Family Medicine Corner

Osteoporosis in Family Practice

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Introduction

Osteoporosis, the disease of the bone that afflicted King David of Israel 3000 years ago[1], is no longer considered a consequence of aging. It is increasingly being recognized as a major health care concern, and accounts for more than 1.5 million fractures annually in the United States.[2]

Bone loss that increases the risk of fractures can affect males and females of any age and ethnicty.[3] This risk is recognized in patients with advanced Chronic Obstructive Pulmonary Disease[4] and chronic liver diseases[5], certain adolescents and patients who take specific medications may also be at risk.[6]

Osteoporosis is usually asymptomatic until a fracture occurs, family physicians must identify the appropriate timing and methods for screening those with subclinical osteoporosis and know when to implement preventive strategies.

Definition

The WHO definition of osteoporosis is based on measurement of bone mineral density (BMD) defined as a BMD of >2.5 standard deviations (SD) below the mean for young adults, while osteopenia is defined as a BMD between 1 and 2.5 SDs below the means for young adults (ie, the T score).[7,8] The risk of fracture increasing to threefold for each SD decrease in BMD.[9]

Etiology

Primary osteoporosis is classified into two major types, postmenopausal and senile. Postmenopausal osteoporosis manifests approximately 10 years after menopause. Loss of the trabecular bone is more, leading to vertebral crush fracture and Colles' fracture of the distal forearm. There may also be acute or chronic back pain, kyphosis and loss of height.[10] Senile osteoporosis presents after the age of 70 years in both sexes, where there is a loss of both trabecular and cortical bone, and increased risk of hip and vertebral fractures.[10]

Secondary osteoporosis results from chronic conditions that leads to accelerated bone loss.(Table 1)[11], and is a complication of long-term glucocorticoid therapy[12] and chronic liver diseases.[13]

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Table 1. Secondary Forms of Osteoporosis.[11]

Endocrine or metabolic causes	Medications
Acromegaly	Cyclosporine
Anorexia nervosa	Excess thyroid hormone
Athletic amenorrhea	Glucocorticoids
Diabetes mellitus type 1	GnRH agonists
Hemochromatosis	Methotrexate
Hyperadrenocorticism	Phenobarbital
Hyperparathyroidism	Phenothiazines
Hyperprolactinemia	Phenytoin Sodium
Thyrotoxicosis	Heparin, prolonged treatment
Collagen/genetic disorders	**Nutritional**
Ehlers-Danlos syndrome	Alcoholism
Glycogen storage diseases	Calcium deficiency
Homocystinuria	Chronic liver disease
Hypophosphatasia	Gastric operations
Marfan syndrome	Malabsorption syndromes
Osteogenesis imperfecta	Vitamin D deficiency

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Bone mass reaches the peak in the third decade and then declines in both sexes, in women accelerating after the menopause[13,14], low bone mass (osteopenia) predisposes to osteoporosis, which decreases the total amount of bone tissue, but the composition remains normal.[10]

Maintaining bone mass involves the activation of precursor osteoclasts, which erode individual remodeling sites (called basic multicellular units)[15], stimulating the activation of osteoblast precursors, which refill each unit. In normal, young adult bone, phases in this activation-resorption-formation process are tightly coupled. Uncoupling of the resorptive and formation phases leads to bone loss. Numerous hormones, growth factors, including cytokines influence remodeling in the bone microenvironment.[15] Contributing factors to osteoporosis include smoking[16] and others (Table 2).

Prevalence

Osteoporosis afflicts 75 million persons in the United States, Europe and Japan and results in more than 1.5 million fractures annually in the United States. Two million US men suffer from osteoporosis and eighteen million Americans have low bone mass .[17,18]

Osteoporotic fractures are more common in whites and Asians than in blacks and Hispanics, and are more common in women than in men.[18]

The National Health Survey of Pakistan conducted in 1998 does not include the prevalence of osteoporosis.[19] However a study conducted at Hayatabad Medical Complex,Peshawar in 1997-1998 on thousand postmenopausal women for simple calculated osteoporosis risk estimation, found that 75.3% were predisposed to osteoporosis and the risk increased with age (97% in women of 75-84 years of age compared to 55% in women of 45-54 years of age).[20]

Evaluation

Careful history and physical examination remain the cornerstone, and a high level of suspicion in those more susceptible to bone loss[21], (Table 2), this should include general inspection of body fat, an assessment of secondary sex characteristics, and sexual maturity rating.[21]

