Original Article

Epidemiological Study of Low Bone Mineral Density States in Patients Visiting Centre For Nuclear Medicine(CENUM), Mayo Hospital, Lahore

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Objective: The objective of this study is to identify risk factors related to low BMD among patients attending the Centre for Nuclear Medicine (CENUM).

Methods: It was a cross sectional study conducted at the Centre for Nuclear Medicine (CENUM) Mayo Hospital Lahore, from February 2011 to September 2011.A sample of 246 participants aged 50 to 85 years (both male and female) was selected using non probability convenient sampling technique. Magnitude of BMD status was described using T score as WHO criteria.The data was analyzed by using SPSS version 17.Pearson Correlation was applied to find relationship between different quantitative variable. Also, an independent sample T test was applied to see the significant difference.

Results: The results have shown that out of 246 participants, 24 (9.8%) were men and 222 were women (90.2%) aged 50-85 yrs. BMD has significant correlation with age, weight and height of the patients ($p \leq 0.05$ for both at Left Hip and lumber spine T score). Also, the patients who did physical activity and had sufficient intake of calcium supplement showed better BMD($p \leq 0.05$ for both Left Hip and lumber spine T score respectively)as compared to other patients. The patients who had low backache also showed low BMD($p \leq 0.000$ for Left Hip and $p \leq 0.000$ for Lumber spine T score).

Conclusions: Based on the study results it is concluded that low BMD is a wide spread public health problem and it needs due importance.

Keywords: BMD, DXA, left hip T score, lumber spine T score, WHO, CENUM

Introduction

Osteoporosis is one of those skeletal disorders in which there is low bone mass and deterioration of micro- architectural bone tissue; with a subsequent increase in bone fragility and vulnerability to fractures.[1] Historically, evolutional bone loss was documented about 150 years back, by Sir Astely Cooper, who performed an experiment and figured out that bone loss was associated with hip fractures.[2] The name, 'Osteoporosis' was initially used in medical cordon in the 1900's by French and German clinicians while presenting the histology of osteoporotic bone. Osteoporosis is a vital community health issue that is affecting about 200 million people throughout the world. 20 million people aged 45 or above have been registered with this disease in the United States. In United States and Europe, 30% of the women who had had their menopause have osteoporosis.[3]

Increasing life expectancy have resulted in aging of the population and increased rates of chronic-degenerative diseases.[4] In Asia, for the last thirty years, the risk of having hip fractures had increased two to three times and it is distressfully predicted that half of the total world fractures will take place in Asia by 2050.[5] The prevalence of osteoporosis in China among the middle- aged and elderly people is 16.1% in 2002. The prevalence among males was 11. 5% and among females was 19.9% respectively.[6]

India is largely perturbed by osteoporosis where one out of three females is affected from osteoporosis while one out of 8 men is affected by this disease. In 2003, the approximate number of osteoporotic patients (both male and females) in India was twenty six million and according to the committee of experts, this number is predicted to rise thirty six million by the year 2013.[7] Pakistan has a high prevalence of osteoporosis as 97% of women aged from 75 to 84 years while 55% of women aged from 45 to 54 years suffer from osteoporosis in Pakistan.[8]

Osteopenia leads to osteoporosis which is a disease that lowers bone mineral density than normal. Bone mineral density (BMD) alludes to the volume of matter for every square centimeter of bones. Throughout adulthood, bone mineral content is reliant on peak bone density accomplished during development and Following bone loss; hence, low BMD can result from increased bone loss, lacking bone accretion, or both. This ailment, present in both

sexes also related to genetic and environmental factors, is becoming a foremost community health issue in developed co untries.[9]

