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Research Paper

Osteoporosis and Osteopenia Among of A Group of Population of Guwahati City, Assam

Anthropology

KEYWORDS : Bone mineral density(BMD), fractures, bone loss

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ABSTRACT

Osteoporosis is characterized by low bone mass with micro architectural deterioration of bone tissue leading to enhanced bone fragility. This increases the susceptibility to fracture. In developed and developing countries, the incidence of osteoporosis is increasing at a rate faster than what would be predicted by the aging of the population alone (Kohrt et. al., 2004). Epidemiological evidence suggests that genetic factors are the most important cause of osteoporosis (Sigurdsson et. al., 2008) and can account for as much as 80% of the variability in bone density in the population (Dequeker et. al., 1987), but a variety of environmental factors have been linked to bone density including: negative energy balance, low calcium intake, lack of fruit and vegetable consumption, low body mass index, strength, and hormone levels (Duncan et. al., 2002; Fisher et. al., 2004; Helge et. al., 2002; Stewart et. al., 2000; and Turner et. al., 2003) - all of which may influence the ability to develop or maintain bone density. The present study was carried out during 8th November to 23rd November 2010. In this study a total of 50 individuals, aged 40-79years, residing in different areas of Guwahati city, Assam was investigated. This study reveals that both male and female patients were suffering from osteopenia as well as osteoporosis but female patients sufferers are more than that of male patients.

Introduction

Osteoporosis ("porous bones") is a progressive bone disease that is characterized by a decrease in bone mass and density and that leads to an increased risk of fracture (Brian *et.al*). In osteoporosis, the bone mineral density (BMD) is reduced, bone micro-architecture deteriorates, and the amount and variety of proteins in bone are altered. A BMD test is the only way to accurately determine if you have osteoporosis before a bone breaks. An estimated 8 million women and 2 million men in the United States have bone density levels in the diagnostic range of osteoporosis (Melton). Osteoporosis is defined by the World Health Organization (WHO) as a bone mineral density of 2.5 standard deviations or more below the mean peak bone mass (average of young, healthy adults) as measured by dual-energy X-ray absorptiometry; the term "established osteoporosis" includes the presence of a fragility fracture (WHO, 1994). There are two scores used by experts to interpret the bone density test results, the T-score and the Z-score.

T score: This indicates how dense your bone is compared to what would be expected in a young healthy adult of your sex. Your T score is the number of units — standard deviations (SD) — that your bone density is above or below the young healthy average. The more negative the T score, the thinner your bones and the more likely they are to break easily. A T score above -1 is considered normal, between -1 and -2.5 is considered osteopenia (low bone mass) and -2.5 or a more negative score is considered osteoporosis.

Z score: This compares your bone density to that of other people your age, sex and race. Your Z score should be between -2 and +2. A Z score more negative than -2 (e.g. -2.5) could indicate that you are losing bone for a reason unrelated to age, it may indicate a need for further medical tests. The form of osteoporosis most common in women after menopause is referred to as primary type 1 or postmenopausal osteoporosis. Primary type 2 osteoporosis or senile osteoporosis occurs after age 75 and is seen in both females and males at a ratio of 2:1. Secondary osteoporosis may arise at any age and affect men and women equally.

Fractures are mainly of four types:

Hip fractures

Hip fractures are responsible for the most serious consequences of osteoporosis. In the United States, more than 250,000 hip fractures annually are attributable to osteoporosis (Yasuda *et.al*). A 50-year-old white woman is estimated to have a 17.5% lifetime risk of fracture of the proximal femur. The incidence of hip fractures increases each decade from the sixth through the ninth for both women and men for all populations. The highest incidence is found among men and women ages 80 or older (Arlot *et.al*).

Vertebral fractures

Between 35 and 50% of all women over 50 had at least one vertebral fracture. In the United States, 700,000 vertebral fractures occur annually, but only about a third is recognized. In a series of 9704 women aged 68.8 on average studied for 15 years, 324 had already suffered a vertebral fracture at entry into the study and 18.2% developed a vertebral fracture, but that risk rose to 41.4% in women who had a previous vertebral fracture (Steiniche *et.al*).

Wrist fractures

In the United States, 250,000 wrist fractures annually are attributable to osteoporosis (Yasuda *et.al*). Wrist fractures are the third most common type of osteoporotic fractures. The lifetime risk of sustaining a Colles' fracture is about 16% for white women. By the time women reach age 70, about 20% have had at least one wrist fracture (Arlot *et.al*).

