A Study of the Relationship between Osteoporosis with Demographic Characteristics and Some Other Factors by Using Bone Densitometry

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Abstract

Background: Osteoporosis presents to be a major public health problem because it is associated with increased morbidity and mortality, particularly hip and vertebral fractures, which are a huge burden on the health system due to the high economic costs of those care fractures and disability derivatives they produce.
Objectives: This study aims to determine relationships between osteoporosis and some factors (demographic factors, menstrual and obstetrical factors in females and life style).
Materials and Methods: The study was carried out on 235 person, 150 of them had been referred to the Rheumatology-Rehabilitation unit in Marjan teaching hospital and considered them as a patients group and 85 of them were completely healthy people without any history of diseases and considered as healthy group. The risk factors were assessed from the patients' interview and bone mineral density measurement had been done for each one of them**.**
Results: The results of this study showed high significant association between osteoporosis and aging ,female gender, low body mass index probability value of ($p<0.05$), Also being menopause, long time since menopause specially more than 10 yeas and high parity number (more than 4 children) were significantly associated with osteoporosis($p<0.05$). High incidence of osteoporosis was found among people with low educational level and those lived in crowded urban areas at ($p<0.05$ for each criterion respectively).
Conclusion: Osteoporosis in our population appears to be associated with several risk factors include (older age, female gender, low body mass index, menopause, long time since menopause, high parity number, low education and living in urban areas. All that may contribute to the adverse prognosis associated with osteoporosis**.**

الخلاصه

هشاشة العظام هي مشكلة صحية رئيسية عامه لأنها ترتبط مع زيادة معدلات الاعتلال والوفيات، وخاصة كسور الورك العمود الفقري، والتي تشكل عبئا كبيرا على النظام الصحي بسبب التكاليف الاقتصادية الباهظة لرعاية هذه الكسور و الاعاقه التي تنتج عنها. تهدف هذه الدراسة إلى تحديد العلاقه بين هشاشة العظام وبعض العوامل (العوامل الديموغرافية، والعوامل المرتبطه بالطمث والولاده عند الإناث، ونمط الحياة). أجريت هذه الدراسة على ٢٣٥ شخص، ١٥٠ منهم ممن قد احيلوا الى وحدة أمراض المفاصل والتأهيل الطبي، وتم اعتبارها كمجموعة المرضى و ٨٥ منهم كانو امن الأشخاص الأصحاء تماما من دون أي تاريخ مرضي وتم اعتبارهم مجموعة صحية ،وقد تم تقييم عوامل الخطر من خلال مقابلة المرضى وقياس كثافة المعادن بالعظام التي تم اجراؤها لكل مريض.
أظهرت نتائج هذه الدراسة علاقه معنوية عالية بين هشاشة العظام وبين الشيخوخة، الجنس الأنثوي، ومؤشر كتلة الجسم المنخفض ($P<0.05$). أيضا اظهرت النتائج ان بلوغ سن اليأس وبلوغه منذ وقت طويل خصوصا أكثر من ١٠ اعوام وانجاب عدد كبير من الاطفال (أكثر من ٤ أطفال) كانت مرتبطة بشكل كبير مع مرض هشاشة العظام($P <0.05$) . بالاضافه الى ذلك نسبة عالية من مرض

هشاشة العظام وجدت بين الناس ذوي المستوى التعليمي المنخفض وأولئك الذين يعيشون في المناطق الحضرية المزدحمة (P<0.05 لكل منهم)

يظهر مرض هشاشة العظام في مجتمعنا ليكون مرتبطا مع عدد من عوامل الخطوره وتشمل (التقدم في السن، الجنس الأنثوي، ومؤشر كتلة الجسم المنخفض، وسن اليأس،بلوغ سن اليأس لفتره طويله، وزيادة عدد الاطفال ،المستوى التعليمي المنخفض، السكن في المناطق الحضرية. كل هذه العوامل تسهم في التكهن بالنتائج السلبية المرتبطة بهشاشة العظام.

Introduction

Osteoporosis is a silent skeletal disorder characterized by compromised bone strength that predisposes individuals to an increased risk of fracture. It is the most common metabolic bone disease, affecting one in two women and one in five men aged >50 years in the western world [1].

