Osteoporosis: Review Of Disease, Diagnosis, And Treatments For The Advanced Practice Nurse

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Citation

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Abstract

Osteoporosis is a common bone disease that is a major threat for millions of individuals. The consequence of this disease is often a fracture of the bone leading to pain and disability as well as even death. There are often no physical findings of osteoporosis creating detection and treatment of osteoporosis difficult. Unfortunately, the rates of osteoporosis and osteoporotic fractures are estimated to rise. A cure for osteoporosis does not exist, however, it is a preventable and treatable disease. Guidelines for appropriate detection, prevention, treatment, and education/counseling are crucial for proper care of patients for the prevention of osteoporosis and osteoporotic fracture. The prevalence and impact of osteoporosis, risk factors, clinical presentation, diagnostic tests, prevention, treatment and education/counseling will be discussed. Health care providers must continue to assess and promote bone health throughout the life span to further prevent osteoporosis from increasing.

INTRODUCTION

Gradually more attention has been drawn to osteoporosis over the last 10 years. Despite having gained knowledge on how to treat and prevent osteoporosis a lack of research and consensus remains in how to properly screen, prevent, and treat individuals with osteoporosis. This is evident in the lack of patients with osteoporotic fractures being treated as well as the lack of known protective methods and medications being offered to such patients. There seems to be an idle attitude when it comes to osteoporosis and those who are at risk for osteoporosis amongst health care providers. Awareness and proactive behavior amongst medical professionals is essential to decrease osteoporosis and osteoporotic fracture and its effects on patients.

Osteoporosis is a disease that causes the bone to become porous and is characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased risk for fractures of the hip, spine, and wrist (National Institute of Health Osteoporosis and Related Bone Disease-National Resource Center, 2005). This disease affects both men and women and has costly consequences financially, physically, socially, and psychologically. Ultimately a fracture of the bone is the major consequence of this disease. Complications that occur from fracture include acute and chronic pain, depression, anxiety, loss of mobility and independence, and even death. Because late-life fractures significantly affect the duration and quality of life, risk assessment, prevention, and treatment of osteoporosis are important components of comprehensive primary health care in women and men (Barker, Burton, & Zieve, 2003).

INCIDENCE AND IMPACT

Osteoporosis is the most common bone disease and is estimated to cause 1.5 million fractures annually in the United States (National Osteoporosis Foundation, 2003). It is a major public health threat for an estimated 44 million Americans, or 55% of the people 50 years of age and older (National Osteoporosis Foundation-Fast Facts, 2005). In the United States, 10 million individuals are estimated to already have the disease and almost 34 million more are estimated to have low bone mass (National Osteoporosis Foundation-Fast Facts, 2005). The rate of osteoporosis incidence is expected to increase from 10 million to 14 million by 2020 (Fisher-Wilson, 2004).

One in 3 women and 1 in 9 men older than 80 years of age will have a hip fracture as a result of osteoporosis, and 15% to 30% will die of complications related to the fracture (Fisher Wilson, 2004). According to the National Osteoporosis Foundation (NOF) a woman's risk of hip fracture is equal to her combined risk of breast, uterine, and ovarian cancer (2005). NOF goes on to state an average of 24% of hip fracture patient's aged 50 and over die in the year following their fracture (2005).

Studies have also shown that osteoporosis has been diagnosed in only about one third, and only one seventh of American women with osteoporosis received treatment (Amin, Kuhle, & Fitzpatrick, 2003). One out of every two women and one in four men over 50 will have an osteoporosis-related fracture in their lifetime (National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005). According to the National Institutes of Health Osteoporosis and related Bone disease osteoporosis is also responsible for more than 1.5 million fractures annually (2005). Yet, there is a segment of the medical community that discounts the importance of osteoporosis (Heaney, 2003). Although, with these statistics and the aging population growing methods for prevention and treatment of osteoporosis are critical to ensure better detection and treatment of this disease before major complications occur.

According to the 2004 Surgeon General's Report on Bone Health and Osteoporosis the medical expense for treating broken bones from osteoporosis is as high as $18 billion each year (U.S. Department of Health and Human Services, 2004). The cost of care for the patients and the work that is lost add billions more to this figure as well. With the aging population, the number of hip fractures and related cost expenditures is expected to triple by 2040 (Amin, Kuhle & Fitzpatrick, 2003). Consequently, the costliness of osteoporosis and related complications manifest the significance of detection and treatment of osteoporosis is for the patient and health care providers.

DEFINITION

The National Osteoporosis Foundation (2005) defines osteoporosis, or porous bone, as a disease characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased susceptibility to fractures, especially of the hip, spine and wrist, however any bone can be affected. Osteoporosis is a treatable and preventable disease, although not curable as of yet. Many call osteoporosis the “silent disease” because bone loss occurs without symptoms, thus developing a challenging and very dangerous disease to prevent and treat (National Osteoporosis Foundation, 2003).