Rib fractures

Fragility fractures of the ribs are common in men as young as age 35. These are often overlooked as signs of osteoporosis, as these men are often physically active and suffer the fracture in the course of physical activity. An example would be as a result of falling while water skiing or jet skiing. However, a quick test of the individual's testosterone level following the diagnosis of the fracture will readily reveal whether that individual might be at risk.

Prevention

Osteoporosis can be prevent by the following methods:

Lifestyle: Lifestyle prevention of osteoporosis is in many aspects the inverse of the potentially modifiable risk factors. As tobacco smoking and high alcohol intake have been linked with osteoporosis, smoking cessation and moderation of alcohol intake are commonly recommended as ways to help prevent it (Lindberg *et.al*; 1984).

Weight-bearing endurance exercise and/or exercises to strengthen muscles improve bone strength in those with osteoporosis (Meyerson *et.al*; 1992). Aerobics, weight bearing, and resistance exercises all maintain or increase BMD in postmenopausal women (Fruth *et.al*; 1995). Fall prevention can help prevent osteoporosis complications. There is some evidence for hip protectors specifically among those who are in care homes (Marcus *et.al*; 1985).

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Nutrition: As of 2013 there is insufficient evidence to determine if supplementation with calcium and vitamin D results in greater harm or benefit in men and premenopausal women (Myburgh *et.al*; 1993). Low dose supplementation (less than 1 gm of calcium and 400 IU of vitamin D) is not recommended in postmenopausal women as there does not appear to be a difference in fracture risk.[58] It is unknown what effect higher doses have (Myburgh *et.al*; 1993). There however may be some benefit for the frail elderly living in care homes (Davies *et.al*; 1990). While vitamin D supplementation alone does not prevent fractures, combined with calcium it might (Bachrach *et. al.,* 1990). There however is an increased risk of myocardial infarctions (Klibanski *et. al.,* 1980 and Bachrach *et. al.*, 1990) and kidney stones (Myburgh *et.al*; 1993). Vitamin K supplementation may reduce the risk of fractures in post menopausal women; (Koppelman et. al., 1984) however there is no evidence for men (Drinkwater *et. al.,* 1986).

Pathogenesis and determinants of bone loss

The net loss of bone that occurs with aging is a universal phenomenon, but rates of loss are modified by genetic, endocrine, and environmental factors. The process of bone remodeling helps explain how bone loss occurs with menopause and aging. Nutritional factors, particularly calcium and vitamin D, and physical activity levels may aggravate or limit bone loss. A myriad of diseases and medications also affect rates of bone loss and risk of osteoporosis and related fractures.

Bone remodeling: The adult skeleton continually undergoes a process of bone remodeling by which old bone is removed and replaced by new bone (Cole, 2000).

Menopause: In the young adult, the amount of bone replaced is equivalent to the amount removed, and the frequency with which the bone remodeling units are activated is constant. There may be a small but significant loss of bone even among premenopausal women (Arlot *et. al.,* 1997), possibly associated with slowly declining ovarian activity or decreasing physical activity. During the menopausal transition, with dramatic reductions in circulating estrogen levels, there is an increase in the rate of bone remodeling and an imbalance between formation and resorption within each remodeling unit (Steiniche *et. al.,* 1989; and Parfitt *et. al.,* 1997). This imbalance appears to be due to aggressive osteoclastic resorption, with an increase in resorption cavity depth and an inability of osteoblasts to keep pace.

Aging: With aging in both sexes, the balance between resorption and formation is offset such that more bone is removed than replaced (Parfitt *et. al.,* 1997; and Heaney, 1996). Although bone loss in women slows after the early postmenopausal years, loss continues throughout the latter decades of life and rates of loss increase again in very old age (Melton *et. al.,* 1986; Hui *et. al.,* 1999; and Looker *et. al.,* 1998). Age-related bone loss is dependent in part on endogenous estrogen production in both women (Ettinger *et. al*., 1998; and Greendale *et. al.,* 1997) and in men, who have an age-associated decline in their ability to aromatize androgens to estrogens (Greendale *et. al.,* 1997; Khosla *et. al.,* 2003; and Slemenda *et. al.,* 1997). Age-related bone loss is also in part due to reduced renal calcium conservation efficiency,(Heaney, 2003) a decreased vitamin D supply, absorption or skin production, and decreased renal activation of vitamin D,(Heaney, 2003; Webb *et. al.,* 1990; and Salamone *et. al.,* 1993) all contributing to increases in PTH with age (Prince *et. al.,* 1995; and Eastell *et. al.*, 1991).

