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ORIGINAL ARTICLE

OSTEOPOROSIS WITHIN A COHORT OF POSTMENOPAUSAL PAKISTANI WOMEN USING DUAL X-RAY BONE DENSITOMETRY

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ABSTRACT

OBJECTIVE: To explore the prevalence of osteopenia and osteoporosis within a cohort of Pakistani postmenopausal women with respect to the lumbar spine and hip.

METHODS: This cross-sectional study was conducted at Shifa International Hospital Islamabad, Pakistan from September 2019 to Feb 2020. Study comprised of 237 postmenopausal females who visited the outpatient department of the hospital. The T-scores of Bone Mineral density (BMD) data was collected and arranged in three groups: normal, osteopenia and osteoporosis. Data was analyzed to explore the distribution of the data and correlation analyses using R software version 3.6.3.

RESULTS: Out of 237 females, majority were ranging in age from 61-70 years (n=110; 46.4%), followed by 51-60 years age group (n=60; 25.3%). Osteopenia was noted in 98 (41.4%) cases in lumber spine and hip area. Osteoporosis was found in 79 (33.3%) and 59 (24.9%) cases in lumber spine and hip region respectively. Mean T score was -1.775±-2.000 and median T score was -1.469 for lumber spine and hip. T-scores distribution of lumbar spine and hip indicated the highest proportion having a sore of -2 SD (n=60; 25.3% each), followed by -3 SD in 52 (21.9%) cases. Bone mass density was negatively correlated with age (p=0.01). However, no significant difference was found among the BMD values of lumbar spine and hip region.

CONCLUSION: Decreased bone density was a common occurrence affecting postmenopausal females and there is increase in degenerative bone loss with increasing age. Hip and lumbar spine region are equally affected by degenerative bone loss.

KEY WORDS: Bone and Bones (MeSH); Bone Density (MeSH); Dual-energy X-ray absorptiometry (DEXA) (Non-MeSH);Tomography, X-Ray Computed (MeSH); Absorptiometry, Photon (MeSH); Osteopenia (MeSH); Osteoporosis (MeSH); T-score (Non- MeSH); Osteoporosis, Postmenopausal (MeSH).

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INTRODUCTION

Osteoporosis is described as reduction in bone mass and tissue as well as disruption of the microvasculature of the bone.[1] It is also highly prevalent in the elderly and is associated with an increased risk for bone fractures.[1-3] The commonest contributing factors are: menopause, aging, rheumatoid arthritis, inactivity and vitamin D deficiency.[4] The number of people being affected by this disease worldwide approximates to 200 million.[5] An estimation of osteoporotic fractures that occurred in European Union was approximately 8.9 million in 2010.[5]There is currently no data available on annual incidence of osteoporotic fractures in Pakistan. However, the estimated cost of hip fractures treatment in Pakistan can be up to 10000 USD with a hospital stay of at least a week.[6]

On the other hand, osteopenia is described as low bone mineral density (BMD) with reference to normal values.[7] Correspondingly, BMD is typically described in the form of T-score which measures the standard deviations (SD) of a person's BMD from the mean value of the BMD of a healthy individual.[5] According to a World Health Organization (WHO) report, a BMD with a T-score range between-1.0 and 1.0 Standard Deviations (SD) is considered to be normal, that between -1.0 and -2.5 SD reflects osteopenia and below -2.5 SD is an indication of osteoporosis.[2,4,8] In view of these, the current study design was to explore the prevalence of osteopenia and osteoporosis within a cohort of Pakistani postmenopausal women with respect to the lumbar spine and hip regions and to determine the correlation between the two conditions with the help of different statistical analyses.