The World Health Organization (WHO) defines osteoporosis by the measurement of bone mineral density more than 2.5 standard deviations below the normal bone mass of women who are less than 35 years of age (Averbeck, Kopher, & Gertner, 2004); Uphold & Graham, 2003). Bone mineral density (BMD) measurement is vital to the diagnosis of osteoporosis and the assessment of fracture risk. Bone mineral density accounts for about 70-80% of bone strength and is the single best predictor of osteoporosis-related fractures (Averbeck, Kopher & Gertner, 2004).

Osteoporosis is classified as primary or secondary depending on the pathogenesis of the disease. Uphold and Graham (2003) states primary osteoporosis occurs in both genders and results from normal aging and decreased gonadal functioning; usually after menopause in women and later in life in men (pg. 729). They also state that secondary osteoporosis is classified in adults that obtain osteoporosis as a result of medications and other diseases (Uphold & Graham, 2003). Secondary osteoporosis can occur from endocrine/metabolic disorders, nutritional conditions, medications, or other diseases. Table 1 consists of recognized secondary causes of osteoporosis from several different sources.

Figure 1

Table 1: Causes of Secondary Osteoporosis

Endocrine/Metabolic	Medications	Nutrition	Other
Glucorticoid excess	Glucocorticoids (most common)	Gastrectomy	Chronic Renal Failure
Hyperthyroidism	Anticonvulsants	Eating disorders	Liver Disease
Hyperparathyroidism	Ethanol	Malabsorption syndromes	COPD
Hypogonadism	Tobacco	Nutritional disorders	CHF
Hyperprolactinism	Barbituates	Pernicious anemia	Hematologic Disorders (Hemophilia, etc.)
Diabetes Mellitus	Heparin (long term use)	Sprue	Rheumatoid arthritis
Acromegaly	Thyroid hormones	Inadequate diet	Malignancy
Adrenal atrophy	Gonadotropin-releasing hormone agonists (GnRh)	Weight loss	Organ Transplant
Addison's disease	Loop Diuretics		Epidermolysis Bullosa
Congential porphyria	Aluminum		Osteogenesis Imperfecta
Cushings Syndrome	Cytotoxic drugs		Amyloidosis
Endometriosis	Immunosuppressants		Ankylosing spondylitis
Female athlete triad	Lithium		AIDS/HIV
Gaucher's disease	Tamoxifen (premenopausal)		Idiopathic scoliosis
Hemochromatosis	Progesterone (parenteral, long-acting)		Inflammatory bowel disease
Hypophosphatasia	Supraphysiologic thyroxine doses		Lymphoma
Thyrotoxicosis	Total parenteral nutrition		Leukemia
			Mastocytosis
			Multiple Myeloma
			MS
			Sarcoidosis
			Stroke
			Spinal cord transsection
			Thalassemia

Compiled from Uphold, C. R. & Graham, M. V. (2003). Clinical Guidelines in Adult Health (3rd edition). Gainesville, FL: Barmarrae Books, Inc., and National Osteoporosis Foundation (2003). Physicians Guide to

Prevention and Treatment of Osteoporosis. Washington, D. C. Retrieved from http://www.nof.org/_vti_bin/shtml.dll/physguide/index.htm

RISK FACTORS

Assessing a patient's risk factors for developing and diagnosing osteoporosis is imperative. Un-modifiable risk factors to assess include gender, age, body size (height and weight), ethnicity, and family history in determining risk for osteoporosis. A personal history of fracture as an adult, a history of fracture in a first-degree relative, and menopause and menstrual history are also specific un-modifiable risk factors to evaluate.

Ultimately, women are more affected by osteoporosis due to menopause. The hormone estrogen is produced by the ovaries and protects against bone loss. Declining estrogen levels at menopause result in increased bone turnover and a loss of bone mass, with subsequent increases in bone fragility and the risk for bone fracture (Harris, et al., 1999). Men are also affected, however, their risk factors are primarily related to aging, genetic factors, and secondary risk factors rather than decreased gonadal function (Campion & Maricic, 2003).

Bones naturally break down and become less dense during the aging process. Bone mass peaks in the 20's, then breakdown or removal of bone (resorption) outpaces formation and density of the bone declines (U.S. Food and Drug Administration, 2004). Low body weight or low body mass index (BMI) are also at greater risk for fracture due to the probable decreased density of the bone. U.S. Preventive Services Task Force (2002) states that lower body weight (<70 kg) is the single best predictor of low bone mineral density.

According to NOF (2005) Caucasian and Asian women are more likely to develop osteoporosis. African American and Hispanic women are also at risk but much lower than Caucasian and Asian women. Zizic (2004) states that the prevalence of osteoporosis in black women is one half that in white and Hispanic women. Cauley, Lui, Ensrud, Zmuda, Stone, Hochberg, & Cummings (2005) examined and compared the bone mineral density and risk for nonspinal fractures in black and white women. They were able to conclude that black women have a lower fracture risk than white women at every level of bone mass density measured.