Calcium intake: Calcium is an essential nutrient, involved in most metabolic processes, and when it is combined with phosphate as crystalline hydroxyapatite, it provides mechanical rigidity to bones and teeth. Calcium balance is determined by intake, absorption, insensible losses (sweat and respiratory), and urinary excretion - all of which vary greatly among individuals. Average fractional calcium absorption is about 30% of intake, and low fractional calcium absorption may be associated with an increase in fracture risk (Ensrud *et. al.,* 2000). Dietary factors, such as phytates in wheat, fiber, oxalates, iron, and high doses of caffeine, can reduce calcium absorption (Heany, 2000). Excessive sodium intake increases calcium excretion, because sodium competes with calcium for reabsorption in the renal tubule. For every 2300 mg (1 teaspoon of salt), urinary calcium excretion increases by 23 mg (Nordin *et. al.,* 1993). Both sodium and protein intakes may have significant effects on calcium balance when calcium intake is low (Heany, 2000; and Nordin, 1997). Ensuring adequate calcium intake, including calcium supplementation if necessary, retards bone loss in postmenopausal women (Nordin, 1997; Storm *et. al.,* 1998; and Baeksgaard *et. al.,* 1998). Calcium intake, both alone and in combination with vitamin D, has been found to reduce the risk of vertebral, hip, and other nonspine fractures (Reid *et. al.,* 1995; Chevalley *et. al.,* 1994; Dawson-Hughes *et. al.,* 1997; and Chapuy *et. al.,* 1992).

Vitamin D: Vitamin D is synthesized in the skin after exposure to sunlight and is obtained from diet. Vitamin D deficiency or insufficiency (less than 20 ng/mL) is believed to play a strong role in osteoporosis, both as a result of increasing rates of bone loss and possibly contributing to muscle weakness, impaired balance, and thereby increased risk of falling (Heaney, 1996; and Heaney, 2003).

Other dietary factors: In the elderly, low-protein intakes can have deleterious effects. Hip fracture patients are frequently malnourished with inadequate protein intakes, and supplementation with protein has been found to reduce complications following hip fracture (Munger *et. al.,* 1999; Johnell *et. al.,* 1995; Huang *et. al.,* 1996; and Bonjour *et. al.,* 1997).

Alcoholism: The abuse of alcohol clearly increases the risk of osteoporosis by inhibiting osteoblast function and reducing bone formation (Gonzales-Calvin et. al., 1993), producing an increase in the risk of hip fractures (Felson et. al., 1998).

Smoking: Smoking exerts a toxic effect on osteoblast function, leads to an earlier menopause, and results in reduced production and accelerated degradation of estrogen (Grainge *et. al.,* 1998). Therefore, smokers usually have low bone mass (Grainge *et. al.,* 1998; Krall *et. al.,* 1991; and Bainbridge *et. al.,* 2004). Smokers also generally weigh less than nonsmokers and are generally less physically active, further increasing the risk of fracture.

Physical activity: Immobilization and diseases, such as spinal cord injury, can produce dramatic rates of bone loss. In contrast, weight-bearing and resistance exercise are associated with increased bone mass or slowed rate of bone loss (Wallace *et. al.,* 2000; and Gregg *et. al.,* 2000. Lifetime physical activity is associated with reduced risk of fracture (Gregg et. al., 2000; Gregg et. al., 1998; Jaglal et. al., 1993; and Jaglal et. al., 1995).

Chronic diseases: Many chronic diseases are associated with more rapid bone loss and an increased risk of osteoporosis. These include endocrine diseases, such as hyperthyroidism, hyperparathyroidism, rheumatologic conditions (such as rheumatoid arthritis and systemic lupus), chronic lung disease, gastrointestinal conditions associated with malabsorption (celiac disease or inflammatory bowel disease), eating disorders, neurologic diseases (Parkinson's disease, multiple sclerosis, and spinal cord injury), hematologic/oncologic diseases (most notably multiple myeloma), and organ transplantation. Bone loss associated with these diseases occurs for various reasons, including medication use, nutritional factors, the diminished ability to perform physical activity, and factors that directly affect bone remodeling.

