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ASSOCIATION OF BONE MINERAL DENSITY WITH BIOCHEMICAL PARAMETERS IN PERIMENOPAUSAL WOMEN

Biochemistry

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ABSTRACT

Objective: Osteoporosis is a silent killer disease that prevails with peak bone loss mainly in women during menopause. The study aims about the early diagnosis of osteoporosis in women with familial association. Methods: This is a Cross-sectional study conducted on twenty postmenopausal women and their respective perimenopausal daughters compared with healthy postmenopausal women. Biochemical parameters such as serum calcium, phosphorus, creatinine, uric acid and alkaline phosphatase were analyzed. Bone Mineral Density (BMD) was analyzed using Bone densinometer with a T score classified as normal, osteopenia and osteoporosis condition. Results: Serum calcium, phosphorus, uric acid with BMD was significantly lower in perimenopausal women compared to control. There was positive correlation seen between serum calcium, phosphorus, uric acid and BMD in perimenopausal women. Conclusion: The perimenopausal women are at increased risk of osteoporosis with significantly lower bone mass.

KEYWORDS

Menopause, Osteoporosis, Calcium, Phosphorus, Uric acid, Bone Mineral Density.

INTRODUCTION

Age related bone loss is asymptomatic and osteoporosis related morbidity is secondary to the fracture that occurs. At (or) after the age of 35, the peak bone mass gets reduced. As age advances, osteoporosis mainly affects the postmenopausal women (above 50 yrs) [1]. A Study has shown that a strong genetic component influences the bone metabolism in the parent-offspring relation which helps to identify the future risk of osteoporosis in the perimenopausal women with osteoporosis mother [2]. As per the Indian Council of Medical Research (ICMR) report, the epidemiology of osteoporosis is more in women (8%) than of men (3%). Especially, Indian women with lower average of peak bone mass have been observed [3]. It's been reported that about 50 million Indians have low bone mass with high prevalence of osteoporosis (52%) [4].

In bone metabolism, mineral like calcium has got a key role along with phosphorus. Dietary intake of calcium determines the peak bone mass, particularly in the elderly women where the low intake of calcium leads to reduced Bone Mineral Density (BMD) [5]. Serum creatinine is a metabolite of creatine phosphate. The rate of creatinine per unit of skeletal muscle mass and breakdown of creatinine both are consistent, thus serum creatine concentration reflects the skeletal muscle mass [18]. Clinical studies have confirmed that oxidative stress is a significant factor in the pathogenesis of bone loss which leads to the primary osteoporosis. Thus, serum uric acid is an important antioxidant which has a key role in the prevalence of osteoporosis. [6], [7]. Serum alkaline phosphatase (ALP) is a clinically diagnosed parameter most widely used in the prevalence of normal and pathogenesis process that reflect the bone cell activity on the skeleton. Serum ALP consists of numerous dimeric isoforms that are from various tissues such as bone, liver, spleen, kidney, intestine and placenta [8]. Bone Mineral Density (BMD) is a fundamental technology and key determinant for the diagnosis, treatment and monitoring of osteoporosis [9]. Reduced bone mass in the calcenous bone occurs faster in women than in men, which leads to significantly lower calcenous bone mass observed in women [10].

MATERIALS AND METHODS

This cross-sectional study was conducted on twenty osteoporotic postmenopausal mothers (55±10) and their respective daughters (35±10) compared with healthy controlled postmenopausal women at SRM Medical College & Hospital - Kattangulathur, Chennai. The study protocol was approved by the Institutional Ethical Committee and written & verbal consent was informed and obtained from each participant

Inclusion criteria

The postmenopausal women of the age 55±10 yrs with the known osteoporotic condition and their respective perimenopausal daughters of the age 35±10 yrs were taken as study subjects. The healthy postmenopausal women of the age 55±10 yrs were taken as controls.

Exclusion criteria

The patients with a clinical history of Obstructive pancreatitis, Hepatitis, Congestive Heart failure, malignancy involving liver and Breast carcinoma were excluded from the study.

Anthropometric parameters

Height and Weight of all participants were noted and Body mass index (BMI) was calculated using the formula

$$BMI = \text{weight (Kg)} / \text{Height (m}^2\text{)}$$

Biochemical Analysis

3ml of the random venous blood sample was collected in a plain test tube from each participant. Serum was separated immediately by centrifuging at 3000 rpm for 10 mins and analyzed for biochemical parameters using auto-analyzer.

Bone Mineral Density (BMD)

Bone Mineral Density (BMD) is a non invasive ultrasound method. Ultrasound uses sound waves to measure BMD at the heel or shin or finger. A gel was applied to the right heel near to the calcenous bone in the participant's foot. The participants were asked to place their feet in the device that emits high frequency sound waves. A computer determines the bone density by calculating how fast the sound waves pass through the heel and recorded.