Potentially modifiable risk factors for osteoporosis include cigarette smoking, low body weight, estrogen deficiency (caused by early menopause (age <45) or bilateral ovariectomy, prolonged premenopausal amenorrhea (>1 year)) low calcium intake (lifelong), alcohol (>2 drinks/day), impaired eyesight despite adequate correction, recurrent falls, inadequate physical activity, poor health/frailty have been recognized (National Osteoporosis Foundation, 2003). Assessing the level of activity, smoking history, alcohol use, medication history, dietary intake of calcium, vitamin D and caffeine are important to detect potentially modifiable risk factors for osteoporosis. Detection of secondary risk factors (See Table 1) should be recognized and treated to reduce the threat of osteoporosis and its complications.

CLINICAL PRESENTATION/PHYSICAL FINDINGS

Osteoporosis is known as the “silent disease” because bones weaken over years and neither a doctor or the patient is aware of it until, unfortunately, a fracture occurs. Patients are often asymptomatic and usually do not have any abnormal physical findings. Considerable bone loss (over 35%) can occur before complaints are present or abnormalities are detected on x-rays (Uphold & Graham, 2003). Although, patients with low bone density usually do not have any abnormal physical findings and a history and physical examination are not sufficient enough for diagnosing osteoporosis it does not mean they are invaluable.

Obtaining a medical history can provide clues to bone density concerns. Within the medical history investigating the presence of chronic conditions, lifestyle, behaviors, and medications and other risk factors are important for the prevention and treatment of osteoporosis. These areas can be good predictors of risk for osteoporosis and osteoporosis itself.

After obtaining a thorough history including past medical history, medications, allergies, diet, activity, alcohol intake, smoking prevalence, and any current physical manifestations concerning to the patient, a complete physical should be performed. Special attention should be drawn to height, weight, posture, mobility, neurological and muskuloskeletal systems, and thyroid during the physical assessment. Although these assessment methods should not be used solely for diagnosis their importance should not be overlooked.

DIAGNOSIS

Our skeleton and bone is essential for many daily processes that are needed to live a healthy life. Bone protects our

internal organs as well as handling minerals, blood clotting, nerve transmission, muscle contraction, and other functions we do on a daily basis (National Osteoporosis Foundation, 2005; U.S. Food and Drug Administration, 2004). Therefore, protecting and treating loss of bone mass is key to preventing osteoporosis and fractures from occurring. A history and physical examination are not sufficient enough for diagnosing osteoporosis. In order to prevent and treat osteoporosis, screening measures must be used to distinguish the degree of bone loss and risk for fracture.

A dual energy X-ray absorptiometry (DEXA) is considered the gold standard for diagnosis of osteoporosis and detection of risk fracture (Siris, et al., 2001). The World Health Organization (WHO) has developed guidelines for quantifying bone mineral density and grading the severity of osteoporosis using T and Z scores (Averbeck, Kopher & Gertner, 2004). It has not been determined whether different scoring methods should be initiated for those of different genders. The T-score compares an individuals bone mineral density with that of a young (25-45 year old) normal reference population in standard deviations above or below the mean (Averbeck, Kopher & Gertner, 2004). The Z-score compares the individuals bone mineral density with other persons of the same age and sex (Averbeck, Kopher & Gertner, 2004). The WHO T-score criteria for bone mineral density are summarized in Table 2.

Figure 2

Table 2: WHO T-score criteria for Bone Mineral Density.

T Score	Diagnosis
0 to > -1	Normal bone density
-1 to > -2.5	Osteopenia
<-2.5	Osteoporosis
<-2.5 with fracture	Severe or established osteoporosis

Retrieved from Averbeck, B., Kopher, R. & Gertner, E. (2004). Screening for Osteoporosis. Health Partners Institute for Medical Education, 5(1), 1-9.

Currently, dual-energy x-ray absorptiometry (DEXA or DXA) is the most widely used technology in the United States (Leib, 2005). Other methods for measuring bone mass do exist, although when compared with the DEXA they show a tendency to underestimate or overestimate the frequency of osteoporosis (Leib, 2005). DEXA results can confirm a diagnosis, predict future fracture risk, and help monitor response to therapy or changes due to a medical condition (Uphold & Graham, 2003; Leib, 2005; National Osteoporosis Foundation, 2005). DEXA of the hip (femoral head) is the best predictor of hip fracture, but DEXA of the hand, wrist, forearm, and heel can also detect risk (Uphold & Graham, 2003; U.S. Preventive Services Task Force, 2002).

The association between screening for osteoporosis and the incidence of hip fracture was examined by Kern, et al. (2005). The researchers wanted to determine if population-based screening for osteoporosis in older adults is associated with fewer hip fractures than usual medical care. DEXA scans were performed on participants in California and Pennsylvania and usual medical care was provided for participants in Maryland and North Carolina. All participants were 65 years or older who were in a longitudinal study called Cardiovascular Health Study (CHS) over 6 years. Participants were offered a DEXA scan and others were not and received usual medical care. Over all they found that screening for osteoporosis with hip DEXA was associated with 36% fewer hip fractures over 6 years than usual medical care. However, a review of this study suggests that the results are not sufficient, stating that the results are not convincing to influence guidelines or clinical practice (Cummings, 2005). Cummings goes on to states that rates of hip fracture vary geographically and that some confounding factors that influence fracture risk were not included in their analyses.

