Profile of Bone Mineral Density in Lactating Women Regarding their Age & Parity, as Assessed by Dual Photon X-Ray Absorptiometry

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Abstract:

Beck ground: Bone mineral density may be affected by pregnancy, lactation & amenorrhea,

Objective: The present study conducted to measure variation of bone mineral density in femoral neck region, of purely lactating women

Methods: Prospective study conducted at Elwyia Maternity hospital for the period between 1/5/2003-15/8/2004. A total of 126 women below 30 years of age, and 124 women of 30 years and above, were studied for measurement of their bone mineral density by Dual photon X-Ray absorptiometry, at two weeks postpartum then 6 months later. Parity was also taken into consideration.

Results: The mean bone mineral density was progressively reduced at two weeks postpartum with increasing parity number, among women in both study groups. The number of women who developed osteoporosis was significantly higher among women age, 30 years and above, than younger age group (11 (0.79 %) Vs. 1 (8.87%), at 6 months postpartum

Conclusion: Breast feeding with lactational amenorrhea in women whose parity is 5 or more, is inversely proportional to the bone mineral density. This is mostly due to poor calcium and protein dietary intake.

Key words: Profile, Mineral, Density, Lactating, Women.

Introduction

It was really interesting that the first physician who has reported the relationship between osteoporosis and woman was Sir Aster Colle, long before the discovery of X-ray [1]. In his classic paper, he has reported that Colle's fracture occurs more in the postmenopausal women due to more spongy changes of the bone. Yet, he didn't refer the exact relationship between estrogen and bone density. After the discovery of X-ray by Rotingen, in Germany, X-ray films have been widely used in the assessment of bone density for almost decades in the 20th century. During the first half the 20th century, the relationship between maternal serum estrogen and bone density has been well clarified to the maximum extent [2, 3, 4]. After binding between the estrogen and its free intra-cytoplasmic receptor, is transferred into the nucleus, where it acts directly on the DNA of the osteocyte, promoting the synthesis of more specific RNA, ultimately forming by that osteblastic proteins at the ribosomes [5, 6]. The above mentioned facts explain why would women develop osteoporosis in the postmenopausal period, and the concept of Hormone Replacement Therapy use, has evolved [6]. However, hypo-estrogenic states are also seen in women with lactational amenorrhea [7, 8]. From physiological point of view, women who are breast-feeding and remain amenorrhoic, have low estrogen levels in the blood [8]. In reviewing the literatures, there are very few papers issued about the bone mineral density (BMD) changes during lactation. More et.al. In 2001 have found reduced bone mineral density (BMD) among 38 lactating women [9]. Matsumoto et.al found reduced bone mineral density among lactating rats compared to controls [10]. In our present study we have tried to demonstrate the effect of breast-feeding in women with lactational amenorrhea in regard to the parity of the women as well as the age factor as detailed in the section of methods and patients.

Aim of the study

To demonstrate the variations of BMD in the femoral neck region, of purely lactating women (No Bottle Feeding) as assessed by the Dual photon X-Ray absorptiometry, at two weeks and 6 months postpartum, and to show how parity and age factors affect their BMD.

Patients & Methods

1. Patients collection & setting

The study was conducted in the Women Health Center of AL-Elwyia Maternity Teaching Hospital in Baghdad City, between May 1st, 2003, up to August 15th, 2004 when all the raw data were collected and analyzed. During this period a total of 250 women have been chosen to participate in the study. Among them; 126 women whose age was below 30 years, while the remaining 124 women, were equal or above 30 years. The patients were collected from the antenatal clinic, labor ward after delivery, as well as some referred cases from private clinics. The purpose of the study was explained for all the women and their consents were taken. The criteria for inclusion in the study were; purely lactating women with lactational amenorrhea with no use of hormonal contraception. All the above women were scanned within two weeks and six months postpartum. The distribution of parity among the two groups is shown below in table number one.

Table 1. The distribution of parity among women in study groups.

parity	Women age below 30 years		Women age 30 years and more	
	No.	**%**	**No.**	**%**
1	30	23.80 %	21	19.93 %
2	23	18.25 %	29	23.38 %
3	22	17.46 %	33	26.61 %
4	25	19.84 %	20	16.12 %
5 and more	26	20.63 %	21	16.93 %
Total	126	100 %	124	100 %

