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Original Research Article

Osteocalcin, a promising marker of osteoporosis: evaluation in post-menopausal females with osteoporosis

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ABSTRACT

Background: Osteocalcin, has high affinity for calcium. In osteoporotic women, deficiency of calcium may lead to lowering of the formation of hydroxyapatite crystals. Thus, in the state of hypo mineralization, free osteocalcin available in the circulation. Therefore, present study was designed to evaluate significance of serum osteocalcin in diagnosis of osteoporosis, and relationship between Serum Osteocalcin and BMD (Bone mineral Density) in post-menopausal females with osteoporosis and without osteoporosis.
Methods: One hundred and forty seven post-menopausal women between age 45 to 80 years attending the hospital OPD were studied. To be eligible for the study they had to have been postmenopausal for at least one year. The diagnosis of osteoporosis was made based on T-Scores (BMD) at the lumber spine (L1 to L4 and femaral neck) by DEXA (GE lunar Densitometer). Serum osteocalcin level was estimated by LIAISON osteocalcin assay. Patients with chronic conditions affecting skeletal health and patients on drugs affecting the skeleton were excluded from the study.
Results: Serum osteocalcin level in post-menopausal female without osteoporosis was 9.87±1.04ng/ml, while post-menopausal female with osteoporosis had 22.62±2.25ng/ml suggesting significant increase in bone marker level in osteoporotic females ($p<0.05$.) Correlation study between BMD and osteocalcin showed strong Negative Correlation ($r=-0.77$, $p<0.05$).
Conclusions: Serum osteocalcin can be considered as a specific marker of osteoblast function as its levels have been shown to correlate with bone formation rates. Thus, serum osteocalcin can be used for diagnosis and monitoring of response to therapy and this may be the better predictor than BMD.

Keywords: Bone mineral density, Mineralization, Osteocalcin, Postmenopausal osteoporosis

INTRODUCTION

Osteoporosis is a progressive systemic skeletal disorder characterized by consequent increase in bone fragility and susceptibility to fracture, according to the world Health Organization worldwide the lifetime risk for women to have osteoporotic Fracture is 30-40%.[1,2] Occurrence of osteoporosis is 10 years earlier in Indian women and one in five men over age 50. Because of related morbidity, disability, diminished Quality of life and mortality, osteoporosis and fractures associated with it are Major public health concern.[3] Osteoporotic patients are characterized by significant Lower body weight higher level of bone turnover marker.[4] The levels of osteocalcin, Bone alkaline Phosphatase, cross linked telopeptide-C parathyroid hormones and 1, 25 dihydroxy vitamin D have been shown to be significantly higher in osteoporotic females Bone Turnover markers can prove beneficial when bone mass density (BMD) changed are too small to be utilized clinically particularly within the first 6 months.[5]After antiresorptive therapy initiation.[6] In women receiving antiresorptive therapy, Short term

changes in bone turnover markers are related to long term changes in BMD and may also predict long term increases therein Serum Osteocalcin can be Considered as a specific marker of osteoblast Function as its levels have been shown to correlate with bone formation rates the change in serum osteocalcin have been shown to correlate with changes in BMD.[7-9] The Present study was designed to evaluate significance of serum osteocalcin in evaluation of osteoporosis, relationship between Serum Osteocalcin and BMD (Bone mineral Density) in post-menopausal females with osteoporosis.

METHODS

The present study was conducted at the Department of medicine and Department of Orthopaedics Katihar Medical College, Katihar, Bihar from April 2018 to April 2019, one hundred and forty seven post-menopausal women between age 45 to 80 years attending the hospital OPD were studied. Informed consent was obtained from all the subjects participating in the study and study was approved by the Institutional ethics committee.

Inclusion criteria

To be eligible for the study subjects had to have been postmenopausal for at least one year and in good health with no vertebral abnormalities in the L1-L4 region and the decreased bone mineral density (lumber spine on right or left femoral meck or both T-Scare-1.0 or less). Out of one hundred forty seven post-menopausal women seventy three subject aged between 45 to 80 years had osteoporosis (T-Scare - 2.5 or less). Rest 74 postmenopausal women were without osteoporosis. The diagnosis of osteoporosis was made based on T-Scores (BMD) at the lumber spine (L1 to L4 and femaral neck) by DEXA (GE lunar Densitometer).

Exclusion criteria

Subjects who had a history of HRT intake within 1 year, Hypothyroidism, Hyperthyroidism, Renal failure, liver disease. H/O Cancer, Peptic ulcer or esophageal Disease requiring prescription, Regular therapy with phosphate binding antacid therapy, any other drug that affects the skeleton e.g. steroids, antiresorptive therapy, anticonvulsant, anticoagulants, etc.

A detailed history and physical examination was carried out for every subject who entered in the study as per a pre-designed performa. Examination comprised of a through physical examination assessment of vital parameters, anthropometry and systemic examination. Serum osteocalcin level was estimated by LIAISON osteocalcin assay. Statistical analysis was performed using SPSS version 16, statistical package for windows (SPSS, chicago, IL)

RESULTS

The baseline characteristics of 147 Postmenopausal Women are shown in Table-1. The mean age in post-menopausal female without osteoporosis was 51±3.88 years and post-menopausal with osteoporosis was 56.57±8.15 years. Similarly, mean duration of menopause in post-menopausal female without osteoporosis group was 3.85±1.8 and with osteoporosis was 9.56±5.8 suggesting significant difference between the two group. In both the group, the patients were above 45 years. The mean body mass index (BMI) was 26.61±4.12kg/m^2 and 25.73±5.72 kg/m^2 respectively in post-menopausal female without osteoporosis and post-menopausal female with osteoporosis groups.