Traditionally, osteoporosis has been classified as primary (includes postmenopausal and age - related bone loss) or secondary (where bone loss is accelerated by the presence of an underlying disease). Secondary osteoporosis accounts for up to 40% of cases of osteoporosis in women and 60% of cases in men [2]. It is no longer regarded as an inevitable result of aging but as a preventable and treatable disorder [3].

It's a multi-factorial disorder and its occurrence is determined by many factors, notably lifestyle, medications, genetic susceptibility, and interactions between these factors [4].

Osteoporosis is a major health burden [5]. Because fragility fractures, the consequence of osteoporosis, are responsible for excess mortality, morbidity, chronic pain, admission to institutions and economic costs [6,7]. They represent 80% of all fractures in menopausal women over age 50 [8]. Those with hip or vertebral fractures have substantially increased risk of death after the fracture [9]. The 1-year mortality of elderly patients with hip fracture is approximately 24% [10].

Identification of modifiable factors that can reduce fractures is important for healthy aging and reducing the social, medical and personal costs of fracture [5]. So the better understanding of the mechanisms that result in fractures is considered an essential step in the early recognition and identification of patients at highest risk of future fracture(s) to better target candidates for preventive measures and therapeutic interventions [4].

The Aim of the Study

This study aimed to show the relationship between the osteoporosis and each of the following, which can provide an insight to future planes for possible of early detection, prevention and treatment measures.

1. Demographic characteristics of patients as age, gender and body mass index (BMI).
2. Menstrual and obstetrical history (menopaused or not, time since menopause and number of children).
3. Life style: address, educational background of the patients and smoking.

Material and methods

The study conducted from November /2012 to May /2013, two hundred thirty five person of both genders (139 females and 96 males) were included to achieve the aim of study at Marjan teaching hospital in Babylon Province.

Since osteoporosis is a silent disease, we selected randomly 150 patients (81 females and 69 males) their age range (30-76 years) with mean (54.8 ± 11) whom suffered from low back pain and bone pain. They were refer to Rheumatology-Rehabilitation unit for examining by specialist doctor considering their complain as a searching tool for our study. Then we chose 85 healthy person (58 females and 27 males) their age range (31-78 years) with mean (55.6 ± 12) and sex distribution is similar to those with low bone mineral density of the patients group to measure their bone mineral density, if they had osteoporosis or not and study their risk factors for getting this disease if present and compare it with patient group.

All people whom enrolled in this study underwent medical history that assessed from their interview to include: name, age, gender, body weight, height, address, educational background as well as history of chronic disease such as hypertention, endocrine disease, gastrointestinal disease, oncological diseases, rheumatological diseases and history of drug use. Also we asked about family history of osteoporosis (paternal and maternal), personal history of getting fragility fracture and smoking habit.

Female patients were asked about menopausal state and its duration for menopausal women and considered a women postmenopausal if they experienced their last menstrual cycle at least 1 year prior to the study [11]. Also we asked about the number of children if they got married and divided them into four groups according to the number of children as follow: A nulliparous woman (nullip) has not given birth previously, a primiparous woman has given birth once, a multiparous woman (multip) has given birth more than once and a grand multipara is a woman who has already delivered five or more infants who have achieved a gestational age of 24 weeks or more [12].Patients and healthy groups were classify into three groups according to their age as: young aged (20 to 39 years), middle-aged (40 to 59 years) and elderly adults (60 To 89 years) [13]. And according to their educational level (years of study) into four groups; group1 (0 -6 years), group2 (7 -9 years), group3 (10-12 years), group4 (≥ 13 years) [14].

Exclusion criteria were: patient refuse, pregnant women, inability to attain the correct position and/or remain motionless for the measurement, extreme obesity or extremely low body mass index that may inversely affect the technique and the ability to obtain accurate and precise measurements, patient already had been diagnosed to have osteoporosis and on treatment, patient recently had gastrointestinal contrast or radionuclides and patient with incomplete information or incomplete tests.

Body mass index (BMI) measurements:

Weights and heights of patients were measured without shoes in light indoor clothing by the use of well calibrated digital weight and height scale measuring device, BMI was calculated by dividing weight in kilograms by the square of the height in meters as in the equation : weight (kilograms) /height (meters)^2 [15].

Bone mineral density (BMD) measurements:

BMD measured at the lumbar spine (L1–L4) (anteroposterior view) by a trained technician using the bone densitometer, (DEXXUM3) and the

same equipment is used in all patients and healthy groups. BMD was expressed as T-score considering the diagnostic criteria for osteoporosis established by World Health Organization (WHO).

