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EVALUATION OF INFLUENCE OF LIFESTYLE FACTORS AND VITAMIN D STATUS ON BONE MINERAL DENSITY

D. R. Galfat[1], Sadab Mahmud[2]

[1] - *Professor and Head, Department of Orthopaedics, Pacific Institute of Medical Sciences, Udaipur, Rajasthan (India)*

[2] - *Ex- Associate professor, Department of Radiodiagnosis, Naraina Medical College, Kanpur*

Abstract:

This study was conducted to know the prevalence of vitamin D deficiency and to explore the effects of various lifestyle factors on the bone mineral density and also to know the number of subjects warranting treatment. Ambulatory men in southern Rajasthan aged above 55 years were included in the study. The physical activity, risk factors in the FRAX tool, BMD, vitamin D were assessed. The number of people requiring treatment were calculated which included subjects with osteoporosis and osteopenia with 10 years probability of major osteoporotic fractures >20% and hip fractures >3%. A total of 176 men with mean age of 58 years were studied. The prevalence of osteoporosis and osteopenia at any one site was 20% (35/176) and 56% (99/176) respectively. Vitamin D deficiency (<20 ng/dl) was seen in 50%. On multiple logistic regression, BMI (OR 0.3, p value = 0.04) and physical activity (OR 0.4, p value <0.001) had protective effect on BMD. 34% warranted treatment. A significant large proportion of south Rajasthani men had osteoporosis and vitamin D deficiency. Further international studies are needed to look at reduction in end points like fractures in these subjects.

Keywords: Osteoporosis, osteopenia, vitamin D, bone mineral density, lifestyle factors

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Corresponding Author

Dr. Sadab Mahmud,
Ex- Associate professor, Department of Radiodiagnosis, Naraina Medical College, Kanpur

Introduction

Osteoporosis in men is well known major public health problem.1 With increase in life expectancy, advancing age related illnesses are increasing.2 Studies have shown that men with osteoporotic fractures have a much higher mortality and morbidity when compared to women.3 Several life related factors like physical activity, calcium intake, smoking, alcohol consumption and vitamin D status influence bone mineral density. In this study, we have tried to find out the prevalence of osteoporosis and vitamin D status in healthy Rajasthani men and to study the influence of various lifestyle factors on bone mineral density. Subjects warranting treatment in these healthy subjects was also estimated.

Material And Methods

It is a cross-sectional study conducted during duration July 2018 to July 2019 in the Department of Orthopaedics, Pacific Institute of Medical Sciences, Udaipur. This study was approved by the Institutional Ethics Committee. 176 men ranging between age group of 55 to 70 years were included in the study.

Exclusion criteria: History of chronic liver disease, hyperthyroidism, hyperparathyroidism, hypogonadism and malabsorption and those on medication

such as anticonvulsants, antiretroviral and antitubercular therapy which affect the bone health were excluded from the study.

The risk factors which were mentioned in the FRAX tool assessment included age, sex, height, weight, past history of fragility fracture, parental history of hip fracture, history of smoking or alcohol intake and any other history suggestive of secondary osteoporosis[4], physical activity was evaluated using a previously published questionnaire standardised for the Indian population and was categorised with a scoring system of <1.4 as sedentary, 1.5 – 1.6 as moderately active and >1.75 as strenuous active.[5]

A overnight fasting blood sample was obtained for estimation of serum calcium (8.6 – 10.2 mg/dl), phosphate (2.5 – 5 mg/dl), albumin (3.5 – 5 g/dl), alkaline phosphatise (40 – 125 IU/L), creatinine (0.6 – 1.2 mg/dl), 25-hydroxy vitamin D (30 – 75 ng/ml) hereafter refer to as vitamin D. These reference ranges are as provided by the local laboratory. Vitamin D deficiency was defined as vitamin D level of <20 ng/ml and a level <10 ng/ml was considered to indicate severe vitamin D deficiency.[6]

BMD was assessed by the BMD machine and DXA. The WHO classification was useful for characterisation of BMD.[7] Osteoporosis was defined as T score < -2.5, osteopenia or low bone mass -1 to -2.5 and normal as > -1. In subjects who were found to have osteopenia, data regarding risk factors were evaluated. The number os people requiring treatment was calculated which included the total number of subjects with osteoporosis at any site and osteopenia with 10 year probability of major osteoporotic fracture >20 and hip fracture >3 as calculated by FRAX India. The prevalence of male osteoporosis above the age of 55 years in the published literature was about 6%.[8]

Results

176 men above the age of 55 years were included in the study. Demographic parameters, biochemistry including vitamin D status and BMD of the study subjects are summarised in Table 1.

