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Changes in Bone Mineral Density in a Sample of Iraqi Patients with Premature Grayness In Comparison With Healthy Controls

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Abstract:
Objectives: *To evaluate the changes in bone mineral density in a sample of Iraqi patients with premature grayness in comparison with healthy controls.*
Patients And Methods: *A sample of one hundred Iraqi patients with premature grayness and convenient sample of one hundred healthy individuals matched for age and gender served as a control group were included in this case descriptive comparative study. These patients and controls were selected from outpatient clinic-Department of Dermatology-Baghdad Teaching Hospital as companion with patients attending the clinic of Rheumatology and Medical Rehabilitation of Baghdad Teaching Hospital and students from Faculty of Medicine of Baghdad University in Iraq. This work was conducted during the period between November 2011 and April 2012.*
Bone mineral density was measured by dual energy X-Ray absorptiometry of hips and lumbar spines for both patients and healthy controls after measuring their height and body weight. A T-score of ≤ -2.5 standard deviation that of young, healthy adults was taken as osteoporotic and scores between 1 -2.5 standard deviation was taken as osteopenic. Informed consent was obtained from individuals in both groups.
Results: *The analysis of dual energy X-Ray absorptiometry of the hips and lumbar spines revealed that the number of patients with premature grayness having osteopenia was 28(28%),compared to 12(12%)among X-Ray controls, which is highly significant p-value (0.0046).Osteoporosis was not recorded neither in the patients nor in healthy controls. Regarding to the severity of grayness, the number of patients with severe grayness having osteopenia was 14 (40%), compared to 6 (15.75%) among patients with mild grayness which is significant (p-value 0.059), while the number was 8 (29.62%) among patients with moderate grayness, compared to 14(40%) among patients with severe grayness, which is non-significant (p-value 0.397). According to the duration of premature grayness, the number of patients with disease duration >10 years having osteopenia was 15 (39.48%), compared to 4 (14.28%) among patients with duration ≤ 5 years which is highly significant(p-value =0.026), while the number was 9 (26.47%) among patients with 6-10 years duration, compared to 15(39.48%) among patients with disease duration >10 years, which is non-significant (p-value=0.243). While depending to the age of patients with premature grayness, the number of patients with age > 25 years old having osteopenia was15 (35.71%), compared to 13(22.41%) among patients with age ≤ 25years old, which is non-significant (p-value=0.144).*
Conclusion: *There was a strong association between premature grayness and reduction of bone mineral density.*
Keywords: *premature grayness of hair, bone mineral density,osteopenia*.

I. Introduction

Grayness of hair is considered a normal physiology of aging process that usually seen after the age of forty as a result of dysfunction or loss of melanocytes at the hair matrix.[1,2] Grayness of hair might start at the earlier age so, called premature grayness (PGH) [3] and this type of grayness is associated with certain organ specific autoimmune diseases like pernicious anemia, hypothyroidism and others and these diseases in collection have a genetic predisposition.[4] Also, this has been supported by the discovery of glycosylated Hb in patients with premature hair grayness. The detection of elevated glycosylated hemoglobin in patients with premature grayness of hair was similar to what has been reported in diseases with possible autoimmune etiology such as vitiligo.[5, 6] These changes together with the well-documented association between premature grayness of hair and autoimmune diseases can support the autoimmune etiology of premature grayness of hair.

As Muslims we always read the verse in Quran, Allah saying(He said: "My Lord! Indeed my bones have grown feeble, and gray hair has spread on my head, and I have never been unblest in my invocation to You, O my Lord!). [7]

From this verse we understand that grayness of hair might go parallel with osteopenia and osteoporosis. As osteoporosis is common among elderly, accordingly this work was designed to choose the PGH among young people in order to evaluate the frequency of osteoporosis among these patients.

II. Patients And Methods

This case descriptive comparative study was conducted during the period between November 2011 and April 2012.The study consisted of 100 Iraqi patients with premature grayness and convenient selected sample of 100 healthy Iraqi individuals matched for age and gender served as a control group were included in this work. These patients and controls were selected from outpatient clinic-Department of Dermatology-Baghdad Teaching Hospital as companion with patients attending the clinic of Rheumatology and Medical Rehabilitation of Baghdad Teaching Hospital and students from Faculty of Medicine of Baghdad University in Iraq. Both patients and controls were male gender with their ages range between 20-30 years with a mean ± SD of 24.90± 2.85 years for patients and 24.75± 2.65 for controls. The severity of grayness of hair was graded according to Sharquie's scoring [5] as follow:

Mild grayness: grayness of hair that can be noticed with difficulty.

Moderate grayness: grayness of hair that could be seen obviously with naked eye. **Severe grayness**: grayness of hair that involved most of the scalp, and beard area.

The duration of PGH was considered as follows:

Patients with PGH of 1-5 years duration, patients with 6 - 10 years duration and patients with > 10 years duration. [5]

Exclusion criteria were done in this study for both patients and controls who had risk factors for osteoporosis like smoking, alcohol intake, low body weight, chronic diseases like diabetes mellitus and hyperthyroidism, chronic rheumatological diseases like rheumatoid arthritis and ankylosing spondylitis, and drugs like steroids, anticonvulsants and thyroxine.