WHO criteria for osteoporosis attempted to clarify definitions and to assist clinicians in their interpretation of bone densitometry results, a normal value for bone mineral content is within 1 standard deviation (SD) of the mean value for young adults of the same age and sex (that is, the T score is more than -1). Osteopenia is considered to be present when the value for bone mineral content is more than 1 SD but not more than 2.5 SDs below the mean for young adults (that is, the T score is less than -1 and more than -2.5). Osteoporosis is considered to be present when the value is more than 2.5 SDs below the mean bone mineral content for young adults (that is, the T score is less than -2.5) [16].

Statistical Analysis:

The data were analyzed by using of computer SPSS program and taking $p < 0.05$ as the lower limit of significant. Chi-square or Fisher exact test when needed used to examine the differences between different groups [17].

Results

1. Age distribution:

All subjects whom enrolled in this study were divided according to their age into three groups. The incidence of osteoporosis was statistically significant among elderly age at $p<0.05$ in both patient and healthy groups as shown in table (1).

Table 1 Incidence of osteoporosis according to age in patients and healthy groups.

Groups	Age (years)	No.	Osteoporosis No. (%)	Sig.
Patients (150)	Young (20-39)	17	(5) 29.40%	P<0.05
	Middle (40-59)	74	(23) 31.10%	
	Elderly (≥60)	59	(32) 54.20%	
Healthy (85)	Young (20-39)	11	(0) 0.00%	P<0.05
	Middle (40-59)	38	(1) 2.60%	
	Elderly (≥60)	36	(12) 33.30%	

2. Gender:

Statistical analysis revealed that the incidence of osteoporosis among female in patient group (N=81) was (50.60%) and among female in healthy group (N=58) was (20.70%) in

comparison to incidence of osteoporosis among male in patient group (N=69) we found that it was (27.50%) and among male in healthy group (N=27) it was (3.70%). Study results shows there is high significant difference in incidence of osteoporosis among gender with significant relationship between female gender and osteoporosis at p<0.05 in both patient and healthy groups as shown in table (2).

Table 2 shows the incidence of osteoporosis according to gender in patient and healthy groups.

Groups	Gender	No.	Osteoporosis No. (%)	Sig.
Patients (150)	Females	81	(41) 50.60%	P<0.05
	Males	69	(19) 27.50%	
Healthy (85)	Females	58	(12) 20.70%	P<0.05
	Males	27	(1) 3.70%	

3. Body mass index (BMI):

The mean of BMI for patient group was (24.7 ± 3 Kg/m^2) and for healthy group was (27.1 ± 3 Kg/m^2). In this study we found that people with osteoporosis had significant low BMI in (Kg/m^2) as shown in table (3) in comparison with people who did not have osteoporosis in both patient and healthy people (p<0.05).

Table 3 Shows (mean ± SD) of BMI in both patient and healthy groups.

Variable	Groups	Osteoporosis Mean ± SD (in Kg/m^2)	No osteoporosis Mean ± SD (in Kg/m2)
BMI	Patients	21.2 ± 1.3*	28.1 ±2.2
	Healthy	20.5 ± 1.7*	29.1 ± 1.7

SD=Standard deviation ,* P<0.05

4. Menopausal state:

The study shows that in patient group, out of 50 menopaused females 32 (64%) had osteoporosis, while out of 31 non menopaused females only 9 (29%) had osteoporosis and in healthy group out of 37 menopaused females 12 (32.4) had osteoporosis, while no female had

osteoporosis among non menopaused females as shown in table (4). Result shows high significant incidence of osteoporosis among menopaused female in comparison to non menopaused at p<0.05 in both groups.

Table 4 shows the incidence of osteoporosis according to menopausal state in patient and healthy groups.

Groups	Menopause state	No.	Osteoporosis No. (%)	Sig.
Patients (81)	**Menopause**	50	(32) 64 %	P<0.05
	Non-menopaus	31	(9) 29 %	
Healthy (58)	**Menopause**	37	(12) 32.4 %	P<0.05
	Non-menopaus	21	(0) 0.0 %	

5. Menopausal duration:

As illustrated in table (5), our results show that the osteoporosis is more prevalent in female with long duration of menopause. In patient group (50 menopused females) the incidence of osteoporosis in female with more than 10 years of menopause was (87.5%) in comparison with (77.8%) and (23.5%) in female with 6-10 years and less than 5 years of menopause respectively. Healthy group (37 menopaused females) show similar results which is high incidence of osteoporosis among females with more than 10 years of menopause (53.3%) when compared with (12.5%) and (21.4%) incidence in females with less than 5 years of menopause and 6-10 years respectively. So, there is significant association between long duration of menopause and osteoporosis at p<0.05.

