Original Article

DOI: 10.7860/JCDR/2013/5022.2761

Orthopaedics Section

Vitamin D Deficiency Among Postmenopausal Women with Osteoporosis

RAMESH NARULA, MUJTABA TAUSEEF, IRAQI AFTAB AHMAD, AGARWAL KIRAN, AGARWAL ASHOK, ARYA ANJANA

ABSTRACT

Background: Hypovitaminosis D is widely prevalent in India and is a formidable issue especially in postmenopausal women. The study intends to estimate the prevalence of vitamin D deficiency among postmenopausal women with osteoporosis.

Methods: The study was performed at a referral teaching institute in north India between 2007 and 2009. One hundred and ninety postmenopausal osteoporotic women were enrolled and the clinical information was collected along with the assessment of biochemical parameters.

Results & Conclusion: Serum vitamin D was found to be deficient in two third of patients. A significant correlation was observed between body mass index and bone mineral density at lumbar spine. Prevention and early detection of hypovitaminosis D is the key to reduce the incidence of osteoporosis among postmenopausal women.

Key Words: Hypovitaminosis D, Fragility fracture, Postmenopausal

INTRODUCTION

With increasing life expectancy there is exponential increase in osteoporotic fractures. It is projected that the number of hip fractures worldwide will exceed six million by 2050 [1]. A person with osteoporotic vertebral fracture has 4 to 5 time's higher risk of another vertebral fracture and 2 to 3 times higher risk of hip fracture [2, 3]. The study intends to estimate the prevalence of vitamin D deficiency among postmenopausal women with osteoporosis.

MATERIALS AND METHODS

The present study was conducted at the Department of Orthopedics and the Division of Endocrinology, Department of Medicine, J. N. Medical College Hospital, AMU, Aligarh, India between 2007 and 2009. The study was approved by the board of studies and the protocol was approved by the local institutional review committee. Informed consent was obtained from all subjects involved in the study.

Inclusion criteria: Women who were post-menopausal for at least one year and had osteopenia or osteoporosis as evidenced by bone mineral density <2.5 SD or fragility fractures.

Exclusion Criteria: Deranged renal function, abnormal thyroid function, significant liver disease, history of cancer, regular therapy with a phosphate binding antacid, estrogen replacement therapy within the previous 9 -12 months, therapy with any other drug that affect skeleton like steroids, anti convulsants and anticoagulants.

All patients were given elemental calcium 1000 mg/day and vitamin D 1000 IU/day. In this study a detailed history and physical examination was carried out for every subject who entered the study as per predesigned performa covering all known risk factors for primary osteoporosis and all known conditions leading to secondary osteoporosis. Blood samples were collected for hematological parameters and ESR, estimation of serum calcium, serum phosphorus, serum 25-hydroxy vitamin D, serum TSH, serum alkaline phosphatase, serum PTH, lipid profile, creatinine and fasting sugar. Bone Mineral Density was estimated by GE Lunar Densitometer.at three sites, lumbar spine (L1- L2 level), right hip and left hip. Serum 25-hydroxy vitamin D was estimated using chemiluminescent immunoassay and other biochemical parameters using spectrophotometric analysis. Statistical analysis was performed using SPSS version 11.5 statistical package for windows (SPSS, Chicago, IL). Continuous variables were expressed as mean +/- S.D or range, and qualitative data was expressed in percentages. The association between continuous variables was tested by linear correlation using Pearson's coefficient. All tests were two tailed, and a P-value of </= 0.05 was considered significant.

RESULTS

One hundred ninety women (146 with osteoporosis attending the endocrine OPD and 44 patients attending orthopedics OPD with fragility fracture) aged 42 to 80 years were studied. Out of one hundred and forty-six post-menopausal females registered from endocrine OPD, one hundred and fourteen had achieved natural menopause and thirty-two had their uterus and ovaries removed surgically due to some pathology before attaining menopause and were included due to decreased bone density on DEXA scan. Among the forty-four Orthopedic patients, all except one had attained natural menopause. This patient underwent hysterosalpingectomy due to fibroid uterus before attaining menopause.

