

The Correlation Between Mineral Levels and Bone Loss Risk in Postmenopausal Women

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ABSTRACT

Background: Calcium and phosphate are two minerals that are important for bone formation. Osteoblasts indirectly regulate osteoclast resorption activity under the influence of estrogen. Estrogen itself produces growth factors and contributes to bone formation so that bone mineral density decreases with an increase in menopause. **Objective:** This study aimed to know correlation between mineral levels and bone loss risk in postmenopausal women. **Methods:** This research was a case control study. Samples size were 34 postmenopausal women. Data was analyzed by chi-square to see the correlation mineral levels to bone loss and the strength of the association between factor and outcome was determined as an odds ratio (OR). **Results:** There is correlation between mineral levels with Bone Loss in postmenopausal woman with p value 0.018 and have possibility (OR=12.000; CI 95%= 1.623 – 88.702). The odds ratio show that the risk to bone loss in low mineral subjects was 12 times compared with normal mineral subjects. **Conclusion:** Need to provide additional calcium for postmenopausal women to increase mineral levels so that they avoid bone loss.

Keywords: Blood calcium, osteoporosis, postmenopause

1. INTRODUCTION

Calcium and phosphate are two minerals that are important for bone formation. Calcium and vitamin D is needed for the growth of strong bones. Calcium is also very important to regulate the work of the heart, muscle and nerve function [1]. Osteoblasts indirectly regulate osteoclast resorption activity under the influence of estrogen. Estrogen itself produces growth factors and contributes to bone formation so that bone mineral density decreases with an increase in menopause [2]. In the local population osteoporosis is common and affects 1 in 4 postmenopausal women [3]. Women have an increased risk of osteoporosis in line with the aging process, so it is important to do bone density testing [4]. A survey in Sao paulo resulted in 33% of 4.332 aged > 40 years who were diagnosed with osteoporosis as postmenopausal [5].

At a young age, the body uses these minerals to form two bones. If calcium intake is not sufficient or the body does not get enough calcium from food, then the formation of bone and bone tissue will be disrupted. According to the American Association of Clinical endocrinologists (AACE) peak bone mass formation (Peak Bone Mass) occurred in the age of 10-35 years and is highly dependent on calcium intake and physical activity. Mineral deposit in the bone will peak (Peak Bone Mass or PBM) around the age of 20-30 years. In this PBM period if bone mass is achieved with maximum conditions will be able to avoid the occurrence of osteoporosis in the next age. PBM attainment is low if an individual lack of exercise, low Ca intake, smoking, and drinking alcohol [6].

Estrogen is the key to the regulation of bone metabolism in women and men. Along with age, which decreases calcium absorption so that it will weaken the bone tissue. The amount of bone loss in women, besides due to the increase of age is

also associated with decreased levels of estrogen in the blood due to decreased function and cessation of ovarian function and is thought to decrease the hormone progesterone play a role [7]. This is common in women during the menopause and post menopause. In postmenopausal women bone loss occurs faster than bone formation [8].

Early longitudinal studies confirm a sighting. In 1986, Riggs et al. Bone loss is typical at 139 women aged 20-80 years. During the 2-year follow-up, women who are premenopausal increased BMD (Bone Mineral Density) in radial shaft by 0.5% but suffered a loss of 1.4% at the spine. The first longitudinal study shows that the loss of BMD begins before menopause, especially in the rich part of trabecular [9].

In Asia as reported by WHO [10] fractures caused by osteoporosis will have risen from 84,000 people in 1986 to 6.26 million in 2050, and 71% of fractures will occur in developing countries. The highest incidence of osteoporosis in women. One in two women and one in eight men will develop osteoporosis in her life. The high incidence of osteoporosis in women causes this condition becomes a public health problem. The purpose of this research was to know correlation between mineral levels and bone loss risk in postmenopausal women.

2. METHODOLOGY

This study was a Case-control study that examined the relationship between the state of a person with certain risk factors. Bone mineral content in the risk of bone loss in postmenopausal women. The population was women during the post-menopausal treatment in the reproductive clinic Asri Medical Center.

Sample size was determined with calculator for un-matched case control according to openepi with assumption that two-sided confidence level (1-alpha) 95 %, power 80 %, ratio controls to cases 1, hypothetical proportion of controls 75 % and hypothetical proportion of cases with exposure was 25 %. Based on that assumption, sample size (minimal) should be 32 subjects. All subjects of this study were 34 postmenopausal women [11]. The case group was defined as postmenopausal woman with low blood calcium levels while the control group was infants and postmenopausal woman with normal and high blood calcium levels. The Both groups were followed for 6 months and measured densitometry picture to see the effects of bone loss. Among the indicators of bone minerals were analyzed by spearman test the strength of the association between factor and outcome was determined as an odds ratio (OR). Primary data were collected by interview and laboratory examination. Interviews were conducted to determine the respondent's name, age of the respondent and the length of respondent's menopause. Blood calcium levels are measured through laboratory tests using a Cobas Integra 400 Plus with methods O - Cresolphthalein Complexon (OCPC) in the Integrated Laboratory of Clinical Pathology and the Reproductive Asri Medical Center.