Table 5 shows the incidence of osteoporosis according to menopausal duration in patient and healthy groups.

Groups	Duration (years)	No. of each groups	Osteoporosis No. (%)	Sig.
Patients (50)	**1_5**	17	(4) 23.5 %	P<0.05
	6_10	9	(7) 77.8 %	
	>10	24	(21) 87.5%	
Healthy (37)	**1_5**	8	(1) 12.5 %	P<0.05
	6_10	14	(3) 21.4 %	
	>10	15	(8) 53.3 %	

6. Number of parity:

Search of this study, in both patient and healthy groups, shows that the incidence of osteoporosis was increase significantly among females when their number of child increase, and as shown in table (6) the incidence of osteoporosis in patient group was (0%) among both nullparous and primiparous. While it's increase to (28.1%) and (72.7%) among multiparous and grand multiparous respectively and in comparison it with healthy group as result found that nearly similar result of high incidence of osteoporosis among multiparous and grand multiparous as (8%) and (33.3%) respectively when compared to (0%) incidence in both nullparous and primiparous.

This result shows significant difference in incidence of osteoporosis according to number of children with significant incidence among female with 5 children or more at $p<0.05$.

Table 6 shows the incidence of osteoporosis according to number of parity in patient and healthy groups.

Groups	Parity	No.	Osteoporosis No. (%)	Sig.
Patients (81)	Null (0 child)	5	(0) 0.0 %	P<0.05
	Primi (1 child)	0	(0) 0.0 %	
	Multi (2-4 child)	32	(9) 28.1 %	
	Grand multi ≥ 5 cildren	44	(32) 72.7 %	
Healthy (58)	Null (0 child)	2	(0) 0.0 %	P<0.05
	Primi (1 child)	1	(0) 0.0 %	
	Multi (2-4 child)	25	(2) 8.0 %	
	Grand multi ≥ 5 cildren	30	(10) 33.3 %	

7. Address:

As shown in table (7) for patient and healthy group, the study revealed that the incidence of osteoporosis among people who lived in urban areas was (63.6%) in patient group and (22.9%) in healthy group while the incidence of osteoporosis in people who lived in rural areas was (15.1%) in patient group and (5.4%) in healthy group. So, present results show that in both groups there is a high significant incidence of osteoporosis among people who lived in urban areas at $p<0.05$.

Table 7 shows incidence of osteoporosis according to address in patient and healthy groups.

Groups	Address	No.	Osteoporosis No. (%)	Sig.
Patients (150)	**Urban**	77	(49) 63.6 %	P<0.05
	Rural	73	(11) 15.1 %	
Healthy (85)	**Urban**	48	(11) 22.9 %	P<0.05
	Rural	37	(2) 5.4 %	

8. Educational level:

We divided people in patient and healthy groups into four subdivision according to the number of years of education as shown in table (8). Therefore, statistical analysis revealed that the incidence of osteoporosis in patient group was (60.7%) among people with (0-6 year of education), (38.9%) among people with (7-9 year of education), (31.8%) among people with (10-12 year of education) and (13.9%) in people with (> 12 year of education), in comparison to the healthy group the incidence of osteoporosis was (30%) in people with (0-6 year of education), (21.4%) in people with (7-9 year of education), (9.1%) in people with (10-12 year of education) and (0%) in people with (> 12 year of education).

Result shows significant difference in incidence of osteoporosis according to the level of education in both patient and healthy groups with high incidence in people with low level of education at p<0.05.

Table 8 shows the incidence of osteoporosis according to years of education in patient and healthy groups.

