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CHANGES IN BLOOD PARAMETERS AND IRON STATUS OF OSTEOPOROSIS WOMEN IN BASRA PROVINCE / IRAQ

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ABSTRACT

Osteoporosis is characterized by low bone mass, deterioration of bone tissue and disruption of bone architecture, compromised bone strength and an increase in the risk of fracture. Blood have different function and play an important role in hematopoietic stem cell and recently, it has been proposed that human osteoblasts support the growth of primitive human hematopoietic cells in vitro and possibly in vivo. Iron intake was associated with BMD in healthy postmenopausal women, while the iron deficiency lead to decreased bone mineral density (BMD) and mechanical strength in osteoporosis women. hemoglobin levels/anemia showed significant associations with total bone density, also level of ferritin was affected by the iron metabolism in humans body. Fifty six women patients aging between (60-69) years old visit a clinic in Ibnalbitar private hospital to determine the percentage of bone density by measuring the bone mineral density of lumber spine and hip by a dual energy x-ray absorptiometry (DEXA) from Lunar Prodigy (version 16) (USA). This women are referring from Basra province. After diagnosis of disease by using DEXA machine, blood sample was taken from each patient, then the blood parameters include RBC, WBC, Hb, PCV was measured by Auto Hematology Analyzer and ferritin level was estimated by using VIDAS automated quantitative test. While (S. Iron, TIBC) was estimated according to coloration method. The results shows significant decrease ($p \leq 0.05$) in Hb, PCV, S. iron and significant increase ($p \leq 0.05$) in ferritin while no changes occurs in RBC, WBC and TIBC compared with healthy women. In conclusion, blood parameters and Iron status have significant changes in osteoporosis women in Basra province / Iraq.

KEYWORDS: osteoporosis, blood parameters, Iron status, hemoglobin, DEXA.

INTRODUCTION

Osteoporosis is defined according to the WHO diagnostic classification by BMD at the hip or lumbar spine that is less than or equal to 2.5 standard deviations below the mean BMD of a young-adult reference population, the osteoporosis means low of bone mineral density and architecture of bone mass.[1] The risk of fractures is highest in those with the lowest BMD; however, the majority of fractures occur in patients with low bone mass rather than osteoporosis, because of the large number of individuals with bone mass in this range.[2] Currently, it is estimated that over 200 million people worldwide have osteoporosis.[3] Worldwide, osteoporosis causes more than 9 million fractures annually. These fractures include more than 1.6 million hip fractures, 1.7 million forearm fractures and 1.4 million clinically symptomatic vertebral fractures.[4]

The osteoporosis affects an enormous number of people, of both sexes and all races, and its prevalence will increase as the population ages, based on data from the National Health and Nutrition Examination Survey.[5] About one out of every two Caucasian women will experience an osteoporosis-related fracture at some point in her lifetime, as will approximately one in five men.[6] Over 1 million vertebral compression fractures - mostly caused by osteoporosis - occur worldwide annually, the morbidity and mortality significantly increase in patients who suffered vertebral compression fractures, and the incidence of this type of fracture rises continually.[7]

Pathogenesis of osteoporosis

There are a number of risk factors associated with the subsequent development of osteoporosis (table 1).

Table 1: Risk factors for the development of osteoporosis. Taken from (WHO, 2003).

Endogenous	Exogenous
	Premature menopause
	Primary or secondary amenorrhoea
	Previous fragility fracture
	Glucocorticoid therapy
Age	Maternal history of hip fracture
Slight body build	Low body weight
Asian or caucasian race	Cigarette smoking
	Excessive alcohol consumption
	Prolonged immobilisation
	Low dietary calcium intake
	Vitamin D deficiency

Types of osteoporosis

1. Primary osteoporosis

Its further divided into Type 1, which occurred in patients between 50 and 70 years old, and Type 2, for patients over 70. The former type was mostly detected women with postmenopausal osteoporosis, clearly related to the loss of estrogen with menopause.[8]

2. Secondary osteoporosis

Is less common than primary osteoporosis, it may be suspected in patients who present with a fragility fracture despite having no risk factors for osteoporosis in addition, secondary osteoporosis should be considered if the bone density Z-score is –2.5 or less.[9]

Blood have different function and play an important role in hematopoietic stem cell, human osteoblasts support the growth of primitive human hematopoietic cells in vitro and possibly in vivo.[10] The relationship between iron deficiency and bone loss also reported, the hematocrit of iron deficient in osteoporosis women low to about 53% of that of healthy women and the hemoglobin concentration of the iron-deficient group low greatly to about 28% of that of the control group.[11] Moreover, anemia consider as a risk factor for low bone mineral density, the study A total of 371 postmenopausal women showed that women with anemia had significantly lower femur T-scores, femur BMD, femur Z-scores, spinal T-scores, spinal BMD, and the number of anemic women was significantly higher in both the low femur BMD group and spine BMD group.[12] The association between levels of serum ferritin and bone mineral density, using data from the Korean National Health and Nutrition Examination Survey, including 730 women, the results suggest that Serum ferritin levels were only significantly correlated with BMD on the lumbar spine in postmenopausal women.[13] The aim of this study is focusing on changing in blood parameters and iron status in women suffering from osteoporosis in Basra city.

