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Research Article

Prevalence and risk factors for osteoporosis in Iraqi patients whom referred to Dual-Energy X-ray Absorptiometry (DEXA) scan unit at AL-Hassan AL-Mujtaba teaching hospital/Karbala-Iraq

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Abstract

Osteoporosis (OP) is a bone metabolic disorder, has an insidious, silent course, first diagnosed when a fracture occurs, can cause disability and may reduce patient's quality of life (QoL). This study aimed to evaluate the prevalence and risk factors that may predispose to osteoporosis. A cross-sectional study that was conducted at the Rheumatology Unit of Al-Hassan Al-Mujtaba Teaching Hospital, involving 80 Iraqi patients. Survey Questionnaire was administered thought interviews, bone density assessment conducted using DEXA of lumbar spine. According to T-scores DEXA results, patients were divided into 3 groups: normal bone density (T-score $\geq$ -1 SD), n=13, low bone density (T-score between -1 SD and -2.5 SD), n=37 and osteoporosis (T-score $\leq$ -2.5 SD), n=30. Study showed that 16.25% of patients have normal BMD, 46.25% exhibit low BMD, while 37.50% have been diagnosed with osteoporosis. Out of 80 patients, 71 (88.75%) were females and 9 (11.25%) were males. Most of the females (93.33%) had OP, (89.18%) had low BMD and (76.9%) had normal BMD. Therefore, osteoporosis can be seen in more than one third of those whom accidentally referred to DEXA, more common in females and its incidence increased with advancing age in both females and males with a mean age 10 years earlier in females than males especially in those with low estrogen (menopause and hysterectomy).

1. Introduction

Osteoporosis (OP) is a progressive disorder of the skeletal system, usually characterized by decreasing bone mass and micro architectural deterioration of bone tissues, making the bone fragile and more susceptible to fracture [1]. Its' more prevalent in elderly people, however, more than 200 million people worldwide are suffered from OP [2]. The prevalence increases with person age and tends to be affected by gender, race and ethnicity [3]. OP is more common in females than males [4], together, the lifetime risk of osteoporotic fractures is 44% for a female and 25% for a male [5]. In addition to female age, delayed age of menarche, early menopause, family history are common predisposing factors. Rheumatic diseases, endocrine dysfunction, malabsorption, malnutrition (calcium and vitamin D deficiency), physical inactivity, depression, chronic obstructive pulmonary diseases (COPD) and chronic steroid intake are common risk factors in both sexes [6]. The pathophysiology of OP is complex and multifactorial and mainly due to the imbalance between bone formation and bone resorption. Genetic, environmental and hormonal factors may play a role in the etiology of decreased bone mineral density [7]. Dual-energy X-ray absorptiometry (DXA) is an accurate and more precise method for the assessment of mass body composition and can be used for quantifying bone mineral density (BMD). It is an X-ray imaging technique, primarily derives the mass of one material in the presence of another one

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through the knowledge of the unique X-ray attenuation at different energies. Bone density scores can provide a knowledge to the physician whether the person at risk of osteoporosis depending upon T-scores and Z-score. T-score usually compare BMD of the patient with that of a healthy individual, while Z-scores depends on the 4 average BMD of people of the same age, sex, and size as a comparator [8]. Osteoblast and osteoclast are the two main cells participating in the process of bone formation and remodeling [9]. Osteoblasts are responsible for new bone formation, while osteoclasts are responsible for resorption of aged bone [10]. Both processes are stable under physiological conditions. However, when the balance is disturbed, bone structure or bone function are affected, resulting in bone metabolic disorders, such as osteoporosis [11]. World Health Organization (WHO) put a definition for osteoporosis as a state of low BMD, with a T-score during DEXA scan $\leq$ -2.5 in the vertebrae, hip bones and femoral neck. However, this definition does not include patients with normal BMD who have an osteoporotic fracture who are very important ([2, 3, 6, 9]. Three different processes can be used to explain changes in bone mass over the course of a person's life. The first phase, which might lead to reaching peak bone mass, is the culmination of growth (90–95%) and consolidation (5%–10%) [12, 13]. The second process which started for a cortical bone around the age of 40 and for a trabecular bone 5-10 years earlier than in both, continues to extreme age and similar in both cortical and trabecular bone and in men and women. The third process, which primarily affects women, is characterized by a disproportionate loss of bone (more trabecular bone than cortical bone) and is superimposed on the gradual phase of bone loss. It is a transitory, rapid post-menopausal bone loss caused by an estrogen deficit [14]. Bone remodeling units' is an anatomical discrete foci in which bone formation and bone resorption take place [15]. By undefined mechanism, at the beginning of each remodeling cycle, activation and retraction in the flattened lining cells to expose the underlying bone [16, 17]. OP can be silent and first diagnosed by fracture [18]. Back pain caused by vertebral compression is the most characteristic symptom, pain may be mild to severe, localized or radiated, lasts several days to weeks. Back pain may occur causing spinal deformity and ends in kyphosis and height loss in untreated or unsuccessfully treated patients [19, 20]. In the earlier stages, low bone mineral density can be expressed by decrease in cortical thickness and loss of bony trabeculae in plain radiograph and mainly recognized in vertebra, and long bones (neck or proximal femur), as showed in Figure 1, however, plain X-ray is not a sensitive modality for the diagnosis of OP as more than 30-50% bone loss is required to be captured by X-ray. Nevertheless, DEXA is the gold standard investigation for diagnosing osteoporosis [21]. Based on DEXA scan, BMD can be divided into three categories: normal BMD (low risk of fracture), low BMD or osteopenic (medium risk) and very low or osteoporotic (high risk). Measurement of BMD in grams/ centimeter 2 (g/cm 2) by central DEXA remains the gold standard, non-invasive measurement of BMD [22]. BMD results are converted into T-scores and Z-scores by the software of manufacturer's device. Both T-score and Z-score values are considered as a base for interpretation of BMD [23–25].