Formal consent was obtained from both patients and controls after full explanation about nature of present study and the goal of the present work. Also, ethical approval was taken from the Scientific Council of Rheumatology-Iraqi Board for Medical Specializations.

Bone mineral density was measured by DXA (dual energy X-Ray absorptiometry) of hips and lumbar spines for both patients and controls after measuring their height and body weight to calculate their body mass index. A T-score of ≤ -2.5 SD that of young healthy adults was taken as osteoporotic and scores between 1 to 2.5 SD was taken as osteopenic.

Data were coded and entered in the computer using the available statistical packages SPSS-18 (Statistical Packages for Social Sciences version 18). Data were presented in simple measures of frequency, percentage, mean and standard deviation. Chi-square test for independence and Fisher exact test used to test the association between discrete variables as appropriate while t-test was applied for the difference between two independent means. Findings with P value less than 0.05 were considered significant.

III. Results

The analysis of DXA of hips and lumbar spines revealed that the number of patients with premature grayness having osteopenia was: 28(28%)patients, compared to 12 (12%) among controls, which was statistically highly significant, (p-value=0.0046). Bone mineral density was significantly lower in patients with premature grayness than controls in both hips and lumbar spines, p-value (0.0001) (Table -1).Osteoporosis was reported neither in patients nor in controls.

The frequency of osteopenia was more common in lumbar spines among controls (67%) than in right hip (50%) and left hip(42%), while it was more common in left hip among patients with premature grayness (64%) than in right hip (61%) and lumbar spines (50%) respectively (Table- 2).

Thirty eight(38%) patients had mild grayness, while 27(27%)patients had moderate grayness, and other 35 (35%) patients had severe grayness.

Twenty eight (28%) patients had disease duration of 1-5 years, 34(34%) patients had disease duration of 6-10 years and 38(38%) patients had disease duration more than 10 years.

According to the severity of grayness, the number of patients with severe grayness having osteopenia was: 14 (40%), compared to 6 (15.75%) among patients with mild grayness which was statistically significant(p-value 0.059).Bone mineral density was significantly lower in patients with severe grayness than in patients with mild and moderate grayness in both hips and lumbar spines, p-value (0.036), (0.004) in right hip, (0.0001),(0.005) in left hip and (0.0001),(0.012) in lumbar spines respectively (Table -3).

According to the duration of PGH, the number of patients with disease duration >10years having osteopenia was 15(39.48%), compared to 4(14.28%) among patients with ≤ 5 years which was statistically highly significant, p-value (0.026), while the number was 9(26.47%) among patients with 6-10 years duration, compared to 15(39.48%) among patients with disease duration >10 years, which is nonsignificant, p-value (0.243).

Bone mineral density was significantly lower in patients with disease duration >10 years than patients with ≤ 5 and 6-10 years, in both hips and lumbar spines, p-value (0.028),(0.003) in right hip,(0.0001),(0.0001) in left hip and (0.014),(0.024) in lumbar spines respectively (Table -4).

Although osteopenia was reported more frequently among PGH over the age of 25 years 15 (35.71%), compared to 13(22.41%) among patients with age ≤ 25 years old, but the difference was non-significant, p-value (0.144). Bone mineral density was significantly lower in patients with age > 25 years than patients with age ≤ 25years in left hip and lumbar spines, p-value (0.001) in left hip, (0.016) lumbar spines while it was non-significant in right hip, p-value (0.439) (Table- 5).

Table -1: Frequency of osteopenia and mean BMD among 100 patients with PGH and 100 controls.

Subject		PGH	Control	
Total No. of individuals		100	100	
BMD g/cm²	Rt. hip	1.032± 0.077	1.141± 0.109	0.0001*
	Lt. hip	0.989± 0.052	1.117± 0.122	0.0001*
	L. spines	0.979± 0.042	1.096± 0.103	0.0001*
No. of patient with Osteopenia		28	12	
Frequency of osteopenia		28.0%	12.0%	
P-value using Chi-square test		0.0046*		

*Significant
BMD=Bone mineral density.
PGH=Premature grayness of hair.

Table -2: Frequency of osteopenia and mean BMD according to DXA site in patients and controls.

DXA site	RT hip	LT hip	L.S
Controls (n=12)	6	5	8
Frequency of osteopenia	50%	42%	67%
PGH (n=28)	17	18	14
Frequency of osteopenia	61%	64%	50%
P- value	0.0147*	0.0093*	0.175

* Significant

DXA= Dual energy X-ray absorptiometry.
PGH= Premature grayness of hair.

Table-3: Frequency of osteopenia and mean BMD in patients according to severity of grayness.