The bone mineral density is regulated by the intestinal absorption, renal excretion, bone uptake and release of the calcium; each of which is regulated by the parathyroid hormone, calcitonin and vitamin D. Low BMD is associated with physical aspects like increasing age, female sex, family history of osteoporosis, irregularity of menstrual cycles, premature menopause, zero history of pregnancies, specific medicine use (anticonvulsants, corticosteroids, diuretics, aluminum hydroxide and anti-inflammatory drugs). In addition, the behavioral factors like low intake of calcium, high amount of protein consumption, intake of coffee and sodium, use of alcohol, smoking, and sedentary lifestyle are also contributing factors.[10]

The peak bone mass is acquired during adulthood, once maximal skeletal mass is attained after 30 to 40 years, a small loss in bone formations take place with every resorptionand formation cycle of each basic multi-cellular unit. Thus, bone loss related to age, which may be average 0.7% every year, is the standard and expected biological phenomenon parallel to hair changing their color to gray. Both sexes are affected equally and ethnically whites are more affected than blacks. Differences in the peak skeletal mass in men compared with women and in blacks versus whites may explain to some extent that why certain populations are prone to be afflicted by this disease.[11]

Osteoporosis has no alarming signs; often the first manifestation of disease is pain or fracture. Approximately all non-vertebral fractures are caused by fall, even though, vertebral fractures often take place without a fall, and might not necessarily be painful. Virtually, two thirds are painless and one third of vertebral fractures are painful. Underlying vertebral compression fractures presented by considerable height loss over the years might not show any significant associated with back pain.

Dual-energy X-Ray Absorptiometry (DXA) provides a convenient and harmless way of measuring BMD accurately, reproducibility and with minimal radiation exposure.Bone mineral density is assessed by DXA scan at neck of femur (hip) and lumber spine as these points increase the incidence of any osteoporotic fracture two to three fold. DXA scan uses X-rays to measure bone mineral density. In this scan, the radiation dose is about 1/10th of a standard chest X-ray .[12]DXA scan of hip and spine is clearly differentiated from other bone densitometry techniques because of its multiple advantages; the results obtained with this scan are analyzed applying the World Health Organization T-score definition of osteoporosis. DXA results provide an authenticated proficiency and effectiveness to predict the risk of fracture and targeting anti-fracture therapies to facilitate the response to treatment.[13]

Bone Mineral Density (BMD)

Measured by Dual Energy X-Ray Absorptiometery Scan (DXA).

T Score: It is a comparison of patient bone density to the bone density of a 30-year-old person of the same sex and ethnicity.

World Health Organization Criteria for Bone mineral Density:

T-Score more than -1 or higher = Normal
T- Score from -2.5 to -1 = Osteopenia
T-Score below -2.5 = Osteoporosis

Methods

This cross sectional study was done at the Centre for Nuclear Medicine (CENUM) Mayo Hospital Lahore, from February 2011 to September 2011.A sample of 246 participants was selected using non probability convenient sampling technique. The study was conducted on the patients attending CENUM for dexa scan aged 50 to 85 years (both male and female). A structured questionnaire was developed including all the variables of interest for use during the interview. After the investigator introduced, medical history was take from each patient including medical history (presenting complaint) and relevant life style pattern.

The investigator inquired the age, weight (kg), height (cm) educational status, eating habits , intake of milk in term of one glass or two (250 500mls)/day and history of intake of calcium (500 1000 mg)/day daily or on alternate days.

The investigator asked the patients about his/her smoking habits. The level of physical activity was inquired from the patients, like walking. It was asked from the patients for their number of children. Menstrual and lactational history was asked from female patients. It was also asked about other clinical presentations from the patients came for DXA scan

For DXA scan, the patients were asked to lie down and take off metallic things on their body (if any). Patients were asked to position according to the requirement of DXA scan under the supervision of the technician.

scan of lumber region (from L1 to L4) and neck of the femur (Left Hip) was recorded on computer with inbuilt system. Bone mineral density content and T-scores were recorded. Magnitude of BMD status was described using T score as WHO criteria. The result of DXA scan of each patient consisted of Lumber spine and Left Hip T score was achieved for this research. The data was analyzed by using SPSS version 17. Data was described in terms of frequencies and percentages for categorical variables.Correlation was applied to find relationship between different quantitative variable.Also, an independent sample T test was applied to see the significant difference.