Groups	years of education	No.	Osteoporosis No. (%)	Sig.
Patients (150)	**0 - 6**	56	(34) 60.7 %	P<0.05
	7 - 9	36	(14) 38.9 %	
	10 - 12	22	(7) 31.8 %	
	≥ 13	36	(5) 13.9 %	
Healthy (85)	**0 - 6**	30	(9) 30 %	P<0.05
	7 - 9	14	(3) 21.4 %	
	10 - 12	11	(1) 9.1 %	
	≥ 13	30	(0) 0.0 %	

Discussion

1. Age:

The present study found that the elderly age group more than 60 years old have a great incidence for getting osteoporosis and this result is closely matching with other research [18,19,20]. The probable explanation is that the balance of cellular activity is altered with ageing process, with a reduced osteoblast response to continued bone resorption, so the resorption cavities are incompletely filled by a new bone formation during the remodeling cycle [21].

2. Gender difference:

Results of this work shows that the female gender more prone to have osteoporosis than men and this is agree with other studies [22,10]. This is largely because of their greater peak bone mass at skeletal maturity and because they do not undergo the period of accelerated bone loss that women do during menopause [23].

3. Body mass index (BMI):

Our result revealed high incidence of osteoporosis among people with low BMI, so this factor was negatively associated with the BMD; this result is consistent with other studies [24,7,19]. The association between body weight and BMD could be explained in various ways. Firstly, subjects with a higher body weight may be subjected to larger loading on the skeleton, which would result in a higher bone mass. Secondly, better nutrition may result in both a higher skeletal bone mass and a higher body weight. Thirdly, the same genes may determine both body mass and bone mass [25].

4. Menopause:

The present study shows high significant difference ($p<0.05$) among menopausal female in comparison with non menopausal one and this finding is consist with other studies reportedly by [26] recorded that post-menopausal status was associated with a decrease in both spinal and femoral neck BMD and [27] mentioned a decrease in lumber spine BMD for each year post-menopause. Also [28] found the spinal and femoral neck BMD were significantly decreases with menopause. The increased rate of bone resorption immediately after menopause clearly indicates a hormonal influence on bone density in women and the most likely explanation for this increased resorption is the drop in ovarian estrogen production that accompanies menopause [29].

5. Duration of menopause:

As previous knowledge explain the role of estrogen in maintaining the BMD especially for women and the effect of estrogen deficiency after menopause predictably leads to bone loss and osteoporosis, our study shows that the long duration of estrogen loss (long duration of menopause) will add more burden on bone health and increase more risk for developing of osteoporosis and this results were being matches with other results got by [30] who stated that osteoporosis is related more to the duration of menopause at the time of BMD measurement rather than the age at menopause among untreated postmenopausal women, [31] who mentioned that the postmenopausal period more than 5 years has been shown as risk factors of osteoporosis.

6. Number of parity:

Our study revealed that the women with high number of children are more prone to have osteoporosis than others who had fewer children and this results are supported by other workers [31,32,11]. This is can be explained by

the accumulation of calcium in a full term neonate during pregnancy is approximately 30g, with approximately 95% of that calcium located in the skeleton so BMD is adversely affected because of calcium loss and if the maternal bone mineral were the sole source of calcium, the mother's skeleton would lose about 3% (30g/1000g) of its mineral per pregnancy. This effect could be especially important in multiple pregnancies and extended lactations [33]. In addition to that the usual high birth rate and short period between births in our society (the region where the present investigation took place), the BMD was adversely influenced by an increase in the number of births.

7. Address:

In the present study, we have shown that BMD in a rural population was significantly higher than in urban population, for both patient and healthy groups. When we compare the present study's results to previous studies' we found differences in methodology and study design. For instance [34] reported that lumbar spine BMD (measured by DEXA) in rural adolescents was significantly higher than that in urban adolescents, but there was no significant difference in femoral neck BMD. Furthermore, a study from Southern Sweden [35] suggested that bone mass at the forearm (measured by single-photon absorptiomety) in rural population was significantly higher than in urban population and the difference was more pronounced when comparing a true urban population who had lived their entire life in a city with a true rural population who had never lived in a city. The difference may be attributed to the difference in physical activity between the two populations. Rural populations were generally more physically active than urban populations. The men and women of the rural area were found to be significantly more active physically at work and during spare time. Housing was larger in the rural area [36].

8. Educational level:

Results of this study show that the education level is one of the most important demographic factors that associate with Osteoporosis. Reverse effects of education level in causing osteoporosis have been reported in some other studies [37,31]. The reason probably is the effect of education on lifestyle, nutrition, health care, good hygiene and economic status. The other possibility is the effect of economic status in education level. People from well to do families have more facilities for continuing their education and they also have better nutritional and health status during childhood which affect the peak bone mass [31].

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