Although DEXA is currently the most powerful tool for measurement of bone mass density other measurement tools are being used and developed. Other diagnostic tests that can be done to identify osteoporosis include peripheral and single energy X-ray absorptiometry (pDXA and SXA), quantitative ultrasound (QUS), quantitative computed tomography (QCT), radiographic absorptiometry (RA), and single and dual photon absorptiometry (SPA and DPA) (National Osteoporosis Foundation, 2003). Biochemical markers can also be used to detect osteoporosis. The bone markers can be detected in the blood or urine and determine bone turnover. These tests are sometimes able to assess the risk of fracture, predict bone loss, or assess response to antiresorptive therapy (National Osteoporosis Foundation, 2003). Although, these tests are available BMD testing is to not be replaced for the detection of osteoporosis.

RECOMMENDATIONS FOR SCREENING

Recommendations for bone mineral density screening for men and women vary amongst organizations. The United States Preventive Services Task Force (USPSTF) recommend that women 65 years of age and older be screened routinely for osteoporosis (2002). USPSTF also

recommends that routine screening begin at 60 years of age for women at increased risk for osteoporotic fractures (grade B recommendation). USPSTF makes no recommendation for or against routine osteoporosis screening in postmenopausal women who are younger than 60 years of age or in women 60-64 years of age who are not at increased risk for osteoporotic fractures (grade C recommendation).

The National Osteoporosis Foundation (NOF) recommends routine screening for women aged 65 years and older regardless of fractures (2003). They also state that younger postmenopausal women who have had a fracture or who have one or more risk factors for osteoporosis (other than being white and female) are to be screened. Postmenopausal women who present with fractures should also have BMD testing to confirm diagnosis and determine disease severity per the National Osteoporosis Foundation.

A study conducted by Gill & Hoffman (2003) looked at the prevention and treatment of osteoporosis and testing for osteoporosis for postmenopausal women in primary care offices. The study was conducted in two family practice offices and three obstetrics/gynecology offices in Delaware. They had found that only 34% of the women studied had been tested for osteoporosis. Recommendations for screening postmenopausal women were found to be inconsistently followed by all primary care offices in this study.

Screening recommendations for BMD in men are less standardized and addressed. According to Uphold and Graham (2003) BMD screening should be considered in men with nontraumatic fractures or who have risk factors for fractures and for men 75 years or older. A study on osteoporosis and men state that screening might be considered routinely in men aged 70 or older, because this age is when fracture rates increase most rapidly (Campion & Maricic, 2003).

A lack of consensus still exists amongst organizations on screening patients for osteoporosis. Cranney, et al. (2002) found this to be concerning. They systematically reviewed the numerous agencies that had developed clinical practice guidelines for assessment of osteoporosis. They found that the quality of current osteoporosis guidelines is low and that many of the guidelines neglected issues of cost, educational material, and health care resources. Many guidelines exist for the screening, prevention, and treatment of osteoporosis yet a lack of collaborated effort on sharing resources and development of appropriate guidelines has been completed. It is suggested from this study that future osteoporosis guidelines need more collaboration amongst organizations along with greater methodological rigor and patient involvement into the development process.

However, since Cranney, et al. (2002) reviewed available guidelines major organizations such as the National Osteoporosis Foundation and the National Institutes of Health have collaborated with many medical associations to provide clearer guidelines for screening, prevention, and treatment of osteoporosis. Many health care providers have looked at these organizations as the leaders in providing clear-cut evidence based guidelines. Although, a lack of consensus on osteoporosis guidelines exists additional investigation needs to be done to provide the best practice guidelines for future screening, prevention and treatment of osteoporosis. Currently research on drug therapy treatments for osteoporosis is the areas of focus rather than the efficacy of the guidelines and prevention measures currently being used.

If osteoporosis has been diagnosed blood tests are recommended to establish baseline conditions and to exclude any secondary causes that may be present. Physical examination of the patient with diagnosed osteoporosis is also important to include in order to exclude any present secondary factors that could be contributing to the diagnosis. These tests are in listed in Table 3 retrieved from several sources.

Figure 3

Table 3: Common blood tests in Osteoporosis patients.

Blood tests	Additional tests
CBC	Thryotropin
ESR	25-hydroxyvitamin D concentration
Calcium (serum and urine)	Free cortisol (urine)
TSH	Acid-base studies
Parathyroid	Tryptase
Glucose	N-methylhistamine (urine)
Estrogen	Protein electrophoresis (serum and urine)
Alkaline Phosphatase (serum and 24-hr urine)	Free or Total testosterone (men)
Creatinine	LH (men)
Albumin	Bone marrow aspiration and biopsy
PSA (men)	

Compiled from Uphold, C. R. & Graham, M. V. (2003). Clinical Guidelines in Adult Health (3rd edition). Gainesville, FL: Barmarrae Books, Inc., and National Osteoporosis Foundation (2003). Physicians Guide to Prevention and Treatment of Osteoporosis. Washington, D. C. Retrieved from http://www.nof.org/_vti_bin/shtml.dll/physguide/index.htm

PREVENTION/TREATMENT

The prevention and treatment modalities for those with osteoporosis are critical for prevention of fractures and further complications from having osteoporosis. Lifestyle approaches are very important for treatment of osteoporosis. Educating and prescribing the osteoporotic patient with lifestyle and behavioral changes are essential for the most effective treatment with drug therapy for osteoporosis.