Table 1: Demographic details, biochemistry and BMD

Variables	Mean	Range
Age (yr)	58	50 - 73
Height (cm)	161	139 - 182
Weight (kg)	64	36 - 82
BMI (kg/m2)	22.8	17.3 - 38.3
Calcium (mg/dl)	8.79	8.2 - 9.98
Phosphorus (mg/dl)	3.7	2.4 - 5.1
Creatinine (mg/dl)	0.94	0.6 - 1.4
Vitamin D (ng/ml)	20.6	7.3 - 49.8
Alkaline phosphatase (U/L)	70.2	44 - 158
Testosterone (ng/dl)	589	310 - 885
PTH (pg/ml)	42.1	18.3 - 148.2
BMD spine (gm/cm2)	0.921	0.908 - 0.969
BMD neck (gm/cm2)	0.759	0.721 - 0.775

The mean age (SD) of the study subjects was 58 (11.8) years and the mean (SD) BMI was 22.8 (4.5) kg/m2. 40% (n = 70) of men were above the age of 60 years. In relation to physical activity, 77% were sedentary, with the rest being moderately to strenuously active. A significantly greater proportion of subjects aged above 60 years had osteoporosis at the femoral neck when compared to men below that age. Osteoporosis at the spine was also more commonly seen among subjects above the age of 50 years. However it was not statistically significant. Overall prevalence of osteoporosis and osteopenia at any one site was 20% (35/176) and 56% (99/176) respectively. Vitamin D deficiency (<20 ng/ml) was seen in 50% (n = 88) and 6% had severe vitamin D deficiency (<10n g/ml). 8% of subjects had biochemical hypogonadism (<300 ng/dl).

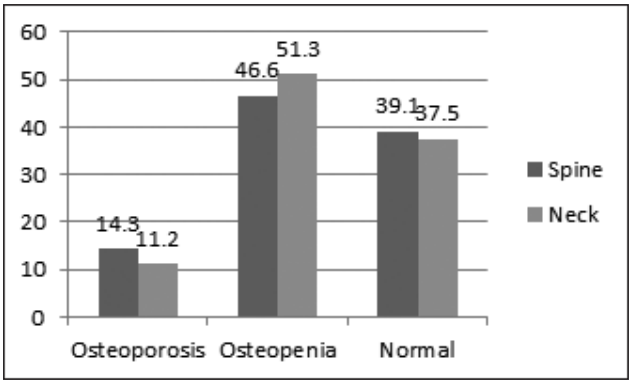

Fig. 1: BMD categorisation

Multiple logistic regression analysis was performed to assess the impact of various factors that affect bone mineral density at femoral neck in healthy male subjects. These included body mass index, hypogonadism, age, vitamin D

deficiency, smoking, alcohol use and physical activity. We found that body mass index (OR 0.3, CI 01 – 0.40, p value = 0.04) and physical activity (OR 0.4, CI 0.12 – 0.9, p value <0.001) had a statistically protective effect on bone mineral density.

Therefore out of the total 176 subjects, 60 subjects (50 osteoporosis and 10 osteopenia) warranted treatment. However, there is no significant co-relation between vitamin D at any site.

Discussion

In our study, about 1/5 of subjects had osteoporosis at any one site. Vitamin D deficiency was found in half of the study population. Men who were physically active were having higher body mass index, had a better BMD at femoral neck. Treatment was warranted in 1 out of 3 healthy subjects who had either osteoporosis or osteopenia.

In previously published literature, 9% prevalence of osteoporosis has been reported in northern India.[9] However in another study at Rochester[10], 19% prevalence of osteoporosis had been reported, which has similarity to our study.

The economic burden of osteoporotic fracture is not only borne by the patient, but by the country as a whole.[11,12] There is a limited availability of DXA scanners in the country excluding major cities. So the healthcare system at the primary level can use FRAX scoring.

A high prevalence of vitamin D deficiency reported in various cohorts of Indian population.[13] Vitamin D deficiency can either decrease mineralization or cause secondary hyperparathyroidism or both resulting in a low bone mineral density.[14] A positive impact of physical activity on BMD or bone mass in our study is probably due to skeletal response to mechanical strength by stimulating bone formation.[15]

Conclusion

A significantly larger proportion of otherwise normal healthy men in our community had osteoporosis and vitamin D deficiency. Men with a higher BMI were physically active and had a better BMD. Further international studies are needed to look at reduction in end points like fractures in these subjects.

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