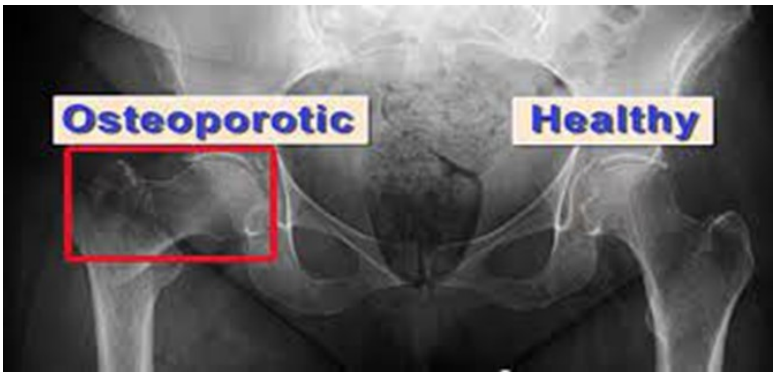

Figure 1: Plain X-ray of hip demonstrate healthy and osteoporotic bone

2. Methodology

Study Area, Design, and Population

A cross-sectional study was conducted at the Rheumatology Unit of AL-Hassan Al-Mujtaba Teaching Hospital, Karbala, Iraq from February, 2023 to March, 2024. The study included 80 Iraqi patients who visited the Rheumatology outpatient clinic for medical consultation and treatment and requested for doing DEXA scan. All attended patients were included without exclusion. All were evaluated by a rheumatologist in the outpatient clinic at the hospital by history, general and skeletal system examinations, and lab investigations and requested to do DEXA scan.

Sample size calculation

Sample size was calculated according to the equation $n = Z2p(1-p)/d2$
(n = sample size, Z = differential coefficient = 1.96, d = estimated error $<$ 0.05 and p prevalence of the problem (12%).

Research Instrument

A well-structured questionnaire was applied throughout direct interview with the patients.

3. Method of Data Collection

Following formal consent, a questionnaire administered for all for the purpose of determining risk factors of OP, low BMD and osteoporotic fracture. Osteoporosis diagnosis was suspected by rheumatologists by history, examination and certain lab investigations and tried to

be established by DEXA scan depending upon T-score value, patient with a T-score $\leq$ - 2.5 on DEXA scans were considered as having osteoporosis. The questionnaire was used to collect information on various factors potentially associated with osteoporosis, including demographic characteristics (age and gender), medical history, surgical history, family history, lifestyle factors (dietary habits and physical activity), history of OP fracture, family history of OP, certain medical conditions and drug history. The study was approved by ethical approval committee of medical college of Kerbala university, together, from the radiology unit (DEXA scan) of the teaching hospital. Informed consent was also taken from all included patients prior to inclusion.

Validity and Reliability of the Research Instrument

To determine the validity of the instrument, the researcher gave the questionnaire to the supervisor and other experts in related fields to ascertain the face validity of the instrument.

Method of Data Analysis

Data was entered in to Excel, 2022 spread sheet analyzed using Statistical Package for Social Sciences (SPSS) version 19. Data was expressed either in mean and slandered deviation or total number and percentage. Chi-Square test was used to determine any significant variance with a p-value ≤ 0.05 was considered as a significant difference.