Results

The results have shown that most of the patients in this study were female. Most of the patients were from urban area (91.5%). Also, most of the patients were married (83.3%). **Table 2** shows mean and standard deviation of age, weight, height, Left Hip T score and Lumber Spine T score of study sample. **Table 3** shows correlation of Left Hip T score and Lumber Spine T score with age, weight and height of patients. It shows that T score of both Left Hip and Lumber Spine is significantly correlated with age, weight and height of patient. The correlation coefficient is negative for age because as the age increases BMD tend to decline whereas correlation coefficient is positive for height and weight i.e; as the weight and height increases BMD also improves.

Table 4 shows that out of 246 patients 148patients came with the complaint of low backache. The Left Hip T score was significantly less($p<0.000$) for low backache patients as compared to patients with no complaint of low backache , so the patients with complaint of low backache were more prone to low BMD. Also, 191 patients who did not walk daily had significantly less Left Hip T score($p<0.05$) so, lack of physical activity plays an important role for low BMD. Out of 246 patients,76 patients did not take dairy products regularly and had less Left Hip T score suggesting that insufficient use of dairy product influence the BMD of Left Hip. Calcium intake has also significant effect on BMD ($p = 0.001$) as 48 patients who were not taking calcium had significantly less Left Hip T score as compared to those patients who had sufficient calcium intake. There was only 4 patients in this study who were smoker and there Left Hip T Score was less as compared to nonsmokers($p = 0.632$). **Table 5** shows that Lumber Spine T score was significantly less for those patients who had complaint of low backache ($p < 0.000$)as compared to other patients. Similarly patients who did not walk daily and had no intake of calcium also showed significantly less Lumber Spine T score($p<0.05$) as compared to those who did walk and take calcium regularly. The patients who did not use of dairy product also had less Lumber Spine T score ($p=0.383$). The smoker patients in the study also had less Lumber spine T score($p=0.475$) as compared to non smokers.

Table-1: Demographic characters (n= 246).

		Number	Percentage
Gender	Male	24	9.8
	Female	222	90.2
Area of Residence	Urban	225	91.5
	Rural	21	8.5
Marital Status	Single	6	2.4
	Married	205	83.3
	Widow	32	13.0
	Divorced	3	1.2

Table-2: Descriptive statistics of study variable.

	Number	Percentage
Age in years	60.95	8.54
Weight in kg	70.50	13.49
Marital Status	154.63	7.81
Left hipT Score	-1.41	1.22
Lumber Spine T Score	-1.45	1.53

Table-3: Relationship of T score and different demographic factors.

		Age (in years and months)	Weight	Height (cm)
Left Hip T score	Pearson correlation	-0.321	0.519	0.183
	P-Value	0.000	0.000	0.004
Lumber spine T Score	Pearson Correlation	-0.140	0.0447	.156*
	P-Value	0.028	0.000	0.014

Table-4: Comparison of Left Hip T Score with different risk factors.

Risk Factors	Left Hip BMD			
	Mean	Stanard Deviation	Total (%)	P-valu
Low backache				0.000
Yes	-1.8095	1.08360	148 (60.16%)	
No	-.8051	1.16896	98 (39.84%)	
Walk daily				0.030
Yes	-1.1327	.98959	55 (22.4%)	
No	-1.4890	1.26974	19 (77.6%)	
Dairy product				0.629
Yes	-1.9841	1.17446	170 (69.1%)	
No	-1.4658	1.24232	76 (30.9%)	
Calcium				0.001
Yes	-1.0924	1.15525	145 (75.13%)	
No	-1.7542	1.23701	48 (24.87%)	
Smoking				0.632
Yes	-1.7000	1.25698	4 (1.6%)	
No	-1.4045	1.22143	242 (98.4%)	

Table-5: Comparison of Left Lumber T Score with different risk factors.