The baseline clinical and biological characteristics of all the one hundred and ninety patients included in the study are given in [Table/Fig-1]. History of back pain was present in eighty three patients and fourteen patients had history of fragility fractures. Sixteen patients had history of cigarette smoking and 2 were chronic alcoholics but no significant liver disease. One hundred and twenty-three patients were living a sedentary life style with no or little weight

Variable	N=(190)	
	Mean	S. D.
Age (yrs)	56	8.9
BMI (kg/m2)	26.4	4.7
Lumbar spine BMD (gm/cm2	0.849	0.134
Lumbar spine t-score	-2.7	1.2
Hip BMD (gm/cm2)	0.851	0.198
Hip t-score	-1.4	1
S.Calcium(ionised) (mmol/L)	1.07	0.07
S.25-OH vitamin D (ng/ml)	19.7	8.2
S. TSH (mIU/L)	2.45	3.25
Creatinine (mg%)	0.97	0.25
Total cholesterol (mg %)	178	41
Triglycerides (mg%	130	60
HDL (mg %)	47	13
LDL (mg %)	117	45
VLDL (mg %)	32	21
Milk Intake (ml/day)	164	128
Sun exposure (mts./day)	33	26

[Table/Fig-1]: Baseline Characteristics of patients (n= 190)

bearing and muscle building exercise. Serum phosphorus was in normal range in all patients. Serum PTH was done randomly in forty-one subjects and was found to be within normal range. Serum alkaline phosphatase done in all patients and levels were raised in 56 patients. Total serum protein level was low in twelve patients. Serum creatinine was slightly raised in six patients who were either due to dehydration or old age and improved on proper hydration and repeat testing. In our study we also found a significant correlation between BMI and BMD at lumbar spine (p= 0.004).

We saw that majority of our subjects had only occasional or no intake of milk and daily sun exposure of less than 30 minutes. But on doing serum 25-hydroxy vitamin D levels in all patients, revealed vitamin D deficiency (serum 25-OH vit. D = 5 - 20 ng/ml) in 118 out of 190 subjects (62%) and severe vitamin D deficiency (serum 25-OH vit. D = < 5 ng/ml) in four subjects (2.1%). Moreover what was more important was that this vitamin D insufficiency was strongly related to the baseline lumbar spine BMD (p< 0.05). In all the patients with osteoporotic fractures treated operatively or non operatively fracture united at six months of treatment and majority of the patients were walking full weight bearing by that time except for five patients with osteoporotic collapse of multiple vertebrae who were able to manage to sit with brace application and had marked improvement in pain but were not able to walk.

DISCUSSION

Our observations reveal very high incidence of hypovitaminosis D among postmenopausal women with osteoporosis. A strong correlation was also observed between BMI & BMD. However, a caution is advised to generalize our observation to the population at large. Our results are restricted to a specific set of patients presenting to a tertiary care referral centre which may not be representative of general community. An adequately powered community based study analyzing bone turn over markers in addition is expected to provide better answer to the research question. Despite the inverse correlation between markers of bone turnover and bone mass, their measurement has wide variations and cannot substitute for measurement of BMD in the diagnosis of osteoporosis. Because elevated values of both resorption and formation markers do indicate increased risk for bone loss and fractures, their measurement may become useful in determining the need for therapy, particularly if they can be made more accurate and less expensive.

Genetic factors exert a strong and perhaps predominant influence on peak bone mass, but physiological, environmental, and modifiable lifestyle factors can also play a significant role. Among these are adequate nutrition and body weight, exposure to sex hormones at puberty, and physical activity [4]. Vitamin D is required for optimal calcium absorption and thus is also important for bone health. Indeed, in patients who are vitamin D deficient, no more than 15 % of dietary calcium is absorbed, whereas in persons who are not vitamin D deficient 30 – 80% of dietary calcium is absorbed [5]. Decreased calcium leads to increased parathyroid secretion which causes increased bone resorption [6]. There is strong evidence that physical activity early in life contributes to higher peak bone mass [7]. Some evidence indicates that resistance and high impact exercise are likely the most beneficial. In our study we found that vitamin D deficiency (< 20 ng/ml) is quite common in India (64.3%) as has been reported by various other studies Arya et al (2004) reported an incidence of 66.3% using 15 ng/ml as the cut-off point [3]. Using 20 ng/ml they reported an incidence of more than 78 %. We also found a significant correlation between low 25-hydroxy vitamin D levels in serum and baseline BMD at lumbar spine. Many studies have earlier reported similar results [8,9,10,11].

All the fractures treated by various methods including devices with improved anchorage techniques like locked plating and locking screws united indicating that osteoporotic fractures usually unite if immobilized properly by proper anchorage implants although it may take a little longer for them to unite. In the present study, we were not able to assess the effect on reduction in fracture risk due to short period of study (15 months). One of our patients suffered a refracture after undergoing surgery for fracture of femoral neck. But this refracture occurred within 3 weeks of starting treatment and role of treatment cannot be assessed. Fourteen of our patients had history of fragility fractures in the past and these patients were not taking any treatment for osteoporosis in the past.