Statistical Analysis

The data were collected in the form of report sheet and presented for

statistical analysis. The data were represented as mean±, standard deviation; student unpaired "t" test was used to assess the significance of difference between groups, Pearson's correlation analysis was done to find correlation between the parameters. The statistical differences between BMI and other parameters like Serum Calcium, Serum phosphorus, Uric acid, Creatinine, Serum Alkaline phosphatase along with BMD are analyzed using Software SPSS Windows. p value less than <0.05 was considered as statistically significant.

OBSERVATION & RESULT

A total of 20 healthy control postmenopausal women are compared with 20 perimenopausal women with their osteoporotic postmen opausal mothers. In Table-1 the statistical data on control postmenopausal women, perimenopausal women and postmenopausal mother (osteoporotic) are compared to Biochemical parameters, BMD and BMI. In this table, the data were expressed in terms of mg/dl, mean ± SD. Serum Calcium, phosphorus, uric acid and BMD between control, perimenopausal women and postmenopausal mother were found to be highly significant (p<0.01).

TABLE – 1
BIOCHEMICAL PARAMETERS

Parameters	Control	Peri-menopausal women	Post-menopausal women
Serum Calcium	9.7±0.15	8.7±0.15*	8.2±0.34*
Serum Phosphorus	3.5±0.23	2.9±0.12*	2.8± 0.11*
Serum Creatinine	0.8±0.16	0.7 ± 0.13	0.6 ±0.10
Serum Uric acid	4.2±0.12	2.7 ± 0.2*	1.9± 0.3*
Serum Alkaline Phosphatase	141±10.4	226 ± 52	264 ± 50
BMD	-1.16± 0.04	-2.34±0.12*	-2.84±0.09*
BMI	28.5 ± 1.2	29.2 ± 1.3	30.6 ± 1.3

* - (p<0.01)

In Table – 2, the biochemical parameters are correlated with Bone Mineral Density (BMD) of perimenopausal daughter. A positive correlation was found between the Serum Calcium, Phosphorus and Uric acid and Bone Mineral density.

TABLE – 2
CORRELATION BETWEEN BIOCHEMICAL PARAMETERS AND BMD

Serum parameters Vs BMD	r value	p value
Serum Calcium	0.64	<0.05
Serum Phosphorus	0.58	<0.05
Serum Uric acid	0.44	<0.05

DISCUSSION

Osteoporosis can be prevented when it is detected early and accurately, but it is undiagnosed until the bone fracture occurs [5]. Moreover, the accelerated bone loss or defect in attaining the peak bone loss causes osteoporosis. In women, the hasten phase of bone loss occurs after menopause, which increases the bone resorption than bone formation [15]. The mean weight and the Body mass index (BMI) of postmenopausal mother were higher than perimenopausal women. Generally, the increased body weight leads to greater force during a twist or turn or fall leads to a greater probability of fracture [16]. The participants involved in this study were professional and non-professionals who do only routine house-hold works. Studies have revealed that lack of either physical activity or weight bearing exercises is an important risk factor for osteoporosis [17]. World Health Organization (WHO) defined diagnostic classification for the Bone mineral density (BMD) based on t score in 3 categories; normal [t score -1 or higher], osteopenia [t score -1 and -2.5] and osteoporosis [t score -2.5 or less] [11]. This asymptomatic advancing disease can be detected early by BMD and biochemical parameters.

Minerals like Calcium and phosphorus helps bone metabolism by reabsorping the bone cells. In our Study, the positive correlation (table-2) seen in between BMD (t-score) and serum calcium, phosphorus and uric acid explains the significance of the risk of osteoporosis in perimenopausal daughter. Many studies have concluded that bone loss can be decreased per year by approximately 1% by increasing the supplementation of calcium in the diet. Physical exercise with increased calcium intake can benefit the BMD of osteoporotic women as age advances during menopause [5]. Every year, women lose three percent of bone mineral density, which causes osteopenia and eventually leads to osteoporosis [15]. Uric acid is a known antioxidant in vivo. The positive correlation between serum uric acid and BMD explains that the high uric acid levels can prevent osteoporosis by inhibiting the generation of osteoclasts bone cells [12], [13]. Studies suggest that oxidative stress can be deleterious factor for increased bone loss in bone metabolism [6].

Perimenopausal women with familial association should be aware of their risk of osteoporosis and hence periodic assessment of their bone status is recommended. The familial association between mother and daughter about osteoporosis would have been explained more if we would have included the daughter of postmenopausal mother without osteoporosis in our study.

However, there was no correlation noted in serum alkaline phospha tase and serum creatinine compared with Bone mineral density (BMD) in perimenopausal women. Studies have concluded that significant decreased in bone mineral density occurs rapidly in perimenopausal state and with increasing age and duration of menopause [3].

CONCLUSION

Mostly in Indian women, the risk factors such as low calcium intake, early menopause, vitamin-D deficiency, genetic predisposition and unawareness lead to prevalence of osteoporosis [14]. In our cross-sectional study compared between postmenopausal mother and their perimenopausal daughter along with control suggests that the daughters of osteoporotic mothers are in a state of osteopenia, which makes them liable to osteoporosis until delay in the sufficient diagnosis and treatment.

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