Risk Factors	Lumber Spine T Score			
	Mean	Stanard Deviation	Total	P-valu
Low backache				0.000
Yes	-1.964	1.4441	148 (60.16%)	
No	-.661	1.3192	98 (39.84%)	
Walk daily				0.030
Yes	-1.051	1.3562	55 (22.4%)	
No	-1.558	1.5645	19 (77.6%)	
Dairy product				0.383
Yes	-1.572	1.4713	170 (69.1%)	
No	-1.388	1.5599	76 (30.9%)	
Calcium				0.001
Yes	-1.087	1.4847	145 (75.13%)	
No	-1.454	1.4964	48 (24.87%)	
Smoking				0.475
Yes	-.9	.6928	4 (1.6%)	
No	-1.445	1.5116	242 (98.4%)	

Discussion

The current research was carried out to assess the bone mineral density (BMD), socio- demographic and symptomatic profile of patients visiting the Centre for Nuclear Medicine (CENUM) for DXA scan. Majority of the patients were female i.e. 222 out of the total 246. In the current study, most of the patients suffering from low bone mineral density were from urban segment of the population i.e.; 225 out of 246. We have seen in current study as the patient's age increased they were more prone to decrease bone mineral density. This result is similar to the result of a study conducting in India and it has been observed that 37.1% of the women in age 50-59 years suffered from osteopenia and 37.5% of women in age group of 60 and above had osteo- porosis.[14] The present study showed that bone mineral density of patients was highly affected by their weight and height. The patients with weight less than 50 kg and more than 80 kg weight, were more prone to low bone mineral density. It has been found that women with BMI less than 16 and weight less than 60 kg were at higher risk of osteoporosis in both Iran and India.[15] Most of the patients (148) in this study came with the problem of low backache. The results of this study indicated that bone mineral density was significantly affected by low backache. The result of our study is comparable with the results of other studies.[16,17] BMD of Hip and Spine had a negative relationship with chronic low backache. Previous studies and the current study assessed that chronic low backache can lead to low BMD. The current study clearly illustrated that bone mineral density is remarkably influenced by physical activity. There is an increased threat of having low BMD both at Left Hip and Lumber spine in patients who did not use to walk daily. So, there is a vital role of physical activity to reduce the risk of low BMD.[18]

The consumption of dairy products also effect Left Hip and Lumber Spine T score. Dairy products are richer in calcium, protein, potassium, magnesium, zinc and phosphorus per calorie than any other delicious food. A sufficient intake of milk and milk products is a best source for optimal bone formation but also a way to prevent enhanced bone resorption as expressed by the 40% to 50% reduction of the serum osteocalcin.[19,20]

Most of the patients in this current study used to take calcium as a supplement. The calcium intake had a significant effect on the bone mineral density of Left Hip and Lumber spine .This is similar to the previous studies [21,22] which reported that continuous intake of calcium over three years decreased the threat of osteoporosis. The result of this study illustrated a non-significant association between low bone mineral density and smoking while in other studies [23,24] indicated a significant effect of smoking on BMD at femur neck and lumbar spine ($p < 0.05$). In our study there was no obvious relationship between smoking and low BMD as most of the patients were females and the ratio of female smokers in Pakistan is very less in comparison to other countries due to our cultural and traditional boundaries.

Conclusion

On the basis of the results of this study it is concluded that bone mineral density is influenced by advanced age, low education, sedentary life style and insufficient intake of calcium. All these factors clinically leads to generalized aches and pains especially low backache .The postmenopausal women were more effected by this low bone mineral density as compared to men of their age due to the lack of protective role of estrogen.

The results of this study highlighted that people in advanced age should take care of their diet(it should be rich in calcium) and physical activity especially the postmenopausal women should be more aware about this crippling disease which slowly but horribly spreads.

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