First, sufficient calcium intake is extremely important to the treatment of osteoporosis and moreover to prevent osteoporosis. Although calcium intake is not alone adequate for preventing and treating osteoporosis it should not be discontinued. According to the 2004 Surgeon General's Report on Bone Health and Osteoporosis individuals older than 50 need 1,200 mg of calcium each day. Table 4 contains an outline of calcium recommendations by the 2004 Surgeon General's Report for each age group (Department of health and human services, 2004). Randomized clinical trials have demonstrated that adequate calcium intake from diet or supplements increase spinal BMD and reduce vertebral and nonvertebral fractures (NIH, 2001). It has been recommended that higher doses of calcium (1,200-1,500 mg/day) are needed for women who are not on estrogen and are postmenopausal. Supplementation of calcium may be needed if sufficient calcium intake is not provided by dietary intake.

Figure 4

Table 4: 2004 Surgeon Generals Report- Recommended Calcium intake.

Age	Calcium recommended each day (mg)
0 to 6 months	210
7 to 12 months	270
1 to 3 years	500
4 to 8 years	800
9 to 18 years	1,300
19 to 50 years	1,000
Over 50 years	1,200

U.S. Department of Health and Human Services. The 2004 Surgeon General's Report on Bone Health and Osteoporosis: What it means to you, U.S. Department of Health and Human Services, Office of the Surgeon General, 2004. Retrieved on February 1, 2006 from http://www.surgeongeneral.gov/library/bonehealth/docs/osteo/osteo04.pdf

Evaluating and counseling on dietary intake of calcium is essential for bone health and reducing the risk for osteoporosis. The role of calcium and dietary protein and their relation to each other in bone health was studied by Weikert, Walter, Hoffmann, Kroke, Bergmann, and Boeing (2005). Protein and calcium are major components of bone tissue and play an active role in bone metabolism. Their relation to each other and their mechanisms in bone health have not been thoroughly studied. Weikert, et al. researched European female participants using a food frequency questionnaire along with a measurement of their bone structure using broadband ultrasound attenuation (BUA). Other studies had identified that increase in consumption of animal protein intake increases the fracture risk. However, Weikert, et al. found that the effects of animal protein can be compensated for by a high calcium intake. They found that dietary calcium intake plays a prominent role in bone health and that proper balanced nutrition, especially balanced protein and calcium intake is important for the prevention of fractures.

Along with calcium intake, vitamin D is essential for the absorption of calcium. It is recommended that individuals should intake 800 to 1,000 units of vitamin D daily (National Osteoporosis Foundation, 2003). The therapeutic effects of most of the clinical trials of various drugs have been achieved in the presence of calcium and vitamin D supplementation among control and intervention groups (NIH, 2001).

Along with calcium and vitamin D intake regular weight bearing exercise is important along with resistance or muscle strengthening. Weight-bearing exercise and muscle strengthening can improve balance, gait, and strength reducing risk for falls. Weight-bearing exercises include impact exercises such as walking or running. Doing weight lifting or resistance exercises is also beneficial to build up muscle and allows for accrual of bone mineral content in the skeleton.

A fracture has often accompanied a decrease in an individual's quality of life and independence. Following a fracture it has been reported that a significant functional decline exists. It has been reported that between 22% and 75% of hip fracture patients do not recover to their pre-fracture ambulatory or functional status between 6 and 12 months after the fracture event (Binder, et. al., 2004). Many individuals who have had a fracture are sent home once independence in ambulation is achieved. Binder, Brown, Sinacore, Steger-May, Yarasheski, & Schechtman (2004)

performed a randomized controlled trial looking at the effects of extended outpatient rehabilitation after hip fracture. The objective of this study was to determine whether extended outpatient rehab that included progressive resistance training improves physical function and reduces disability when compared to low-intensity home exercise among the physically frail elderly patients with hip fracture. They concluded that extended outpatient rehabilitation, including whole-body progressive resistance training, is effective at improving physical functioning and mobility among these patients. When compared with the low-intensity home exercise program, the intensive rehabilitation program led to reduced self-reported disability and an improved quality of life. Further attention needs to be drawn to the rehabilitation phase of recovery after a fracture to decrease the chances of loss of independence and mobility as well as morbidity following a fracture.

Fall prevention is also very crucial for those diagnosed with osteoporosis due to their risk for fracture. Prevention of falls can be evaluated by the health care provider by assessing vision, hearing, and neurological systems as well as review the individual medications that may affect the balance and stability of the individual. Safety at home is important to consider when attempting to prevent falls from occurring. Floors should be clear from clutter, installation of grab bars in the tub or shower, non-skid rubber mats in the kitchen and bathroom, and railing on stairways are just a few household safety measures that can be done to reduce the risk for falls.

