Original Article

Importance of serum osteocalcin in prevention and treatment of osteoporotic fragility fractures in geriatric patients

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Abstract

Osteoporosis is a major international health problem, characterized by low bone mass and structural detoriation of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture. Reduced bone density is a major risk factor for fragility fracture. Osteocalcin is also known as a bone Gla protein, a marker of bone formation. It is a vitamin K and vitamin D dependent protein produced by osteoblasts and most abundant and most widely studied non collagenous protein in bone. It is the most sensitive bone marker. **Objective:** To evaluate sensitivity of serum osteocalcin along with other bone markers in diagnosis of osteoporosis. **Material and methods:** Prospective study..The study period was 24 months. (April 2014-April 2016)**.** 25 cases were studied. **Estimation of Osteocalcin levels:** Serum osteocalcin was estimated using MicroVueOsteocalcin EIA Kit. **Results:** In our study it was found that the mean serum osteocalcin was 19.36 ±5.71 (ng/ml). The mean alkaline phosphatase among patients was 15.24 ±3.99 (mg/dl). The mean serum calcium among patients was 8.39 ±0.46 (mg/dl).The ROC curve analysis of biochemical markers for osteoporosis in this study suggested that the serum osteocalcin showed the maximum sensitivity with 89.31% as a biochemical marker.
Keywords: osteoporosis,fragility fractures,osteocalcin,bone markers,geriatric patients.

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INTRODUCTION

Osteoporosis is a major international health problem, characterized by low bone mass and structural detoriation of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture. Osteoporosis leads to nearly 9 million fractures annually worldwide. Reduced bone density is a major risk factor for fragility fracture. Others factors that may affect risk of fragility fracture include use of gluco-corticoids, age, gender, previous fracture and family history of osteoporosis. .Osteoporosis occurs when bone resorption is the more active resulting in a low bone mass and micro-architectural deterioration of bone tissue, leading to increased bone fragility and consequent increase in fracture risk. Osteoporotic fractures are a significant cause of morbidity and mortality. Bone turnover may be assessed by measurement of enzymes or the matrix proteins produced by the osteoblasts (which form bone) or osteoclasts (which resorb bone). The introduction of reliable, specific tests for biomechanical markers of bone metabolism would aid in the clinical management of bone diseases, including

Osteocalcin is also known as a bone Gla protein, a marker of bone formation. It is a vitamin K and vitamin D dependent protein produced by osteoblasts and most abundant and most widely studied non collagenous protein in bone. It is the most sensitive bone marker.Osteocalcin, incorporated into the bone matrix, is released into the circulation from the matrix during bone resorption and, hence, is considered a marker of bone

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turnover.It is useful for monitoring and assessing effectiveness of antiresorptive therapy in patients treated for osteopenia, osteoporosis, Paget's disease, or other disorders in which osteocalcin levels are elevated. Serum osteocalcin is a promising marker of bone turnover in post-menopausal women with osteoporosis, as it was found to be elevated in osteoporosis; also, its level reduced after treatment with risedronate. Therefore, osteocalcin provides a dynamic measure of bone remodelling and it can be potentially useful in diagnosis and monitoring of response to therapy inpatients of osteoporosis.

MATERIAL AND METHODS

This study was prospective study undertaken to evaluate utility of serum osteocalcin in prevention and treatment of osteoporotic fragility fractures in geriatric patients**.**The study period was 24 months. (April 2014-April 2016)**.**A total of 25 cases with Simple Random Sampling satisfying inclusion and exclusion criteria were included in the study

1. Patients with osteoporosis
2. Patients above 50 years of age
3. Patients with fractures caused by trivial trauma were included in this study.

Estimation of Osteocalcin levels

Serum osteocalcin was estimated using Micro Vue Osteocalcin EIA Kit. The assay uses osteocalcin coated strips, a mouse anti osteocalcin antibody, an anti mouse IgG-alkaline phosphatase conjugate and a pNPP substrate to quantify osteocalcin in serum. Storage -2-8 degree Celsius. Storage of unused reagents at 2-8 degree Celsius. Storage of 1X Wash Buffer(10X diluted) at 18-28 degree Celsius. Reagents and Sample preparation-Wash Buffer was prepared by diluting 10X wash buffer(Nonionic detergent in a buffered solution containing sodium azide 0.05%) in the ratio of 1:10 with deionized water. Reconstitute Standards and Controls were made with 0.5 ml 1X Wash Buffer. Assay Procedure-25 µL of Standards, Controls and samples were added to the wells.125 µL of Anti-Osteocalcin antibody was added to it. This was incubated for 2 hours at room temperature .1X Wash buffer was washed 3 times. Enzyme conjugate was prepared within 2 hours of use. Each required vial of enzyme conjugate was reconstituted with 10mL of 1x wash buffer.150 µL of reconstituted enzyme conjugate, was added to it. This was further incubated for 60 minutes at room temperature. Again 1X Wash Buffer was washed 3 times. Working substrate solution was prepared within 1 hour of use. One substrate tablet was put in each required bottle for 20-25 degree and was allowed to dissolve for 30-60 minutes.150µL of working substrate solution was added to it, which was further incubated 35-40 minutes at room temperature.50µL of Stop Solution(0.5N NaOH) is added. Finally Optical Density was read at 405 nm. Analysis of the Assay Procedure. Assay Procedure results were analysed using 4 parameter curve fit.

RESULTS

In our study it was found that the mean serum osteocalcin among patients was 19.36 ±5.71 (ng/ml). The mean alkaline phosphatase among patients was 15.24 ±3.99 (mg/dl). The mean serum calcium among patients was 8.39 ±0.46 (mg/dl).

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Table 1: ROC curve analysis of biochemical bone markers for osteoporosis

Factor	Sensitivity	Specificity	AUC	CI	P value
Serum osteocalcin	89.31	83.12	0.902	0.881-0.973	<0.001
Alkaline Phosphatase	82.13	90.16	0.826	0.807-0.912	<0.001

The ROC curve analysis of biochemical markers for osteoporosis in this study suggested that the serum osteocalcin showed the maximum sensitivity with 89.31% as a biochemical marker.

DISCUSSION

Osteocalcin is a product of osteoblasts that is considered a marker of bone formation. However, osteocalcin is also released from the bone matrix into blood during bone resorption, suggesting that osteocalcin is also a marker of bone turnover. Therefore, the higher serum osteocalcin levels and ALP observed in patients reflect an increased bone turnover rate rather than simply increased bone formation, and thus may be associated with an increased risk of bone fracture and OP.

It was observed that majority of patients were in age group 65-70 years (36%) followed by 56-60 years (28%). The patients in age group >70 years were 16%. The mean age among patients was 67.12 ±7.09 years

This study concluded that serum Osteocalcin can be used as a sensitive bone marker in early detection of osteoporosis and prevention of fragility fractures. The response of patient to anti resorptive treatment of osteoporosis can also be monitored effectively. The mean serum osteocalcin among patients was 19.36 ±5.71 (ng/ml). The mean alkaline phosphatase among patients was 15.24 ±3.99 (mg/dl). The mean serum calcium among patients was 8.39 ±0.46 (mg/dl). The ROC curve analysis of biochemical markers for osteoporosis was

done. The serum osteocalcin showed the maximum sensitivity with 89.31% as a biochemical marker. In the present study, serum osteocalcin and ALP concentrations were significantly higher in patients. The serum osteocalcin concentrations were observed in patients probably due to increased bone turnover rate due to presence of fracture and healing

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