METHODS

This study was conducted at Shifa International hospital Islamabad, Pakistan for a duration of 6 months, from September 2019 to February 2020, after approval from IRB. A sample size of BMD T-scores data from 237 women was selected via non-probability convenience sampling technique. We estimated that this sample size of would be required with 95% confidence limits and 3% margin of error. Postmenopausal women were included with the exclusion of candidate having any disability, chronic disease, already on supplements or unwilling to participate in the study. Women falling in the appropriate criterion were screened with BMD test for hip and lumbar spine bones. Furthermore, a classification of these subjects was done as normal, osteopenic and osteoporotic on the basis of the T-scores. T-score <-1 was considered normal; -1 to -2.5 was considered osteopenia; and T-score of -2.5 or

TABLE I: ASSESSMENT OF LUMBAR SPINE AND HIPBONE OSTEOPENIA AND OSTEOPOROSIS IN STUDY SUBJECTS (N=237)

Parameters		Number of subjects	Percentage
Age Group (years)	≤40	16	6.7
	41-50	35	14.8
	51-60	60	25.3
	61-70	110	46.4
	>70	16	6.7
Lumbar spine	Normal bone health	60	25.3
	Osteopenia	98	41.4
	Osteoporosis	79	33.3
Hip	Normal bone health	80	33.7
	Osteopenia	98	41.4
	Osteoporosis	59	24.9

above was taken as osteoporosis.[6]

In addition to the BMD screening and classification, the statistical analyses of the data were done using R studio (version 3.3.6) to assess and decipher the distribution of age and T-scores in the cohort, ratios of the subjects falling in each of the above defined categories, statistical summaries of the data collected, distribution of the lumbar spine and hip T-scores with age, normality distribution of the variables and finally the correlation analysis between the variables using package GGPUBR.[9]

RESULTS

Distribution of age, lumbar spine T-scores and hip T-scores

Out of 237 females, majority were ranging in age from 61-70 years (n=110; 46.4%), followed by 51-60 years age group (n=60; 25.3%) [Table I).

The distribution of lumbar spine and hip T-scores indicated the highest proportion lies on the scale at -2 SD (n=60; 25.3% each), followed by -3 SD in 52 (21.9%) cases. Mean T score was -1.775±-2.000 and median T score was -1.469 for lumber spine and hip.

Percentage of subjects with normal bone health, osteopenia and osteoporosis

Overall, most of the women were osteopenic for both hipbone and lumbar spine. Osteopenia was noted in 98 (41.4%) cases in lumber spine and hip area. Osteoporosis was found in 79 (33.3%) and 59 (24.9%) cases in lumber spine and hip region respectively (Table I).

Distribution of T-scores with age

The distribution of T-scores was also analyzed with respect to the age. As is evident from the Figure I (a), the majority of lumbar spine T-scores are lying below the 0 SD and are also concentrated between the age of 70 -80 years. In the same manner, similar pattern of distribution has been observed for the distribution of hipbone T-scores with age [Figure I (b)]. Normal T-score being -I to I. BMD was negatively correlated with age (p=0.01). However, no significant difference was found among the BMD values of lumbar spine and hip region (p>0.05).

Correlation analysis

The strength of the association between T-scores of lumbar spine and hip was done via Pearson's correlation analysis (Figure 2). This showed a positive correlation between lumbar spine T-scores and hipbone T-score (R= 0.57; p<0.001).

DISCUSSION

Aging causes a gradual reduction of bone mass resulting in osteopenia and osteoporosis.[10] A measurement of BMD remains the distinguishing diagnostic feature between the two conditions.[10,11] However, despite the susceptibility of the disease to both males and females, the burden is comparatively high on postmenopausal women eventually elevating the fracture risk up to 60 % for women above 50 years of age.[12,4]

The primary goal of the current study was to report and document the BMD screening performed on a wide range of postmenopausal women belonging to different age groups in the capital city of Pakistan, Islamabad. The main reason for women being specifically selected over men for this study is because women are at 2-3 times higher risk of osteoporosis than men and hence more prone to pathological fractures.[13,14]

This study encompassed a more or less normally distributed age cohort of women and their BMD measurements likewise showed identical prevalence of osteopenia in both the bone regions selected for this study i.e., lumbar spine region and hip bone which came out to be 41.3%. This observation is supported by another study reporting 40.3% prevalence of osteopenia in lumbar spine of an Indian female cohort.[15] Analogous is the case for another study on the Bangladeshi women presenting 40.7% osteopenia in 46-65 years old women.[16]