The prevention of hip fractures using external hip protectors has also been used in the elderly population to prevent hip fracture from falls. Researchers van Schoor, Smit, Twisk, Bouter, & Lips (2003) performed a randomized controlled trial on elderly persons (70 years or older) who have known low bone density and are at high risk for falls using external hip protectors. These participants lived in multiple homes for the elderly where increasing dependence and care was needed. With the assistance of nursing staff the participants wore external hip protectors and kept a record of falls or fractures on a calendar. Compliance was found to be moderate to good in this study. It was recorded that 18 hip fractures in 727 falls occurred for participants wearing the hip protectors, while 20 hip fractures occurred in 1075 falls in the control group. This study found that hip protectors were not effective in reducing the incidence or prevention of hip fractures. They concluded that these results may have been related to the compliance of wearing the hip protectors (noncompliance occurred at night) and the inability to wash the hip protectors, due to incontinence, etc. so periods of time the participant was not wearing one. Research on how hip protectors affect activity level may be helpful to determine lack of compliance in wearing them. The modification of the hip protectors for comfort may also help compliance with wearing hip protectors for the prevention of hip fractures.

Avoiding tobacco use and alcohol intake are also important preventative measures that should be encouraged and counseled with those diagnosed with osteoporosis. Risk factor reduction is just as imperative as intake of vitamins and minerals. It is important to continually encourage lifestyle and behavioral changes for the prevention of osteoporosis and fracture.

PHARMACOLOGIC TREATMENT

Pharmacologic treatment is not initiated in everyone who exhibits low bone density. A consensus on which patients are appropriate for osteoporosis treatment with medication does not exist. However, according to NOF (2003) individuals with BMD T-scores below –2 by hip DEXA with no risk factors, T-score below –1.5 by hip DEXA with one or more risk factors, and those who have had a prior vertebral or hip fracture should be started on pharmacologic therapy. Those who will be initiated on drug treatment for osteoporosis should also be attempting to reduce risk factors and be taking recommended calcium and vitamin D supplementation and started on a weight-bearing exercise program to have optimal effects.

The U.S. Food and Drug Administration (2004) approved drugs for osteoporosis include bisphosphonates (alendronate, alendronate plus D, ibandronate, risedronate or risedronate with calcium), calcitonin (Miacalcin, Calcimar, or Fortical), estrogens (estrogen therapy and/or hormone therapy), parathyroid hormone (PTH (1-34), teriparatide) and selective estrogen receptor modulators or SERMS (raloxifene) (National Osteoporosis Foundation, 2003; National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005). Head-to-head comparisons of the efficacy of these agents in preventing fractures have not been conducted (Zizic, 2002). Combination therapy has been used, however, the actual affect it has on fracture rates has not been thoroughly studied.

Bisphosphonates suppress the osteoclast-mediated bone resorption (Zizic, 2004). They are approved for both prevention and treatment of postmenopausal osteoporosis and are the most frequent used medication for osteoporosis.

According to the National Institutes of Health Osteoporosis and related Bone Disease-National Resource Center (2005) alendronate and risedronate is also approved to treat bone loss that results from glucocorticoid medications and also osteoporosis in men. The bisphophonates have been evaluated more than any other class of drug used in the management of osteoporosis (Garton, 2001). According to Bone, et al. (2004) continuous treatment with alendronate 10 mg daily for 10 years was associated with sustained therapeutic effects on bone density and remodeling, with no indication that the antifracture efficacy of the drug was diminished. They were also able to conclude that the discontinuation of the treatment resulted in a gradual reduction of effect.

Alendronate has also been studied for the treatment of osteoporosis in men. Orwall, et al. (2000) studied 241 men, ages 31-87 who had identified osteoporosis at the femoral neck and lumbar spine. These men were given alendronate 10 mg daily or a placebo daily for up to two years. They had found that those who had been given alendronate for treatment of osteoporosis had an increased bone mineral density of the spine, hip and total body after two years. These results are very similar to those of postmenopausal women with osteoporosis after two years on alendronate therapy.

Absorption of oral bisphosphonates is very poor and can be virtually abolished by concomitant ingestion of food, certain drugs, and minerals (calcium, aluminum, or iron) (Garton, 2001). Consequently, bisphosphonates should be taken on an empty stomach with a full glass of water right away in the morning when they are fasting. The bisphosphonates can cause gastro-esophageal erosion and in sever cases ulceration. Therefore, remaining in an upright position for 30 minutes as well as not eating or drinking for this period of time after taking the medication is important for the prevention of gastrointestinal problems. Bisphosphonates should be avoided in those with active esophagitis or peptic ulceration (Garton, 2001).