Severity of Grayness		A Mild	B Moderate	C Severe	P value / A & C	P value / B & C
No. of patient		38	27	35		
BMD g/cm²	Rt.hip	1.037±0.066	1.065±0.072	1.001±0.081	0.036*	0.004*
	Lt.hip	1.007±0.037	1.004±0.051	0.959±0.053	0.0001*	0.005*
	L.spines	0.992±0.020	0.989±0.043	0.958±0.051	0.0001*	0.012*
No. of pt. with osteopenia		6	8	14		
Frequency of osteopenia		15.75%	29.62%	40.0%		
P value using Chi-square test compare to C		0.059*	0.397	-		

*Significant
BMD=Bone mineral density.

Table -4: Frequency of osteopenia and mean BMD in patients according to disease duration.

Disease duration		A 1-5 y	B 6-10 y	C > 10 y	P value / A & C	P value / B & C
No. of patient		28	34	38		
BMD g/cm²	Rt.hip	1.044±0.070	1.056±0.068	1.001±0.080	0.028*	0.003*
	Lt.hip	1.008 ±0.041	1.005±0.043	0.961±0.054	0.0001*	0.0001*
	L .spines	0.990±0.017	0.988±0.038	0.963±0.053	0.014*	0.024*
No. of pt. with osteopenia		4	9	15		
Frequency of osteopenia		14.28%	26.47%	39.48%		
P value using Chi-square test compared to C		0.026*	0.243	-		

*Significant
BMD=Bone mineral density.

Table -5: Frequency of osteopenia and mean BMD according to the age of the patients.

Age		20 - 25y	26- 30 y	P value using t-test
No. of patient		58	42	
BMD g/cm²	Rt.hip	1.037±0.068	1.025±0.088	0.439
	Lt.hip	1.003±0.038	0.969±0.061	0.001*
	L .spines	0.988±0.031	0.967 ±0.052	0.016*
No. of pt. with osteopenia		13	15	
Frequency of osteopenia		22.41%	35.71%	
P value using Chi-square Test		0.144		

*Significant
BMD=Bone mineral density.

IV. Discussion

Aging process affects all systems of the body including bones and hair, and osteoporosis in elderly might go parallel with the senile grayness of hair. While PGH has been reported commonly before age of forty [8,3], and has been considered as a variant of vitiligo.[9,10] Glycosylated Hb and increased oxidative stress had been noticed in patients with PGH.[11,5] Both vitiligo and PGH have been associated with other autoimmune diseases like pernicious anemia, hyperthyroidism, DM,… etc.[12, 4]

The verse in Quran saying that grayness of hair goes parallel with osteoporosis inspired us to conduct this study. The present work had confirmed close association between PGH and osteopenia and this association increased with the severity of grayness of hair.

These findings are in agreement with other studies that found a positive association between PGH and low bone mineral density (Orr- Walker et al., 1997) and (Rosen et al., 1994). [13,14]

Rosen et al., 1994 showed that people with gray hair by age 40 are 4.4 times more likely to suffer from osteoporosis.[14]

It is difficult to explain this close association between PGH and osteopenia but we can speculate the following linkages between the two problems:

1- As mentioned, the well-documented association between premature grayness of hair and autoimmune diseases, [4] and they linked together on the basis of autoimmune pathogenesis, can support the autoimmune etiology of premature grayness of hair. [5,6] Deregulation of immune and inflammatory response is crucial in initiating the bone resorption associated with these conditions and pro-inflammatory cytokines like interleukin-1(IL-1), interleukin- 6 (IL-6) and tumor necrosis factor (TNF) regulate the onset and progression of bone loss by initiating a cascade of cellular signals resulting in differentiation and activation of bone-resorbing osteoclasts. [15]

2- In addition to vitamin D's crucial role in calcium homeostasis with deficiency leading to skeletal abnormalities, such as osteopenia and rickets, deficiencies have been linked to a growing list of pathologic states, including autoimmune disorders such as diabetes mellitus [16,17],and the autoimmune skin disorder vitiligo.[18]So osteopenia in autoimmune diseases might be related to vitamin D deficiency.

3- Oxidative stress has been implicated in the pathogenesis of premature graying.[11] Studies have also indicated a positive correlation between oxidative stress and increased bone turnover. [19,20]

4- Patients with premature grayness have abnormal lipoproteins. [5] An increase of low density lipoprotein cholesterol (LDL-C) and a reduction of high density lipoprotein cholesterol (HDL-C) levels have been associated with low BMD. [21] So osteopenia in PGH might be related to abnormal lipoproteins.

5- Premature graying has been shown to be inherited in an autosomal dominant pattern and to be less frequent in racial groups with higher BMD (e.g. blacks) and this suggests that it may be linked to genetic factors that influence BMD. [22]

6- Accordingly this study encourages us as a doctor to screen cases of osteopenia and osteoporosis among people with PGH and to be managed in the proper way. Also, this study confirm what had been reported that vitiligo and PGH have systemic impact and not only localized to the absence of the function of melanocyte of the skin. [5,6]

In conclusion this study had confirmed the close association between PGH and osteopenia and proved the scientific fact that mentioned in Quran saying the intimate correlation between grayness of hair and osteoporosis.

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