PATIENTS AND METHODS

This prospective study was conducted between March 2017 to September 2017 in Basra province to include a 56 women patients aging between (60-69) years old and weighting between (60-70 kg) while the length of this patient about (150-165 cm)referring from Basra province. This patients was visit a clinic in Ibnalbitar private hospital to measuring the bone mineral density of lumber spine and hip by a dual energy x-ray absorptiometry (DEXA) from Lunar Prodigy (version 16) (USA). According to the WHO criteria the patients are divided into normal, osteopenia and osteoporosis.

Human models

The patients are divided according to age.

Fifty six patients age between (60-69) years old, this are subdivided into two subgroups

a. Twenty five healthy patients age between (60-69) years old
b. Thirty one osteoporosis patients age between (60-69) years old

The forma was prepared to have an information data to patients referring to center according to search subject.

Dual Energy X-ray Absorptiometry

Dual-energy X-ray absorptiometry (DXA; DEXA) is the technique of choice to diagnose osteoporosis and to monitor the response to treatment. It is also useful for measuring body composition. DXA densitometry is accurate and precise. It is essential to optimize each step of the diagnostic process, taking care to ensure the best acquisition, image analysis, and interpretation of the results.[14] a BMD value at the spine or hip that is more than 2.5 *SD*s below the optimal mean for healthy young individuals of the same race and gender defines an individual as having osteoporosis (T- score $\leq$ -2.5).[15]

Sample collection

Five milliliters of venous blood sample was drawing from each patient after diagnosing of disease by using DEXA machine. Blood samples were collected from patients and healthy persons. Blood was divided into two part, one transfused into disposable plain tube, left at room temperature for at least 30 minutes for clotting, centrifuged (3500 r/m for 10 minutes) then the produced serum was divided, removal into special tube and stored at (– 20 C^0) unless used directly. While the remainder blood was transferred into a clean anticoagulant tube (provided with EDTA) to be used in assaying of blood parameters.

Measurement of blood parameters

Blood physiological parameters were measured by using Auto Hematology Analyzer in figure below, the Hematology Analyzer counts a number of cells from a specified dilution during a fixed time (normal counting), or count the time until a fixed quantity of cell is reached (proportional counting).

Assay of ferritin level

VIDAS automated quantitative test that assay serum or plasma by using the ELFA technique (Enzyme Linked Fluorescent Assay) was used to determination the human ferritin level.

Estimation of Iron level concentration in blood serum

Using the coloration method to determination the concentration of Iron level by Randox kit from England.[16]

Estimation of Total Iron Binding Capacity (TIBC) concentration in blood serum

Using the coloration method to determination the concentration of TIBC by Randox kit from England.[17]

Statistical analysis

Analysis of variance table (ANOVA) in computer according to SPSS16 program was used in statistical analysis of this study, and then the Least Significant Differences test (L.S.D) was used to determine the significant differences among the categories at significant level ($p \leq 0.05$).

RESULTS AND DISCUSSION

Blood parameters in healthy and osteoporosis women in age (60-69) years.

Table (2) shows the changes in blood parameters, which include a significant decrease (p<o.o5) in Hb and PCV for women with osteoporosis while other parameters include RBC and WBC shows not significant changes compared to healthy women from the control group.

Table 2: Blood parameters in healthy and Osteoporosis women (mean ± SD).

Blood parameters	Healthy women (n=25)	Osteoporosis women (n=31)
RBC count (10^6) /µL	4269 ± 7.39	4281 ± 8.48
WBC count (10^3) / µL	6996 ± 5.12	6834 ± 5.91
Hb (g/dl)	11.30 ± 1.50	*8.20 ± 0.76
PCV%	39.10 ± 2.11	*25.60 ± 1.75

Iron levels in women with osteoporosis aged between (60- 69) years.

Table (3) shows that women aged between (60-69) years with osteoporosis disease have a significant decreased (p<o.o5) in their serum iron and increase (p<o.o5) in serum ferritin values with no difference in TIBC compared with healthy women in the same age.

Table 3: Iron levels in osteoporosis and healthy women at the age (60-69) years. (mean ± SD).