Calcitonin is a naturally occurring hormone that is involved in the calcium regulation and bone metabolism. Calcitonin slows bone loss, increases spinal density, relieves pain associated with bone fractures, as well as reduces the risk of spinal and hip fractures (National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005). This medication is recommended for use in women with osteoporosis who are at least five years past menopause and cannot take other agents (Zizic, 2004). This medication can be prescribed and given as an injection or nasal spray. Side effects of taking this medication has been related to the route it is given. Those who have had it injected have had reported side effects such as flushing of the face and hands, frequent urination, nausea, and skin rash (National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005). Rhinorrhea has been reported with those who have taken the nasal calcitonin as well.

Estrogen/Hormone therapy has been shown to reduce bone loss, increase bone density in both the spine and hip and reduce the risk of hip and spine fractures in postmenopausal women (National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005). According to Zizic (2004) hormone therapy is approved for the prevention but not the treatment of postmenopausal osteoporosis. It is commonly prescribed in the form of a pill or skin patch. Side effects include vaginal bleeding, breast tenderness, mood disturbances, blood clots in the veins, and gallbladder disease. Prescribing estrogen or hormone therapy for osteoporosis in postmenopausal women is controversial. The Women's Health Initiative (WHI) study showed that use of estrogen/hormone therapy is associated with a modest increase in the risk of breast cancer, stroke, and heart attack (National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005). These risks may outweigh the benefits for use of hormone therapy for fracture prevention. Any type of estrogen/hormone therapy used has been recommended for a short period of time and in women who are at significant risk of osteoporosis.

Teriparatide (Forteo) is an injectable form of human parathyroid hormone. It is approved for postmenopausal women and men with severe osteoporosis who are at high risk for fracture (National Institutes of Health Osteoporosis and related Bone Diseases-National Resource Center, 2005; Zizic, 2004). This medication stimulates new bone formation in both the spine and hip as well as reducing the risk of vertebral and non-vertebral fractures in postmenopausal women. It is only approved for use for up to 24 months because long-term effects are not known. Side effects have included nausea, dizziness, and leg cramps.

Raloxifene (Evista) is approved for the prevention and treatment of postmenopausal osteoporosis. This medication is in a class by itself called the Selective Estrogen Receptor Modulators (SERMs). This medication prevents bone loss in the spine, hip, and total body and reduces the risk of vertebral fractures. Some side effects have been reported,

however, they are not common. Side effects include hot flashes and blood clots in the veins.

Combination therapy with hormone replacement and alendronate for the prevention of bone loss in elderly women has been examined. Greenspan, Resnick and Parker (2003) wanted to compare monotherapy treatment of osteoporosis with that of a combination therapy of hormone therapy and bisphosphonate (alendronate) and determine if it was efficacious and safe. This study contained 573 women aged 65 years or older and was completed over a 5-year period. Those women who received combination treatment were found to have an improvement of their BMD at the spine and total hip than did the women with monotherapy. This study found that combination therapy using alendronate and hormone replacement is safe and efficacious as well as monotherapy of alendronate to be superior to hormone replacement, with combination therapy being superior to either alone. Still there is a lack of evidence of the use of combination therapy is effective. Few studies of other combination therapies for osteoporosis have been completed. More research is needed to fully determine whether combination therapy for osteoporosis is effective and safe long-term.

Monitoring patients who are on osteoporosis drug therapy has not been studied thoroughly. It has been suggested that follow up DEXA scans should be done every 1-2 years following initiation of treatment. However, guidelines do not exist on appropriate re-evaluation of osteoporosis and the effects of the medication.

PATIENT AND FAMILY COUNSELING/EDUCATION

Despite the fact that osteoporosis is a major public health threat many individuals believe that it is a normal process of aging and that everyone gets osteoporosis (Jachna & Forbes-Thompson, 2005). Jachna and Forbes-Thompson (2005) studied the perceptions and barriers of osteoporosis and osteoporosis treatment on assisted living residents. Residents in this study reported that they did not recognize osteoporosis as a serious silent disease and they perceived osteoporosis to be an irreversible normal aging process. They concluded that educating and counseling about osteoporosis may help improve osteoporosis knowledge and their perceptions of the disease and its process.

The prevalence and preventative nature of osteoporosis should be focused on during counseling of osteoporosis. Prevention measures, risk factors, screening, and lifestyle modifications for optimal bone health need to be focused on when providing specific osteoporosis prevention. Bone health is important to address at every preventative care visit throughout the life span.

Educating patients and family about osteoporosis medications (effect, side effects, proper use, etc.), modifiable and un-modifiable risk factors of osteoporosis, and the diagnostic procedures is vital. Identifying the patient's perspective and thoughts about screening and treatment for osteoporosis is also important. A qualitative study conducted by Richardson, Hassell, Hay and Thomas (2002), looked at women's understanding and experience of DEXA scanning for osteoporosis. They found that many of the women lacked the understanding of osteoporosis. They also found that many of the women linked their ideas and expectations about the scan to their knowledge of other procedures. Radiation and perceived health risks were identified as the main reason for not having a scan done. This research study provides great insight to the importance of educating the patient about the procedure and its uses. Richardson, et al. also point out the importance of providing information that the results will help in the decisions about treatment and possible lifestyle changes.

Appropriate counseling and education measures to be provided to patients and their families are outlined below through common questions that may be encountered in the clinical setting.