4. Results

Table 1 illustrates the classification of patients who participated in the study according to BMD depending upon Z-score. About 16.25% of patients have normal bone mineral density, 46.25% exhibit low bone mineral density and the remaining 37.50% have been diagnosed with osteoporosis.

Table 1: Classification of patients according to BMD

Parameter	Numbers Of Patients	Percentage
Normal Bone Density	13	16.25%
Low Bone Density	37	46.25%
Osteoporosis	30	37.50%
Total	80	100%

While gender distribution is best illustrated in Table 2, from the 80 patients, 11.25% were males and 88.75% were females.

Table 2: Influence of Quality of health care workers on the utilization of health care services.

		Parameter (No.%)			
		Normal BMD	**Low BMD**	**Osteoporosis**	**Total**
Gender	Female	10 (76.9%)	33 (89.18%)	28 (93.33%)	71 (88.75%)
	Male	3 (23.07%)	4 (10.8%)	2 (6.66%)	9 (11.25%)
Total		13	37	30	80 (100%)

Table 3 shows the mean age of the included patients of both sexes in each groups. With the advancement of the age in both sexes, the risk of reduction in BMD and osteoporosis is increased respectively. Females are at higher risk with a mean age approximately 10 years less than mean male age.

Table 3: The mean age of the included patients in each group.

Parameter	**Normal BMD** ($Mean \pm SD$)	**Low BMD** ($Mean \pm SD$)	**Osteoporosis** ($Mean \pm SD$)
Female	34 ± 10.02	49.8 ± 10.53	65.41 ± 0.38
Male	55.33 ± 7.24	60.66 ± 9.78	76 ± 1.5

While the most common risk factors that might predispose to decrease BMD and OP are considered in Table 4.

Table 4: Common risk factor that may predispose to low BMD and OP among Patients.

	Parameter	Normal		Low Bone Density		Osteoporosis		P-value
		No.	%	No.	%	No.	%	
Risk Factors (Yes)	Sport (physical activity)	11	84.6%	22	59.5%	14	46.7%	**0.012**
	Stress	9	69.2%	31	83.8%	25	83.3%	0.375
	Weight loss	2	15.4%	8	21.6%	16	53.3%	**0.004**
	Previous fracture	0	0.0%	9	24.3%	23	76.7%	0.000
	Parent suffering from osteoporosis	3	23.1%	16	43.2%	11	36.7%	0.595
	Parent previous fracture	2	15.4%	12	32.4%	7	23.3%	0.847
	Hx of fall	1	7.7%	10	27.0%	20	66.7%	**0.000**
	Menstrual cycle	5	38.5%	13	35.1%	3	10.0%	**0.020**
	Hx of hysterectomy	0	0.0%	3	8.1%	5	16.7%	**0.082**
	Contraceptive drugs	3	23.1%	18	48.6%	9	30.0%	0.902
	PPI drugs	3	23.1%	20	54.1%	22	73.3%	**0.003**
	Anti-depressent drugs	0	0.0%	0	0.0%	0	0.0%	
	Anti-epileptic drugs	0	0.0%	0	0.0%	0	0.0%	
	Renal disease	2	15.4%	4	10.8%	7	23.3%	0.337
	Hyperthiorodism	0	0.0%	0	0.0%	3	10.0%	**0.049**
	Rheumatoid arthritis	3	23.1%	26	70.3%	21	70.0%	**0.016**
	Steroids	0	0.0%	9	24.3%	23	76.7%	**0.000**
	Cancer	1	7.7%	0	0.0%	4	13.3%	0.205
	Cardiovascular disease	2	15.4%	5	13.5%	12	40.0%	**0.027**
	Liver disease	2	15.4%	1	2.7%	4	13.3%	**0.774**
	Neurological disease	0	0.0%	3	8.1%	5	16.7%	0.082
	Celiac disease	0	0.0%	1	2.7%	1	3.3%	0.560
	Crohn disease	0	0.0%	0	0.0%	0	0.0%	
	Ulcerative colits	0	0.0%	0	0.0%	0	.0%	
	Irritable bowel syndrome	4	30.8%	9	24.3%	6	20.0%	0.448
	Asthma	1	7.7%	0	0.0%	1	3.3%	0.666
	Previous GIT surgery	1	7.7%	5	13.5%	4	13.3%	0.657
	Milk consumption	9	69.2%	17	45.9%	15	50.0%	0.390
	Smoking	4	30.8%	7	18.9%	5	16.7%	0.342
	Alcohol drinker	0	0.0%	1	2.7%	0	0.0%	0.762
	Carbonated drinks	8	61.5%	24	64.9%	14	46.7%	0.227
	Radiation exposure	1	7.7%	13	35.1%	21	70.0%	**0.000**
	D3 deficiency	9	69.2%	29	78.4%	19	63.3%	**0.031**
	D3 supplement	9	69.2%	23	62.2%	17	56.7%	0.433