3. RESULTS AND ANALYSIS

The results of this study showed that the average of all the results of the blood calcium levels in postmenopausal women was 4.7 mg/dL were classified as low category (Table 1). Blood calcium levels were obtained from the examination results are divided into three categories: low (<8.60 mg/dL), normal (8.60 to 10.20 mg/dL), and high (>10.20 mg/dL) [12]. Based on the results of the study, the majority of respondents have a low blood calcium levels as many as 26 people (76.5%). By age group, from 34 respondents, low blood calcium levels or case group are most commonly found in the age group 50-55 years, as many as 13 people (38.2%) (Table 2). Based on the long menopause, from 34 respondents, low blood calcium levels or case group are most commonly found in menopausal women who have undergone menopause for 1-5 years, as many as 21 people (61.8%). Fisher test was used as the alternative of chi square test with the result $p = 0.018$, for $p < 0.05$ it could mean that there is a correlation between levels of minerals in the bone against bone loss in postmenopausal women (Table 3). Odds ratio (OR) is 12.000 and the 95% confidence interval is 1.623 – 88.702. The odds ratio show that the risk to bone loss in low mineral subjects was 12 times compared with normal mineral subjects.

The average of all the results of the blood calcium levels in postmenopausal women was 4.7 mg/dL were classified as low category. Research results in Table 1 show that 76.5% of respondents have low blood calcium levels, 11.8% of respondents have normal blood calcium levels, and 11.8% of respondents have high blood calcium levels. This illustrates that more postmenopausal women who had low blood calcium levels. These results are consistent with research conducted in the Village Sendangmulyo RW 03, District Tembalang, Semarang, where the results of blood calcium in postmenopausal women collected were low at 69.23% and only 30.77% had normal blood calcium levels [13]. One study

reports that longer time since menopause is associated with a higher prevalence of osteoporosis [14]. Unlike the results of research conducted in Manado, where the majority of menopausal women studied had normal blood calcium levels is as much as 76.67% [15].

Serum calcium is tightly controlled by various factors including nutrition is accepted by the body. In addition, control is also performed by 1,25-dehidroxycholecalciferol, parathyroid hormone, calcitonin, phosphorus, protein, and estrogen [16]. Decreation in blood calcium levels can occur if there is an imbalance between these factors. One is a decrease in estrogen levels gradually experienced by menopausal women. The hormone estrogen has an indirect effect on the body that play a role in regulating calcium balance in the body. Estrogen increases calcium absorption in the intestine and lower expenditures of calcium from the kidney, so the calcium levels in the blood can be maintained [17]. Decreation of blood calcium levels in menopausal women the highest age group, the 62-65 year age group. Analysis of the blood calcium level of 34 respondents obtained the lowest blood calcium level is equal to 1.2 mg / dL were found in respondents aged 62 years, while high blood calcium levels (but still within the normal range) is 18.0 mg / dL was found in respondents aged 53 years. These results illustrate that the older the blood calcium level will decrease. These results are in line with research conducted in Tresna Elderly Social Institution Wana Seraya Denpasar, where examination of blood calcium levels for postmenopausal women aged 50-60 years shows a decrease in blood calcium levels most often occurs in menopausal women aged 60 years [18]. Other studies have shown that an increased risk of fractures occurs in the longer duration of estrogen deficiency. Women with younger menopause (<40 years) significantly increased the risk of any fracture compared to women who report menopause at an older age (40-49 years or > 50 years) [19].

Low blood calcium levels found in post menopausal women with menopause time span of 1-5 years old. These results illustrate that blood calcium levels decreased after menopause. The body's ability to absorb calcium from food decreases with increasing age [17]. The rate of calcium loss will increase rapidly in postmenopausal women (three to seven years after menopause) due to lack of the hormone estrogen. Hutton explained that the decline in estrogen levels will be followed by a decrease in the absorption of calcium contained in the food so that women who reached menopause tend to experience a reduction in the absorption of calcium as much as 20-25% [20].

Estrogen production will not stop abruptly at the start of menopause because there is damage to the ovary. Estrogen production will be gradually reduced and this reduction will take quite a long and gradual. Reduced estrogen levels will interfere with the absorption of calcium that would affect blood calcium levels that would interfere with the process of bone formation and work functions in the body [21]. Low estrogen in the long run would pose a threat of osteoporosis (bone loss), which makes easy fracture. Research conducted by showed the prevalence of low bone density in the 40-50 year age group was 43.8%; 67.7% at ages 51-60 years; 84.9% at age 61-70 years; and 86.7% in the 71-80 year age group [22].

4. CONCLUSION

The majority of postmenopausal women have low calcium levels and this is common in postmenopausal women aged 50-55 years. Postmenopausal women who have low calcium levels have the most menopause for 1-5 years. There is a relationship between calcium mineral levels and the risk of bone loss in postmenopausal women. The odds ratio show that the risk to bone loss in low mineral subjects was 12 times compared with normal mineral subjects. Need to provide additional calcium for postmenopausal women to increase mineral levels so that they avoid bone loss.

Table 1. blood calcium levels in women postmenopausal

Blood Calcium levels (mg / dL)	Total	Percentage (%)
<8.60	26	76.5
8.60 to 10.20	4	11.8
> 10.20	4	11.8
TOTAL	34	100

Table 2. Characteristics of Subjects Study

Characteristics	Case	Control	n (%)
Group Age (years)			
50-55	7	8	13 (38.2)
56-60	10	0	10 (35.3)
61-65	9	0	9 (26.5)
Length of Menopause			
1-5	13	8	21 (61.8)
6-10	6	0	6 (17.6)
11-15	5	0	5 (14.7)
16-20	2	0	2 (5.9)

Table 3. Correlation between bone mineral levels to risk of bone loss in women postmenopausal

Risk of Bone Loss	Blood calcium levels		Σ	p	OR (CI 95%)
	Low	Normal and High			
Bone Loss	24	4	28	0,018	12.000 (1.623 – 88.702)
Not Bone Loss	2	4	6		
Σ	26	8	34		

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