WHAT IS OSTEOPOROSIS?

Osteoporosis is a disease that makes the bones more fragile and prone to break. Osteoporosis can affect both men and women, although women are affected more due to menopause (decrease in estrogen). Osteoporosis is a silent disease and often does not have any physical signs and symptoms to diagnose it.

WILL EVERYONE GET OSTEOPOROSIS?

Osteoporosis is a preventable and treatable disease. Although our bones weaken as we get older in age there are many actions that we can take to prevent osteoporosis. Individuals more prone to having osteoporosis include those of a Caucasian race, postmenopausal women, individuals weighting under 127 pounds, those with a family history of osteoporosis, and a history of amenorrhea.

WHAT ARE THE RISKS OF HAVING OSTEOPOROSIS?

The major complication of having osteoporosis is the

presence of a fracture. When a fracture occurs many individuals may have mobility problems affecting their independence, acute or chronic pain, anxiety, and depression. Individuals can even die because of the complications of osteoporosis.

WHAT CAN I DO TO PREVENT OSTEOPOROSIS OR FRACTURE FROM OCCURRING?

Risk factors such as age, gender, ethnicity, and past or family history cannot be changed. It is important to recognize these un-modifiable risk factors and talk to your primary care provider for appropriate screening measures for osteoporosis. Risk factors for osteoporosis that are modifiable is your level of activity, intake of calcium and vitamin D, smoking, and alcohol intake. Doing weight-bearing exercise with resistance training (weight lifting) taking calcium and vitamin D supplements and proper balanced meals, smoking cessation, and alcohol intake in moderation are preventative measures that can be taken to reduce the risk of osteoporosis and fracture. Doing household modifications to reduce the risk for falls is important for those who may be more at risk. Modifications can include railings on the stairway, non-skid mats in the bathroom and kitchen, and grab bars in the bathroom shower and toilet.

HOW DO I FIND OUT IF I HAVE OSTEOPOROSIS?

Osteoporosis is diagnosed by a DEXA scan. This test takes x-rays of the bones in your body and measures your bone density. Your primary care provider will assess when you are appropriate for testing. Usually if you are age 65 or older you should have a DEXA scan. Although if you have other risk factors for osteoporosis present you may be appropriate for a bone density test because you are more prone to breaks. Talk with your health care provider if you feel that you should be tested.

IS THERE A TREATMENT FOR OSTEOPOROSIS IF I AM DIAGNOSED?

There are several medications that you can take for osteoporosis. However, doing lifestyle changes to reduce your risk for fracture is important and a part of the medical treatment of osteoporosis. Continuing to exercise, taking calcium and vitamin D supplements, smoking cessation, alcohol in moderation, and fall prevention measures should be used in conjunction with drug therapy.

The most common drug therapy used for osteoporosis is Bisphosphonates (alendronate and risedronate). Theses medications used for the prevention and treatment of osteoporosis and reduce bone loss, increase bone density, and reduce the risk for fractures. They should be taken right away in the morning on an empty stomach with a full glass of water. You must stay upright for 30 minutes after taking the medication with no food or drink intake within that time as well. Side effects of this medication include gastrointestinal difficulties. This medication is avoided if you have a history or present esophagitis peptic ulcers.

Other medications include calcitonin, estrogen/hormone therapy, raloxifene (SERMs), and Parathyroid hormone. Not all individuals need drug therapy for osteoporosis. Consulting with your health care provider is essential for drug therapy initiation and monitoring.

CONCLUSION

A lack of consensus exists on appropriate guidelines for osteoporosis screening, prevention and treatment amongst health care professionals and organizations. This provides a great dilemma for all of us. Osteoporosis is a preventable disease, yet studies have shown that health care providers are deficient in the prevention and treatment of individuals at risk for osteoporosis. Too often a fracture provides the diagnosis of osteoporosis. Many individuals are then left with disability and a decrease in quality of life. Attention to bone health throughout the lifespan of patients is key to public awareness of the threat of this disease. Clearly more evidence-based research is required to prevent the projected incidence of osteoporosis and osteoporosis fracture from occurring. Health care professionals are at the front line of this disease and their responsibility to acknowledge the seriousness of this condition currently and in the future is vital. Osteoporosis is a multi-faceted problem that needs adequate approach from all health care providers.

RECOMMENDED WEBSITES

National Osteoporosis Foundation http://www.nof.org National Institute of Health http://www.osteo.org/ US Surgeon General 2004 Report http://www.surgeongeneral.gov/library/bonehelath/docs/osteo/osteo04.pdf CDC-Bone Health Campaign: http://www.cdc.gov/nccdphp/dnpa/bonehealth/ Internal Medicine-Doctors for Adults : http://www.doctorsforadults.com/topics/dfa_oste.htm American College of Rheumatology: http://www.rheumatology.org/public/factsheets/osteopor_new.asp?aod=pat Endocrine disorders: http://www.edocrineweb.com/osteoporosis Harvard Center

for Prevention-Your disease risk (questionnaire):

http://www.yourdiseaserisk.harvard.edu

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