Variables	Healthy women (n=25)	Osteoporosis women (n=31)
S. iron (micg/dl)	76.77 ± 11.82	*48.31 ± 8.82
S. ferritin (ng/ml)	133.97 ± 24.27	**191.31 ± 7.85
TIBC (micg/dl)	281.39 ± 27.42	277.31 ± 25.54

Data from the present study indicate a reduction of hemoglobin, PCV values in women suffers from osteoporosis disease while no changes in RBC and WBC variables compared with healthy women. Other results was have a significant decrease in serum iron level of osteoporosis women, serum ferritin exhibited significant increase in osteoporosis women compared with healthy women. While the TIBC showed no significant changes in osteoporosis women compared with healthy women in the same age**.** The result may not be affected by the production of red and white blood cells probably that low amount of iron found within bone marrow as a factory for production hemoglobin without affecting to produce normal cells, so we find the normal parameters for this cell compared with healthy women.[18] Such an influence in blood parameters in these women may be to effect of osteoporosis on mesenchymal stem cells (MSCs) in bone marrow, these cells play an important role in the repair of bone fractures and contributing to the regeneration of cartilage, ligament, tendon, muscle and adipose tissue.[19] Bone marrow is still the most important

source of stem cells, stem cells play an important role for production a new cell of blood, bone marrow extracts have been used for treating non-union gaps in orthopedic surgery for many years.[20] The reduced in hemoglobin amount and PCV percentage probably that hematopoietic stem cell differentiation occurs in direct proximity to osteoblasts within the bone marrow cavity, recently, it has been proposed that human osteoblasts support the growth of primitive human hematopoietic cells in vitro and possibly in vivo.[21] The evidence to support this hypothesis is explained as a reviewed that influence of osteoblasts on osteoclast development, the participation of osteoblasts in long-term bone marrow cultures, the production of positive hematopoietic regulatory molecules by osteoblasts, the production of cell-cycle inhibitory factors by osteoblasts, and cell – cell interactions between early hematopoietic cells and osteoblasts.[22] However, severe osteoporosis may be affected on the bone marrow, that will be affected for production hemoglobin and decrease PCV by effect in the trabecular network and subsequent bone destruction.[23] Also trabecular bone is particularly vulnerable to transplant-related with spine and hip, they contain 50% to 75% trabecular bone and are most at risk for fracture after hematopoietic cell transplantation.[24] The reduction in hemoglobin and packed cell volume may be by osteoblast-derived factors play a central role in hematopoietic development in the marrow, osteoblasts are in a biologically relevant site to transmit information to the developing hematopoietic lineages.[25] The normal value of TIBC in osteoporosis women probably due to that TIBC is associated with other disease such as celiac disease, several lines of evidence suggest that abnormal TIBC may play an important role in the development of celiac disease.[26] A low iron status can reduce physical activity and increase susceptibility to infections, iron deficiency can cause fatigue and reduce work performance and it has been observed in young women that a good iron status enhances various components of wellbeing.[27] The iron deficiency affects bone metabolism and at the same time osteoporosis and bone alterations are highly prevalent to iron deficiency for bone remodeling, evaluate iron status and bone resorption.[28] Moreover, chronic iron deficiency increased production and maturation of osteoclasts which then enter the cycle of bone resorption and risk of osteoporosis, by decrease bone mineral density in postmenopausal women.[29] Furthermore, menstrual blood loss contributes to a negative iron balance in women therefore, these women constitute an important risk group for osteoporosis due to the additional iron demands of menstruation in menopausal women.[30] Another mechanism in which iron participates in bone metabolism is through vitamin D concentration, in this pathway iron is essential for vitamin D metabolism as all of the vitamin D-related cytochromes catalyze single or multiple hydroxylation reactions on specific

carbons of the vitamin D substrate using a heme-bound iron that will be effect in bone formation and bone metabolism.[31]

The iron deficiency could decrease vitamin D and lead to a decline in calcium absorption from the gut will be effect in bone formation by increase bone resorption and loss bone density causes osteoporosis.[32] On the other hand, The level of ferritin was affected by the iron metabolism in humans body, the two subunits of ferritin was synthesized under the control of iron metabolism and the regulation mechanism of ferritin may potentially take part in the regulation of iron in the body.[33] Also the increase ferritin and transferrin in osteoporosis women were in a significant relation with iron metabolism and they were under the control of hepcidin due to decrease serum iron associated with increase serum ferritin receptor in osteoporosis women.[34] Moreover**,** higher ferritin are significantly associated with lower bone mass at various skeletal sites and cause an increased prevalence of osteoporosis and fractures, especially in women ≥45 years old.[35] The increase of ferritin level in osteoporosis women may be by estrogen deficiency, estrogen deficiency causes detrimental effects on bone health with serum ferritin increases by 2–3 times during this period due to the lack of a major mechanism of iron excretion and BMD in women based on menopausal status.[36] Likewise, the high ferritin in osteoporosis women may be inhibiting osteoblast differentiation, stimulating osteoclast resorption, decreasing activity of alkaline phosphatase (ALP) which is an important enzyme in early osteogenesis and also inhibiting anterior pituitary synthesis of gonadotropins.[37,38]

In conclusion, blood parameters and Iron status have significant changes in osteoporosis women in Basra province / Iraq.

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