2. Method of scanning by Dual Photon X-ray absorptiometry (DPX)

This device was manufactured by Lunar Medical Equipment. The area, which was chosen for scanning in this study, was the Ward's triangle, which includes the femoral head, neck as well as the trochanteric areas. The patient is instructed to lie on the scanning table with her leg in the scanned side 30-degree abducted and medially rotated, to avoid the foreshortening of the femoral neck. The dual x-ray-emitting probe is mounted on a sliding arm 30 cm above the body. The point of scanning start as guided by a laser point, which is shown on the body of the women. During the procedure of scanning, the probe is emitting two electromagnetic waves in the x-ray range, which pass through the area to be scanned, and the degree of attenuation is recorded by the special gamma scintillation camera which is fitted below the scanning table. During scanning, the emitting probe moves towards cephalic direction from 20 mm below the pubic symphysis up to 30 mm above the anterior superior iliac spine. Each scan requires average 15 minutes. After the data is fed to the computer supplied with the device, the total BMD is expressed as gram of total bone mass per square centimeter surface area (gm/cm2). This represents how much bone as measured in gram is present per square centimeter surface area of the body. However, even when this value is matched for exact height and age, there exists a wide variation as guided by the Natural Distribution Theory of Poisson. Upon this, the standard deviation is assessed for each value of BMD calculated, as corrected for age and height, and calculated by the computer supplied with the device. This deviation, is expressed either as z or t value, for each BMD calculated. The WHO definition of osteoporosis is a value of BMD as corrected for standard deviation –2.5 or more below the mean, as assessed by the T or Z score. The T-score for standard deviation was used in this study for statistical analysis.

3. Statistical analysis

The continuous data were presented as mean and standard deviation, while the discrete data were presented as number and percent. The paired, double tailed t-test was used to test the statistical significance for the mean t- value of the BMD among groups. P values were considered to be significant at 0.05 or less. Excel Microsoft Software, 1997 was used to calculate the statistical analysis.

Results of the study

After the collection and analysis of data of women who have participated in this study, the following tables were constructed as detailed below.

Table 2: The changes in the mean and standard deviation for the T-score of BMD at 2 week, 6 months postpartum for women below 30 years according to parity.

Parity distribution in women whose age is less than 30 years (n=126)	The mean + SD of T-score for BMD within two weeks postpartum	The mean + SD of T-score for BMD at six months postpartum	Number of women who have developed osteoporosis	P- Value
Para 1 (n=30) *	1.19+0.74*	-1.32+0.64	Nil	P <0.0001
Para 2 (n=23)	0.04+0.71	-1.74+0.67	Nil	P<0.0001
Para 3(n=22)	-0.21+0.76	-.2.11+0.45	Nil	P<0.0001
Para 4 (n=25)	-0.58+1.08	-2.31+0.83	Nil	P<0.05
Para 5 >= (n=26)	-1.62+0.58	-2.44+0.20	1	P<0.0001

* The coefficient of correlation between BMD at 2 weeks postpartum and parity equal –0.96(r = -0.96)

It is really interesting from the above table to note that although there is significant reduction in the mean T-score for bone mineral density immediately postpartum and six months postpartum, yet only 1 woman has crossed into the range of osteoporosis. This woman was para 7; she was 28 years old. It is also interesting to note that the initial mean T-score for bone mineral density progressively decreased with the increase in the number of parity.

Table 3: The changes in the mean and standard deviation for the T-score of BMD at 2 weeks and 6 months postpartum, in women age 30 years and above, according to parity.

Parity distribution among women whose age is equal or more than 30 years (n=124)	The mean + SD of T-score for BMD within two weeks postpartum	The mean + SD of T-score for BMD at six months postpartum	Number of women who have developed osteoporosis	P- Value
Para 1 (n=21) *	2.09+0.17 *	0.18+0.64	Nil	P <0.0001
Para 2 (n=29)	-0.085+0.11	-1.15+0.37	Nil	P<0.0001
Para 3(n=33)	-0.088+0.68	-2.04+0.44	Nil	P<0.0001
Para 4 (n=20)	-1.01+1.9	-2.35+0.34	4	P<0.05
Para 5 > =(n=21)	-1.63+0.68	-2.45+0.39	7	

* The coefficient of correlation between BMD at 2 weeks postpartum and parity is –0.93(r = -0.93)

It really interesting to note the following points from table number three, that there is progressive reduction in the mean of T-score for BMD, with increasing parity. Also, despite significant changes in the T-score of BMD among the whole age groups, yet only 11 women have crossed into the range of osteoporosis, as assessed by DPX. Four of those women were para 4, and their ages were (31, 33, 35 and 36 years); while the remaining 7 were para 5 and more have crossed into the osteoporosis range of their t value. Those are detailed below as such;

1-Woman number 1. She was para 7 and 31 years old.
2-Woman number 2. She was para 10 and 32 years old.
3-Woman number 3. She was para 9 and 34 years old.
4-Women number 4. She was para 11 36 years old.
5-Women number 5. She was para 13 and 39 years old.
6-Women number 6. She was para 12 and 40 years old.
7-Woman number 7. She was para 9 and 44 years old.

All the above mentioned women were from low social class & with extreme poverty. Three of them came from villages surrounding Baghdad City.

The final result in this study was to express the statistical significance for the difference in the number of women who have developed osteoporosis six months postpartum, among the two study groups, as shown in table number four.

Tables 4: The statistical significant difference between the numbers of women who have developed osteoporosis between the two age groups, at six months postpartum.