Table 1: Baseline characteristics of study subject.

S.no.	Parameter	Postmenopausal without osteoporosis (n=74)		Postmenopausal with osteoporosis (n=73)		p value
		Mean	SD	Mean	SD	
1.	Age (years)	51	3.88	56.57	8.15	<0.05
2.	Time since menopause (years)	3.85	1.82	9.56	5.80	<0.05
3.	BMI (kg/$\mathbf{m^2}$)	26.61	4.12	25.73	5.72	NS
4.	BMD-lumbar spine (g/$\mathbf{cm^2}$)	1.20	0.18	0.81	0.13	<0.05
5.	T-score lumbar spine	1.41	0.29	-3.14	1.10	<0.05
6.	BMD hip (g/$\mathbf{cm^2}$)	1.22	0.15	0.81	0.15	<0.05
7.	T-score hip	1.34	0.26	-1.87	1.03	<0.05
8.	Ionised calcium (MIu/l)	1.16	0.10	1.07	0.09	<0.05
9.	S. Tsh (MIu/L)	2.90	1.23	2.65	2.05	NS
10.	S. Creatinine (mg/dl)	1.14	0.19	0.95	0.16	<0.05
11.	Serum osteocalcin (ng/ml)	9.87	1.04	22.62	2.25	<0.05

The mean BMD at Lumbar spine was 1.20±0.18g/cm^{2}and 0.81±0.13g/cm^2 respectively and means BMD at hip was 1.22±0.15g/cm^2 and 0.8±0.15g/cm^2 respectively in post-menopausal female

without osteoporosis and post-menopausal female with osteoporosis groups while mean T-score at lumbar spine was 1.41±0.29 and -3.14±1.0 respectively and T-score at hip was 1.34±0.26 and -1.87±1.03 respectively in post-menopausal female without osteoporosis and post-menopausal female with osteoporosis group which was suggestive of significant difference in both groups.

Serum osteocalcin was 9.87±1.04ng/ml and 22.62±2.25ng/ml respectively in both groups. Serum osteocalcin level was found to be significantly higher in post-menopausal women with osteoporosis as compared to post-menopausal women without osteoporosis ($p<0.05$).

On comparing impact of duration of menopause in BMD and serum osteocalcin level at baseline patients with less than 10 years of menopause had mean BMD at spine 0.86±0.13g/cm^2, Mean BMD at Hip 0.86±0.159/cm^2 and Mean Serum osteocalcin 22.35±2.10ng/mi while Patients with >10yrs of Menopause had Mean BMD at spine 0.75±0.119/cm^2, Mean BMD at hip 0.75±0.139/cm^2 and Mean Serum osteocalcin 22.92±2.41ng/ml on applying paired t-test showed significant difference in two groups in terms of mean BMD but there was not much difference in two groups in terms of mean serum osteocalcin as shown in Table 2.

Table 2: Impact of duration of menopause in BMD and Serum Osteocalcin.

S no	Parameters	Patients with <10yrs of menopause n=38		Patients with >10yrs of menopause (n=35)		p value
		Mean	SD	Mean	SD	
1	BMD spine (9/**cm^2**)	0.86	0.13	0.75	0.11	<0.05
2	T-score spine	-2.73	1.08	-3.59	0.96	<0.05
3	BMD hip (9/**cm^2**)	0.86	0.15	0.75	0.13	<0.05
4	T-score hip	-1.52	0.85	-2.25	1.09	<0.05
5	Serum osteocalcin (ng/ml)	22.35	2.12	22.92	2.41	<0.27

DISCUSSION

The Present study was carried out with the aims to determine the significance of Serum Osteocalcin in diagnosis of osteoporosis and relationship between S. osteocalcin and bone mineral density in post-menopausal females with osteoporosis and without osteoporosis women. Osteocalcin has high affinity for calcium in osteoporotic women, deficiency of calcium may lead to lowering of the formation of Hydroxyapatite crystals. Thus in the state of Hypo mineralization free osteocalcin available in the circulation this may explain the increased concentration of serum osteocalcin in osteoporotic female. Osteocalcin is a promising marker of bone turnover useful in the diagnosis and follow up of high turnover osteoporosis.[10-13] Serum osteocalcin has also been reported as predictive of the rate of bone loss after menopause and as a tool to selecting appropriate therapy.[14,15] In the present study serum osteocalcin level in post-menopausal female without osteoporosis was 9.87±1.04ng/ml, while post-menopausal female with osteoporosis had 22.62±2.25ng/ml suggesting significant increase in bone marker level in osteoporotic females ($p<0.05$.) Correlation study between BMD and osteocalcin showed strong Negative Correlation ($r=-0.77$, $p<0.05$) A case control study of 90 Postmenopausal women showed results that were consistent with the results of the present study conducted by Pirro Metal, 2010.[16] Hari Kumar KV et al, 2008 studied on 82 post-menopausal osteoporotic female in Hyderabad and found similar results.[17]

CONCLUSION

Thus serum osteocalcin can be used for diagnosis and monitoring of response to therapy and this may be the better predictor than BMD.

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