Plain radiographs are not sensitive enough to diagnose osteoporosis. Dual-energy X-ray absorptiometry (DEXA) is the most precise and diagnostic measure of choice.[22] Less expensive systems include DEXA scans of the distal forearm and the middle phalanx of the nondominant hand and quantitative ultrasound measurements on bone. In the World Health Organization classification system, the patient's Bone Mineral Density is assigned a T-score (peak bone mass). A patient with a T-score of -1.0 or higher is considered normal; a T-score between -1.0 and -2.5 indicates osteopenia; and one lower than -2.5 indicates osteoporosis. z-score, is the number of standard deviations away from the mean BMD measure for persons of the patient's age and ethnicity.[23]

Screening

Early recognition and preventive therapy are essential in avoiding fractures in an asymptomatic individual.[4] Dual-energy x-ray absorptiometry (DEXA), remains the gold standard for diagnosis.[23,24] Peripheral DEXA or heel ultrasonography is used for large-scale screening.

The Osteoporosis Risk Assessment Instrument and the Simple Calculated Osteoporosis Risk Estimation[20] identify women at greatest risk for fragility fracture. Men who have conditions associated with low bone mass and those who are older than 75 should be considered for osteoporosis screening.

Approach to management

Family physicians frequently encounter patients with osteoporosis, a condition that is often asymptomatic until a fracture occurs. Women of all ages should be encouraged to maintain a daily calcium intake of 1,500 mg.[25] Evidence shows there are significant reductions in nonvertebral fracture rates as a result of physiologic replacement of vitamin D in the elderly.[25] Statin use is reported as primary prevention in reducing the risk.[26] Assessment of osteoporosis risk is important when following a patient for a chronic disease that is known to cause secondary osteoporosis. Regular physical exercise can reduce the risk of osteoporosis and delay the physiologic decrease of BMD[27,28] and has shown to improve the quality of life in patients with COPD and those receiving high-dose inhaled corticosteroids.[29,30]

Pharmacological management of osteoporosis includes the use of calcium and Vitamin D, Hormone Replacement Therapy (HRT), Calcitonin, Bisphosphonates and Selective Estrogen Receptor Modulator. Calcium and vitamin D alone are shown to be insufficient to prevent the bone loss, in addition urinary calcium excretion should be monitored for hypercalciuria.[31] Hormone Replacement Therapy (HRT) is advocated to prevent osteoporosis in postmenopausal women.[32] Randomized trial data supporting HRT impact on fracture is limited. A large randomized controlled trial failed to demonstrate a beneficial effect of HRT on secondary prevention of cardiovascular risk and that HRT may have associated risks of breast and endometrial cancer and increase the risk of thromboembolism.[33] Testosterone in men with low testosterone levels have shown to improve muscle mass and strength.[34, 35]

Selective estrogen receptor modulator such as raloxifene have estrogen like effects on the bone without the risk of breast or endometrial cancer.[36] Raloxifene inhibits trabecular and vertebral bone loss by blocking the activity of cytokines, which stimulate bone resorption. A meta-analysis of raloxifene on bone density demonstrated that it

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Calcitonin has shown to prevent trabecular bone loss during the first few years of menopause. Meta-Analysis of Calcitonin on bone density demonstrates increase in bone density and likelihood of reducing the risk of vertebral fracture; its effect on non-vertebral fracture remains uncertain.[38]

Bisphosphonates as oral alendronate, cyclical etidronate, clodronate, risedronate and intravenous zoledronic acid have shown to increase BMD and a trend towards decreasing vertebral fractures[39] and preventing corticosteroid induced osteoporosis in primary biliary cirrhosis[5] and chronic lung disease.[40] A Meta-Analysis study on Alendronate clearly demonstrate that it increases bone density in both early postmenopausal women and those with established osteoporosis while reducing the rate of vertebral fractures over 2-3 years of treatment.[41] Risedronate substantially reduces the risk of both vertebral and non-vertebral fractures and increase bone density in both early postmenopausal and those with established osteoporosis.[42]

Annual infusion of zoledronic acid has shown to be an effective treatment for osteoporosis.[43]

Conclusion

Preventive strategies to decrease the morbidity from osteoporosis should begin with heightened awareness among the family physicians and an early screening of high risk patients. Patients should be encouraged for physical therapy, and to include 400 to 800 IU vitamin D and 1000 to 1500 elemental calcium in their daily diet.[44] Those receiving high dose inhaled or oral glucocorticoids, and chronic liver disease should have BMD testing, those with normal BMD and no other risk factors for osteoporosis should be monitored for bone loss with a repeat BMD in 6 to 12 months.[45]

Treatment is recommended in postmenopausal women with T scores of < -2 or < -1.5 with one risk factor, and men with T scores of < -2.5.[46-48]

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