Materials and methods

The present study is an outcome of the project, *"Osteoporosis and Osteopenia among of a group of population of Guwahati city, Assam"* carried out during 8th November to 23rd November 2010. In this study a total of 50 individuals, aged 40-79years, residing in different areas of Guwahati city, Assam was investigated. Data on the secondary data were available in birth register of Pratiksha Hospital, Guwahati.

Results and discussion

Table-I shows the weight and height of the both male and female patients. The highest number of weight of patients is seen from 70-79kg which have 8patients bearing 16% and the lowest weight seen from 60-69kg which has only 1patient. While among female patients, the highest number of weight of patients is seen from 70-79kg which have 16patients bearing 32% and the lowest weight seen from 80-89kg which has only 1patient. And, range of height is same from 170-174cm and 175-179cm having 4patients and bearing 8% followed by 165-169cm which has 2patient and 160-164cm and 180-189cm which bear only 1patient each. Accordingly, the highest number of female patients according to their ranges from 160-164cm which have 15number of patients and bearing 30% and the lowest height is seen from 180-189cm which has only 1patient.

Table-II shows that the bone mineral density (BMD) among the male and female according to their age. It can be seen that most of the male patients suffering from osteopenia and osteoporosis at the age group of 50-59years (4.00%). But in all total maximum number of males suffering from osteopenia. But in case of female patients, most of the females patients suffering from osteoporosis at the age group of 50-59years (16.00%). Similarly, in all total maximum number of females suffering from osteoporosis (36.00%).

Conclusion

The pathogenesis of osteoporosis is complex and multifactorial. Alternations in bone density almost certainly represent the final common pathway by which pathologic factors affect risk of future osteoporotic fracture. The interplay of various physiologic processes which result in peak mass and maintenance of adult bone mass are key to understanding the pathogenesis of this disease. Changes in hormonal status and in particular estradiol, clearly are important factors in both formation and resorption of bone in men and women. Perturbations in growth hormone activity; musculoskeletal function, dietary intake of calcium and vitamin D and genetic determinants are also important pathogenic factors. Defining the role of genetic factors and their interaction with many of the environmental and hormonal determinates that have been established as potential etiologic agents responsible for bone mass will certainly be the most difficult challenges for the clinical researches into the next century. On the other hand, the strength of data from bench and clinical studies over the last decades, now allows practitioners to confidently diagnose and treat osteoporosis.

BMD measurement and risk factors can be used to predict osteoporotic fractures. The important osteoporotic fractures are hip fractures, vertebral fracture and forearm fracture. The incidence of hip fracture increases exponentially with age in both sexes, but remain higher in women than men throughout life. Most vertebral fractures are clinically silent, but are associated with much morbidity. Hip fractures are associated with extremely high direct cost in developed countries and the cost is on the rise in developing countries.

Table –I: Distribution according to the weight and height of the male and female individuals suffering from osteoporosis

		Male patients		Female patients	
		No.	%	No.	%
Weight (in kg)	50-59	0	0	6	12%
	60-69	1	2%	15	30%
	70-79	8	16%	16	32%
	80-89	3	6%	1	2%
Total		12	24%	38	76%
		Male patients		Female patients	
		No.	%	No.	%
Height (in cm)	160-164	1	2%	15	30%
	165-169	2	4%	9	18%
	170-174	4	8%	10	20%
	175-179	4	8%	3	6%
	180-189	1	2%	1	2%
Total		12	24%	38	76%

Table-II: Bone mineral density (BMD) among the male and female patients according to their age

Age group (in years)	Male patients						Female patients					
	Normal		Osteopenia		Osteoporosis		Normal		Osteopenia		Osteoporosis	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
40-49	-	-	1	2.00%	1	2.00%	2	4.00%	6	12.00%	3	6.00%
50-59	1	2.00%	2	4.00%	2	4.00%	3	6.00%	5	10.00%	8	16.00%
60-69	1	2.00%	1	2.00%	-	-	1	2.00%	2	4.00%	5	10.00%
70-79	1	2.00%	1	2.00%	1	2.00%	-	-	1	2.00%	2	4.00%
Total	3	6.00%	5	10.00%	4	8.00%	6	12.00%	14	28.00%	18	36.00%

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