Characteristics	Women below 30 years (n= 126)	Women equal or above 30 years (n=124)	P Value *
Number of women who have developed osteoporosis six months postpartum	1(0.79%)	11(8.87%)	$P < 0.05$ (P= 0.002816)

* P value was assessed by the Chi-square test.

Discussion

Discussion will be focused on two main points, which have been concluded in the section of results, as below;

1-There was progressive reduction in the mean T-Score of BMD, as measured two weeks postpartum, with increasing parity. This reduction was found among the two study groups.

2-The number of women who have developed osteoporosis six months postpartum, was significantly higher among women whose age was 30 years and above, than the younger age group.

Actually, many researchers have reached the above findings in the last 10 years. .Sowers et.al. [11] In his study has measured the bone density at the femoral neck as well as the lumbar spines in 98 women at 2 weeks post partum, 2 months, 4 months and six months. He has found that there is 5.1% reduction in the lumbar BMD and 4.8 % reduction in the femoral BMD, while Drinkwater et.al. [12] in his study, has measured the bone density in the femoral neck as well as in the tibia. He has found that during lactation, the BMD of the tibia returned to normal while the femoral neck density decreased progressively with lactation. He suggested that mechanical stress might play a role in modulating the BMD despite the low levels of estrogen during lactation, as the tibia receives more mechanical stress than the femoral neck. . More et.al. [9], in his study included 38 women being scanned at radius and lumbar spines immediately postpartum, 6 months and 12 months postpartum. He reported significant reduction of the BMD at six months postpartum, which was associated with rapid recovery of the BMD after weaning at 12 months postpartum, as his measurements extended up to one year after delivery. However in our study, measurements of the BMD were restricted up to 6 months postpartum. Kojima et.al.[13] in a nice cross-sectional study, included 456 premenopausal women and 713 postmenopausal women being scanned with dual photon x-ray absorptiometry, found no significant correlation between the BMD in his study and the duration of lactation in months, instead the coefficient of correlation was negative, & inversely related. This indicates that later postmenopausal BMD changes have got no relationship with the BMD changes, which occur during lactation.

In our study, the main factor associated with the development of osteoporosis was increasing multiparity. The trend of nutritional habits among Iraqi women with low social class and increased parity with low birth spacing may explain the occurrence of the 12 cases of osteoporosis, which have been reported in our paper. Those women were poor, with low protein and mineral diet as well as virtually no antenatal services in their countryside regions. . Kalkwarf et.al [14] has mentioned that approximately 250 mg of calcium is secreted in the breast milk per day, in normally lactating women. Up to 9% of this calcium comes from the bone, even when there is good intake of calcium, and this turnover of calcium is obligatory from the physiological point of view. . Kalkwarf also stressed in his paper that neither parathyroid hormone nor calcitonin is involved in this turnover. He has refereed to the role of estrogen and parathyroid hormone-related peptides, as the main hormones related to the control of this turnover. It seems clearly evident that the best prevention and treatment of BMD reduction during lactation is by calcium supplementation as well as restoration of the ovarian function as soon as weaning is established. This fact has been discussed in more details by Specker et.al [15], who has suggested that dietary replacement of calcium and sufficient exposure to sunlight may help to reduce the BMD changes during lactation.

The other aspect of discussion in this paper is about the method of contraception, which may be used to reduce the BMD changes during lactation. In our paper, no patient has used any form of hormonal contraception within the first six months postpartum. However, this has raised the following question: To which extent the use of progestogen only contraception or low dose combined contraceptive pills may prevent serious reduction of BMD during lactation?

Oral combined contraceptive pills are usually contraindicated in women with breast feedings as they reduce the amount of milk, as well as they are relatively contraindicated in women above 35 years. . Kaunitz et.al.[16] in his nice study about the long term use of injectable medroxyprogesterone acetate as well as the Norethisterone acetate(Norplant) though the study was not committed in lactating women, has found that after two years, there was some reduction in the BMD which was not significant statistically but was reversible with the discontinuation of their use. While, Diaz et.al.[17] in his study, on 29 lactating women who were put on Norethisterone implant contraception, 28 lactating women who were put on Progestogen loaded vaginal rings and 51 lactating women who were put on copper loaded IUCD, found that there was no significant changes of BMD at the femoral neck among the above three groups.

All these findings suggest that the use of hormonal contraception versus non-hormonal one in lactating women have no significant effect in preventing the changes of BMD, which occur during lactation.

Conclusion:

This study has shown that lactating women with parity of 5 or more are at risk of developing osteoporosis during the first six months postpartum, especially if their ages are equal or above 30 years. This may be attributed to social status with deficient dietary intake of calcium and high protein. It is unlikely that any hormonal contraception will have a significant impact on the BMD changes during lactation. The best prevention from developing osteoporosis during lactation is by increasing the intake of calcium supplementation during pregnancy and puerperium.

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