References

1. D. Kirk and S.A. Fish, "Medical Management of Osteoporosis," Amer.J. Managed Care, 10, 445 (2004).
2. N.B. Watts, "Focus on Primary Care Postmenopausal Osteoporosis: An Update, " Obst. Gynecol. Surg., 55, S49 (2000).
3. P.J. Meunier, P.D. Delmas, R. Eastell, M.R. McClung, S. Papapoulos, R. Rizoli, E. Seeman, and R.D. Wasnich, "Diagnosis and Management of Osteoporosis in Postmenopausal Women: Clinical Guidelines, Clin. Ther. 21, 1025 (1999).
4. R. Sagraves, "Evaluating Therapeutic Modalities for Prevention and Treatment of Postmenopausal Osteoporosis, " Ann. Pharmacother, 37, 744 (2003).
5. H.D. Nelson, M. Helfand, S.W. Woolf, and J.D. Allan, "Screening for Postmenopausal Osteoporosis: A Review of the Evidence for the U.S. Preventive Services Task Force," Ann. Inter. Med., 137, 529 (2002).

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LESSON EVALUATION

Please fill-out this section as a means of evaluating this lesson. The information will aid us in improving future efforts. Either circle the appropriate evaluation answer, or rate the item from 1 to 7 (1 is the lowest rating; 7 is the highest).

1. Does the program meet the learning objectives?

List types of osteoporosis & their causes	Yes	No
Describe prevalence of osteoporosis	Yes	No
Significance of intake of calcium & vitamin D, plus exercise	Yes	No
Techniques used to measure BMD	Yes	No
Evaluate medications for treating & preventing osteoporosis	Yes	No
Explain directions for use of FDA-approved bisphosphonates	Yes	No

2. Was the program independent & non-commercial? Yes No

	Poor			Average		Excellent	
4. Relevance of topic to your practice	1	2	3	4	5	6	7
5. Author's ability to communicate	1	2	3	4	5	6	7

6. What did you like most about this lesson?_____

7. What did you like least about this lesson?_____

8. How would you improve this lesson?_____

9. Further comments or suggestions for future programs_____

(WATCH OUR WEBSITE FOR RESULTS OF PARTICIPANT EVALUATIONS)

Quiz—Please Select the Most Correct Answer

1. Which of the following may cause secondary osteoporosis?
   A. Penicillin
   B. Aspirin
   C. Glucocorticoids
   D. Sodium fluoride
2. The difference in progression of osteoporosis between men & women is due to:
   A. Men live significantly longer
   B. Most healthy men, under 50, have up to approximately 90% more bone mass than women
   C. Women exhibit exponential increase in osteoporosis before & after menopause
   D. Men have tendency to be more physically active
3. Which of the following has no influence on reducing incidence of fracture?
   A. Intake of food rich in carbohydrates
   B. Intake of calcium & vitamin D
   C. Weight-bearing exercise
   D. Smoke cessation
4. Which of these methods is used to measure BMD in the hip, wrist, and spine?
   A. pDXA
   B. QCT
   C. DXA
   D. SXA
5. Severe osteoporosis is confirmed in women whose T-score is at or below –2.5, and who already suffered from one or more fractures
   A. True
   B. False
6. The NOF guidelines for BMD testing in women recommend:
   A. All women over 75
   B. Younger, postmenopausal females
   C. Premenopausal with fracture history
   D. Females of all ages
7. Which is true regarding alendronate?
   A. Take with meals
   B. Do not lie down for 30 minutes
   C. Use for patients with renal dysfunction
   D. Dose is 150mg, once a week
8. To minimize osteoporosis, start treating at the age of 35.
   A. True
   B. False
9. Which of these is an FDA-approved drug for treatment & prevention of osteoporosis
   A. Calcitriol
   B. Pamidronate
   C. Zoledronic acid
   D. Raloxifene
10. Which of these drugs may be administered intranasally?
    A. Estrogen
    B. Calcitonin
    C. Parathyroid hormone
    D. Risedronate

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