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To cite this article: Mustafa A Almajeed and Thamer A Hamdan 2019 *J. Phys.: Conf. Ser.* **1294** 062024

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Dual energy x-ray absorptiometry for diagnosis of bone mineral density in pre and post – menopausal women.

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Abstract. Osteoporosis is a common metabolic bone disorder causing fractures and incurring substantial morbidity and mortality specially in women after menopause.

Patients and Methods: The bone mineral density of (172) pre and post-menopausal women with a mean age (31.5) and (64.5) years respectively underwent dual energy x-ray absorptiometry (DEXA) during the period. (BMD) measurements and the resulting patient classification based on T- scores values according to WHO criteria.

Results : (54.08%) of post- menopausal women were in the osteoporotic range specially in spine , (29.12%) of them had osteopenia , while the others were in normal (24.96%). In pre-menopausal women (7.48%) had osteoporosis, (14.28%) had osteopenia and (24.48 %) had normal bone mineral density according to the WHO criteria. **Conclusions:** This study shows lower BMD T –score for the lumbar spine and femoral neck in post – menopausal women compared with lumbar spine and femoral neck in pre-menopausal women according to the WHO criteria.

Key word : osteoporosis , post – menopausal women, BMD

1. Introduction

Osteoporosis is a disease of bone in which the BMD is reduced, It can be called the silent disease because it can progress without symptoms until a fracture occurs in the hip, spine, and wrist and can be permanently disabling(1). Osteoporosis affects 10% of the total population but the prevalence among post menopause women is more than 30% , most studies support a positive association between these women (2). Functionally osteoporotic bone is characterized by fragility and an increased propensity to fracture(3). Osteoporosis is most commonly found in post menopause women , where the absence of the hormone estrogen is related to the loss of bone mass(4). Other conditions that may cause osteoporosis or osteopenia are renal failure , hyperparathyroidism , long term corticosteroid therapy , long term hormone replacement therapy , smoking , excessive alcohol consumption , and malabsorption disorder (5). This public health problem is affecting 75 million persons in the United States , Europe and Japan including one third of post menopause women(6). Reduced bone mass is the results of varying combination of hormone deficiencies , inadequate nutrition , decreased physical activity , and the effects of medications used to treat various unrelated medical conditions(7). Osteoporosis is defined technically as a bone density that falls 2.5 standard deviation below the mean of 30 years old adult , which is also called T- score of -2.5 (8). Dual energy X-ray absorptiometry (DEXA) is accepted as the standard and is the most widely used modality in bone mineral content and



density measurement (9). patient observed radiation dose in DEXA is extremely low, somewhat equal to the environmental daily background radiation absorption as estimated to be 0/0005 to 0.0090 milli-sieverts (mSv), and about 1/2000 of a conventional standard chest X ray(10). once the diagnosis of osteoporosis was made and after beginning of its treatment, central DEXA (of vertebrae and femoral neck) should be performed annually or biannually (11).

There are four recognized types of osteoporosis :-

- primary osteoporosis is the most common form of osteoporosis and it is broken down into two type :-
Type I , or post menopause osteoporosis , typically occurs due to post menopause loss of estrogen secretion .
Type II , or involutional or senile osteoporosis can occurs in both sexes above 75 year old .
- secondary osteoporosis , occurs due to extrinsic factors , corticosteroids , rheumatoid arthritis , chronic kidney disease , liver disease and hyperparathyroidism.
- Idiopathic osteoporosis , is a rare form of primary osteoporosis that could occurs in pre- menopause women.
- Juvenile osteoporosis is a rare form of varying severity that could affect prepubertal children(12).

Objectives : To determine the accuracy of hip and spine density by using densitometry in the diagnostic of osteoporosis in pre and post-menopausal women.

2. Patients and Methods

This was a descriptive study of (172) women referred to the unit of DEXA (Alzahraa Center in Ibn Albitar Hospital in Basrah) from March to September 2018. (68) patients pre – menopausal ranging in age 26 to 37 (mean: 31.5) years and (104) patient post- menopausal women aged 54 to75 (mean: 64.5)years . The women had generalized bone pain and no known history of any disease. The bone mineral density assessment was performed both at lumbar spine (L1-L4) and femoral neck hip using a dual energy x-ray absorptiometry (Lunar- prodigy version 16, USA). The main outcome measure bone mineral density (T-score). The body mass index was calculated from the height (m) and weight (Kg). The world health organization (WHO) criteria for the definition of osteoporosis in pre and post menopause women was used.

3. Operational definition

The national osteoporosis foundation of the United State and the World Health Organization was used to categorize (BMD) into:-

- Normal : A value of (BMD) less than one standard deviation below the peak bone mass of healthy adults.
- Osteopenia : A value of (BMD) between 1.0 (SD) and 2.5 (SD) below the average value of the peak bone mass of healthy adults.
- Osteoporosis : A value of (BMD) more than 2.5 (SD) below the average value of the peak bone mass of healthy adults (13).

4. Statistical analysis

Data analysis were performed using SPSS soft -ware , (version 15). chi-square test was used and the level of significance was set at p 0.05,in order to find a significance of difference between the T-score in pre and post menopausal women.

5. Results

(172) women including this study (68) patients pre – menopausal and (104) patient post-menopausal women meaning age 31.5 , 64.5 respectively. all of them were having bone pain and not on hormonal replacement therapy or vitamin D. The pre and post- menopausal women were subdivided according the age, height weight and bone mineral index (BMI) and diagnostic according to the T-Score which means a measurements expressed in standard deviation units from a given mean used in assessment of osteoporosis , equal to a patient s bone mineral density measurement by DEXA minus the value in a young healthy person , divided by the standard deviation of the measurement in the population.