Our study indicates very high incidence of hypovitaminosis D among postmenopausal women with osteoporosis. Prevention of vitamin D deficiency by appropriate diet, activity, sunlight exposure appears to be the primary prerequisite in reducing the incidence of osteoporotic fractures among postmenopausal women.

REFERENCES

[1] Marie PJ, Hott M, Modrowski D et al. An uncoupling agent containing strontium prevents bone loss by depressing bone resorption and maintaining bone formation in estrogen deficient rats. *J bone Miner Res*.1993; 8:607-15.
[2] Meunier PJ, Strosman DO, Delmas PD et al, Strontium ranelate: a dose dependent effects in established postmenopausal osteoporosis- a 2 year randomised placebo controlled trial. *J Clin Endocrinol Metab*.2002; 87:2060-66.
[3] Arya V; Bhambri R, Godbole M, Mithal A:Vitamin D status and its relationship with bone mineral density in healthy Asian Indians; *Osteoporosis International*. Volume 15, Number 1, January 2004 , pp. 56-61(6).
[4] Factors involved in building and maintaining skeletal health throughout life.health-care.net: July 2005.
[5] Hollick MF, Vitamin D: the underappreciated D-lightful hormone that is important for skeletal and cellular health. *Curr Opin Endocr Diab*. 2002; 9; 87-98.

[6] Holick MF, Krane SM, Potts JT Jr. Calcium, phosphorus, and bone metabolism: calcium regulating hormones. In: Fauci, AS, Braunwald E, Isselbacher KJ, et al, eds. Harrison's principles of Internal Medicine. New York: *McGraw-Hill*. 1998:2214-27.
[7] Marcus R. The mechanism of exercise effects on bone. In: Bilezikian JP, Raisz LG, Rodan GA, eds. Principles of Bone Biology. *San Diego: Academic press.* 1996:1435-45.
[8] Batra Sameer, Yamin M, Sabharwal Sanjeev; Relationship between vitamin D insufficiency in osteoporosis and blood bone biochemistry; *Indian J orthop*. 2006: 40:1: 41-45.
[9] Chittari V Harinarayan, Tirupati Ramalakshmi, Upadrasta V Prasad, Desineni Sudhakar, Pemmaraju VLN Srinivasarao, Kadainti VS Sarma and Ethamakula G Tiruvenkata Kumar; High prevalence of low dietary calcium, high phytate consumption, and vitamin D deficiency in healthy south Indians; *American Journal of Clinical Nutrition*. Vol. 85, No. 4, 1062-1067, April 2007.
[10] Lips P, Duong T, Oleksik A, Black D, Cummings S, Cox D, Nickelson T.A Global study of vitamin D status and parathyroid function in postmenopausal women with osteoporosis: baseline data from the multiple outcomes of raloxifene evaluation clinical trial; *Endocrinol. Metab*. 2001 Mar:86(3):1212-21.
[11] Ghannam NN, Hammami MM, Bakheet SM, Khan BA;Bone mineral density of the spine and femur in healthy Saudi females: relation to vitamin D status, pregnancy, and lactation: *Calcif Tissue Int*. 1999 Jul;65(1):23-8.

AUTHOR(S):

1. Dr. Ramesh Narula
2. Dr. Mujtaba Tauseef
3. Dr. Iraqi Aftab Ahmad
4. Dr. Agarwal Kiran
5. Dr. Agarwal Ashok
6. Dr. Arya Anjana

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, Rohilkhand Medical College, Bareilly U.P., Pin-243006, India.
2. Consultant, Department of Orthopaedics, Chhota Telpa, Chhapra, Bihar, Pin- 841301, India.
3. Professor, Department of Orthopaedics, Rohilkhand Medical College, Bareilly, U.P., Pin-243006, India.
4. Associate Professor, Department of Gynaecology, Rohilkhand Medical College, Bareilly, U.P., Pin-243006, India.
5. Associate Professor, Department of Paediatrics, Rohilkhand Medical College, Bareilly, U.P., Pin-243006, India.
6. Assistant Professor, Department of Pathology, Rohilkhand Medical College, Bareilly, U.P., Pin-243006, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Ramesh Narula,
Associate Professor, Department of Orthopaedics,
Rohilkhand Medical College, Bareilly, U.P.,
Pin-243006, India.
Phone: 09719740866
E-mail: rameshnarula55@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Submission: **Sep 03, 2012**
Date of Peer Review: **Nov 11, 2012**
Date of Acceptance: **Jan 01, 2013**
Date of Online Ahead of Print: **Jan 08, 2013**
Date of Publishing: **Feb 01, 2013**