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Magnesium as an Important Marker in Post-Menopausal Women with Osteoporosis and Osteopenia

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ABSTRACT
Objective: *Osteoporosis is quite common in elderly people, especially in post-menopausal women. The role of Magnesium, an important cation along with calcium for bone formation, is not very well-studied in osteoporosis as well as osteopenia group.*
Methods: *Total 68 post-menopausal women 48-75 years of age group, were included in this study. In which, 33 women were having osteoporosis while rest 35 were from osteopenia. The differentiation between osteoporosis and osteopenia were done with the bone mineral density usually expressed in T score and Z score. Serum total calcium, ionized calcium, serum phosphate, serum alkaline phosphatase, and serum magnesium were estimated in post-menopausal women.*
Results: *Significant results were obtained in various parameters. In osteopenic women, the mean values of total calcium (8.25±1.25 vs. 9.29±0.62) and ionized calcium (4.22±0.51 vs. 4.64±0.31) were significantly (<0.001) higher. The serum concentration of alkaline phosphatase (159.87±37.11 vs. 137.21±33.29) was significantly higher (<0.01) in osteoporosis group. The serum concentration of magnesium (1.95±0.44 vs. 2.22±0.42) was lower in osteoporosis group, and the result was statistically significant (<0.05).*
Conclusion: *In post-menopausal women, osteoporosis is characterized by a lower concentration of calcium and definitely Low Magnesium. Hypomagnesemia may result in inflammatory disorders which have an existing relationship with bone loss. The dietary intake of magnesium supplement may be useful in reducing the adverse effect of osteoporosis.*
Keywords: *Hypomagnesemia, Osteoporosis, , Osteopenia, Post-menopause*

I. Introduction

Osteoporosis is characterized by a decreased concentration of bone mineral content due to which increased risk of bone fracture takes place [1]. Osteoporosis is quite common in elderly women rather than men due to smaller bone mass [2]. In post-menopausal women, osteoporosis quite frequently occurs, because they produce less amount of estrogen, which reduces the ability to retain calcium (Ca) in the bones [3]. Osteopenia, sometimes referred as pre-osteoporosis, because the bone mineral content is lower than normal, but not as osteoporosis, occurs at the early age of post-menopausal women [4]. Decreased concentration of bone mineral content leads to degeneration of bones that get easily fractured [5]. Decreased Ca absorption with increasing age might create adverse effects on the body in the form of electrolyte imbalance [6,7], which can increase the risk of development of various diseases in the body, e.g., magnesium (Mg) deficiency stimulates inflammation [8], which has an existing relationship with bone loss [9]. Mg and Ca are closely related due to the presence of approximately 50-60% of total Mg in the bones along with calcium phosphate [10]. An experimental Mg deficiency in animal models has consequences in osteopenia and impaired bone growth [11]. Mg is an important ion due to its catalytic activity in the various metabolic process [12]. So, evaluation of Mg (Magnesium)might be helpful in bone homeostasis, especially in post-menopausal women with osteopenia and osteoporosis, which are not very well discussed in the in the past.

II. Methods

Total 68 post-menopausal women were selected from OPD Dept of Orthopedics between Jan 2010 to Oct 2012 for the study, in which 33 women were having osteoporosis while the rest 35 were having osteopenia. The age group criteria were kept from 48 to 75 years. Due permission taken from patients and Ethical committee of HIMS college & Hospital, BBK. First patients were advised for Bone mineral density (BMD) measured in post-menopausal women for diagnosis of osteoporosis and osteopenia. BMD, usually reported as T score and Z score, were checked at Tibia and radius level in both the groups [13]. Serum total Ca (8.5-10.5 mg/dl), ionized Ca (4.6-5.4 mg/dl), serum phosphate (1.6-6.8 mg/dl), serum alkaline phosphatase (60-170 IU/L), and serum Magnesium (1.9-2.5 mg/dl) levels were estimated in the aforesaid population [14].

Statistical analysis

The IBM SPSS (statistical package of social sciences) version 20 was used for statistical analysis. The results were expressed in mean ± standard deviation. The unpaired student's *t*-test was used for comparison between the groups. The $p<0.05$ were considered as statistically significant (Table 1).

III. Results

Significant results were obtained between the groups. The concentrations of total Ca and ionized Ca were observed in post-menopausal women with osteopenia. The results of total Ca and ionized Ca were highly significant (<0.001) between the groups. Serum phosphate and alkaline phosphatase were significantly higher (<0.01) in post-menopausal women with osteoporosis. The serum concentration of Magnesium was significantly (<0.05)altered in osteopenic post-menopausal women.

Table 1: Baseline characteristics in post-menopausal women with osteoporosis and osteopenia**§**

S. No.	Parameters	Osteoporosis	Osteopenia	P value
1.	Age	59.63±12.12	57.25±5.54	0.308
2.	Total calcium	8.25±1.25	9.29±0.62	<0.001
3.	Ionized calcium	4.22±0.51	4.64±0.31	<0.001
4.	Serum phosphate	4.23±1.35	3.50±0.97	0.013
5.	Alkaline phosphatase	159.87±37.11	137.21±33.29	0.009
6.	Magnesium	1.95±0.44	2.22±0.42	0.013

All the data were presented in mean±SD. [§]By Student's *t*-test, SD: Standard deviation

IV. DISCUSSION

In this study, decreased the concentration of Mg was observed in both osteoporosis and osteopenic post-menopausal women. Epidemiological studies have shown that higher intake of Mg is associated with higher BMD in elderly women [15]. Post-menopausal women from the north-west of Iran supported this study by observing the deficiency in energy and loss of micronutrients, i.e. Ca, Vitamin D and Mg which can be deleterious to bone health [16]. A meta-analysis further concluded a casual relationship between serum Mg and osteoporosis in post-menopausal women [17]. Similar to this study, Multu *et al*. observed the lower concentration of Mg in osteopenic women and the lowest concentration in osteoporotic post-menopausal women compared to healthy post-menopausal women [18].

Saito *et al*. suggested that decreased the concentration of Mg may be a risk factor for osteoporosis in elderly patients, especially in women [19]. In addition to this, Odabasi *et al*. supported this study by observing the significantly lower level of Mg in red blood cells in post-menopausal women with osteoporosis, further concluded Mg transport mechanisms could be affected in osteoporosis patients [20]. On the contrary to this, another study of elderly Chinese women, Wang *et al*. observed a higher concentration of Mg in women with osteoporosis and osteopenia compared to normal women and inverse relation between serum Mg and serum Ca was observed [21]. In support to this, Suwansaksri *et al*. concluded that Mg estimation does not seem to be the marker of osteoporosis in pre-menopausal women [22]. While Okyay *et al*. concluded that low level of Mg is an important risk factor for osteoporosis in post-menopausal women to support this study [23].

V. Conclusion

The outcome of this study suggests that osteoporosis is characterized by a lower concentration of Magnesium(Mg). Early detection of this Mg deficiency may be helpful to avoid the risk of development of various diseases as an osteopenic group also showed slightly lower concentrations of Mg. Hypomagnesemia might result in endothelial dysfunction, which is important for bone health. As far as nutrition is concerned, Mg rich diet might be useful to avoid this Mg deficiency in post-menopausal women. Study with large sample size should be conducted to confirmation of this finding.

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