5. Discussion

It is essential to understand the risk factors related to BMD reduction or osteoporosis so as to manage the disease effectively and come up with appropriate preventive measures against osteoporotic fractures. Addressing a sedentary lifestyle among other modifiable risk factors tallies with this while non-modifiable risk factor can only be addressed through screening for proper treatment [26]. Current study exhibited a statistically significant association between vitamin D3 insufficiency and the development of osteoporosis, p-value of 0.031. This discovery is consistent with the findings of a study carried out at the University Medical Center, Amsterdam, 2008 which similarly found a link between low levels of vitamin D3 and the risk of osteoporosis. Given that vitamin D3 is essential for calcium absorption and bone metabolism, its identification as a risk factor for bone health emphasizes how important it is [27]. Current study showed a significant association between osteoporosis and rheumatoid arthritis (RA), 70% of osteoporosis patients, totaling around 21 individuals, also suffered from RA. The associated p-value of less than 0.05 underscores the statistical significance. The connection between RA and osteoporosis can be attributed to several factors, including active systemic inflammation inherent to RA and chronic steroid intake which can lead to an increase [28]. The current study showed that (30 out of 80 patients), more than one-third of the patients suffer from osteoporosis, especially with the advancement of age, According to recent findings from the NHANES data, there has been a notable rise in the prevalence of low bone density across different age groups especially in the adulthood [29]. Together, 93.88% of the females in the current study showed signs of osteoporosis, especially with the increase in age due to low estrogen (menopause and hysterectomy), which is in agreement with a study that found women aged 50 years or older have a four times higher rate of osteoporosis compared with men During the study, we noticed an interesting rise in the number of people with osteoporosis who engaged in exercising we talking about engaging in physical activities, 14 out of 30 patients (46%) had this disease with a p-value of 0.012 showing that there was statistical significance to it. This result is consistent with a study done by Sigurdsson et al., in 2021, which examined the effect of exercise patterns on bone mass density (BMD). From their findings, it was concluded that over 57% of patients engaged in physical activities every week more than 4 hours. One important point that must also be mentioned is that the sedentary group had highly statistically significant lower median BMD than their active counterparts and at higher risk of hip fractures. Given that the processes of bone mineralization and resorption take several years to complete, this result is expected. In our study, we identified 12 patients diagnosed with osteoporosis who also had cardiovascular disease, yielding a statistically significant p-value of 0.027. This finding underscores a notable association between osteoporosis and cardiovascular

conditions among the study participants. Another research indicates a correlation between osteoporosis and cardiovascular as well as cerebrovascular diseases, highlighting shared pathophysiological mechanisms and risk factors. These factors include heredity, aging, poor dietary and lifestyle habits, endocrine imbalances, smoking, sedentary lifestyle, and alcohol misuse [30]. We found that about 21 (70%) diagnosed with osteoporosis had previous radiation exposure and a significant p-value (0.000), result in another study showing that radiation has harmful effects on bone mineral density. Bone atrophy and bone fractures increase in patients after exposure to radiation [31] Also, we found that patients with weight loss suffer from osteoporosis 16 (53.3%) with a p-value of (0.004), It is clear that a low body weight increases osteoporosis risk, and a more generous body weight some protection against osteoporosis and related fracture risk [32]. about 26 (76.7%) of the osteoporosis patients had a previous fracture with a highly significant p-value (0.000), another study found patients with a positive fracture history had lower BMD and there was a significant relationship between OP and fracture history and that is an agreement with our result [33]. Finally, we found in our research about 23 (76.7%) of patients who suffer from osteoporosis take steroids with a p-value of (0.000), Given their potent immunosuppressive properties, steroids represent a valuable class of medications extensively employed in managing inflammatory and autoimmune conditions. The discovery of cortisone and cortisol in the 1930s marked a significant milestone, leading to the successful utilization of synthetic glucocorticoid derivatives across various medical specialties, notably in rheumatology [34]. However, prolonged steroid use is associated with commonly recognized adverse effects including diabetes, osteoporosis, and increased susceptibility to infections.

6. Conclusion

Osteoporosis may involve more than one third of population, more common in females and its incidence increased with advancing age in both females and males with a mean age 10 years earlier in females than males especially in those with low estrogen (menopause and hysterectomy). Common predisposing factors are physical inactivity, decreased weight, steroid use, using PPI drugs, previous fracture, history of fall, radiation exposure, hyperthyroidism, rheumatoid arthritis, Cardiovascular diseases and vitamin D deficiency.

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