T- Score $-1 = \text{Normal}$; -2.5 T-Score $-1 = \text{Osteopenia}$; T-Score $-2.5 = \text{Osteoporosis}$

Table (1) and (2) show the details of pre and post- menopausal women respectively. presence of osteoporosis and osteopenia showed significant differences in T-Score for both hip and lumbar spine site for post- menopausal women in table (4) compared with pre- menopausal women with different T-score in table (3). According to the (LS) and (FN) T-score, 52 patients (54.08%) had osteoporosis, 28 patients (29.12%) had osteopenia and 24 patients (24.96%) had normal bone mineral density in post- menopausal women , while in pre – menopausal women 11 patients (7.48%) had osteoporosis, 21 patients (14.28%) had osteopenia and 36 patients (24.48%) had normal bone mineral density.

Table (1) :Details of pre- menopausal women , N= 68.

Age (y)	31.5 ± 5.4 (26-37)
Height (m)	159.5 ± 1.13 (148-171)
Weight (kg)	72.5 ± 1.65 (47-98)
BMI* (kg/m ²)	34.2 ± 3.7 (14.6-53.8)

* Body Mass Index. Results are mean ± SD (Range).

Table (2) :Details of post- menopausal women , N= 104.

Age (y)	64.5 ± 2.7 (54-75)
Height (m)	161.5 ± 1.21 (150-173)
Weight (kg)	70.5 ± 3.79 (52-89)
BMI* (kg/m ²)	30.1 ± 1.4 (21.4-38.8)

* Body Mass Index. Results are mean ± SD (Range).

Table (3) : BMD and T- scores of the lumbar spine (L1-L4) and femur (total + neck) regions in pre- menopausal women.

Region	BMD(g/cm ²)	T-score (SD)
L1-L4	1.295 ± 0.212 (0.828-1.765)	-1.3 ± 0.342 (-2.9 – 2.4)
Neck	1.113 ± 0.169 (0.713-1.514)	-0.9 ± 0.661 (-3.1 – 1.7)
Total	1.208 ± 0.081 (0.451-1.966)	-0.5 ± 1.211 (-2.5 – 1.9)

Results are mean ± SD (Range).

Table (4) : BMD and T- scores of the lumbar spine (L1-L4) and femur (total + neck) regions in post- menopausal women.

Region	BMD(g/cm ²)	T-score (SD)
L1-L4	0.855 ± 1.313 (0.491- 1.219)	-3.1± 1.651 (-4.9 – 1.1)
Neck	0.709± 1.612 (0.248 – 1.171)	-2.9 ± 0.742 (-3.8 – 1.4)
Total	1.195 ± 0.281 (0.955 – 1.436)	-2.5 ± 1.335 (-3.3 – 1.8)

Results are mean ± SD (Range).

6. Discussion

The study reveals that using WHO criteria for the definition of osteoporosis and osteopenia , a significant fraction of patients would show T- Scores discordance between hip and spine sites. Factors that increase the incidence of osteoporosis include low body weight , cigarette smoking , excessive alcohol consumption these factors have been shown to depress osteoblast function and decrease bone formation (14). The presence of multiple risk factors (old age, poor health, limited physical activity, post menopause fractures and psychotropic drug use) seems to be a stronger predictor of hip fracture than low bone density(15).

Most research in post – menopausal women suggest strength training exercises attenuate the progressive loss of bone in post- menopausal women but do not increase bone mass (16). There was also association between having a job, exercising, height, and bone mineral index with osteoporosis after adjusting for all other variables, housewives were more likely to develop osteoporosis but this relationship could be confounded by age (17). The differences between velocities of bone loss in different parts of human body could be the main reason to osteoporosis. (18) Clinical conditions causing low estrogen environments in post menopause women allow increased local production of the bone – active cytokine and the progression of periodontal disease (19).

Women are more prone to develop osteopenia and osteoporosis , the bone loss accelerates with menopause when ovaries stop producing estrogen , the hormone that protects against bone loss (20). High frequency of osteoporosis among post-menopausal women may be as a consequence of lower socioeconomic level, scant sun exposure, low calcium diet, and lack of hormone that accelerate osteoporosis (21). A significantly lower BMD for lumbar spine and femoral neck in post-menopausal women have been due to physiological life style, poor calcium, and low activity factors (22). The bone resorption increases rapidly after the age of 50 years , thus the risk of fractures is significantly enhanced in this age group , more so for the patients who have osteopenia at the relatively younger age of 31-40 years (23).

In post menopausal osteoporosis , lack of estrogen leads to increased numbers of bone multi-cellular units and to uncoupling of bone formation and bone resorption , resulting in too little bone laid down by osteoblasts compared with the amount of bone reabsorbed by osteoclasts (24). The reasons for the protective effect of higher bone mineral index and the link between obesity and lowered osteoporosis risk are not fully understood, some experts have postulated that estrogen produced or stored in fat tissue might attenuate bone loss (25). A recent nationwide study with random sampling from five major cities reported a high prevalence (80%) for vitamin D deficiency in population (26). The primary argument for screening is that post menopausal women with low bone density are at increased risk for subsequent fractures of the hip , vertebra , and wrist and that intervention can slow the decline in bone density after menopause (27).

In conclusion, our results indicate a lower BMD in both LS and FN in post – menopausal women and more frequent osteoporosis than results in pre- menopausal women according T- score values.

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