The second variant investigated in this

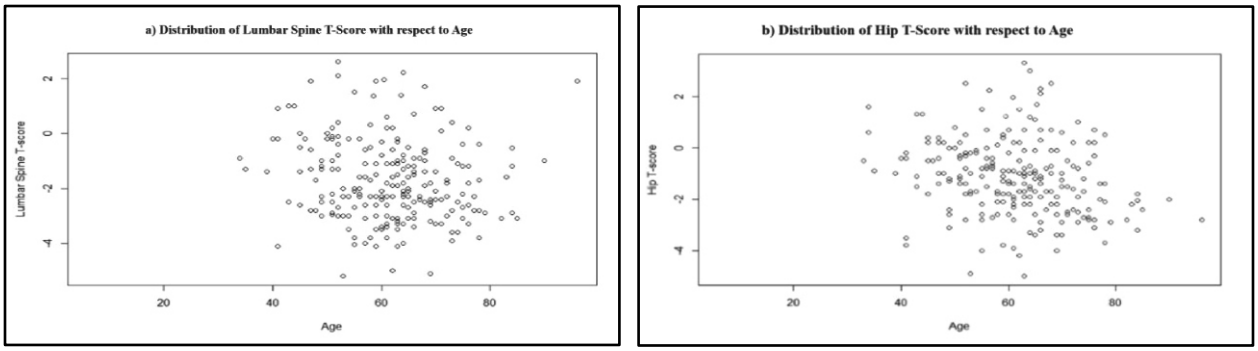

Figure 1: Distribution of (a) Lumber spine T-Score and (b) Hip T-Score with respect to age

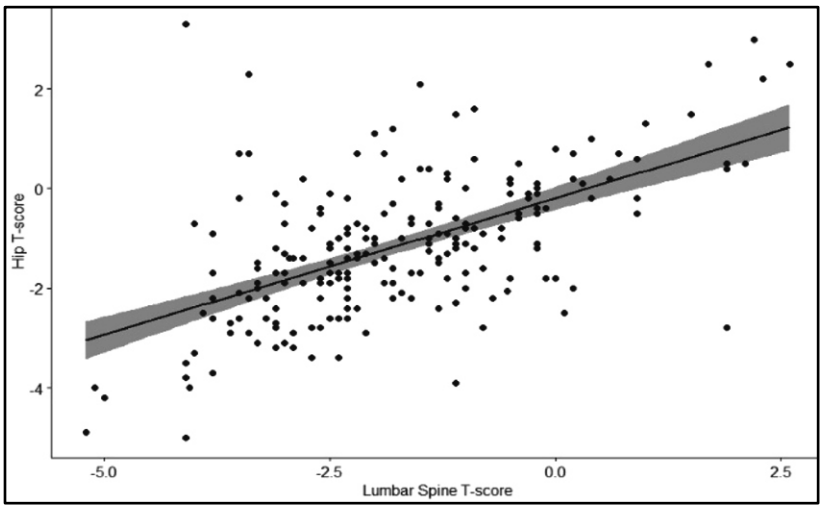

Figure 2: Correlation between lumbar spine T-scores and hipbone T-scores

study was the occurrence of osteoporosis via BMD measurements in lumber spine and hipbone. Menopause is associated with impaired bone health in the form of loss of bone structure, as well as bone mass, leading to increased risk of osteoporotic fractures.[17] In our study, osteoporosis was found in 33.3% and 24.9% cases in lumber spine and hipbone respectively. Our findings are consistent with local figures of osteoporosis ranging from 20-49.3% in postmenopausal females.[18]

Another important finding of our study was a significant negative correlation of the T-score of both the bone regions with age. This has been reinforced by a number of studies e.g., a rapid decrease in BMD in women after 49 years of age and a negative correlation between age and BMD has already been reported in the selected populations of the world.[19,20] Other local studies have also reported significant negative correlation of BMD with age.[21,22]

Our study showed a significant positive correlation between lumbar spine T-scores and hipbone T-score (R= 0.57). In its comparison, a Chinese study of hip and spine assessment via quantitative computer tomography found discordance between these two regions thus point out the limitation of the unavailability of the BMD data for the study.[23] However, a study in a Thai cohort reported a positive correlation between BMD values of various sites thus providing auxiliary support to our findings.[24]

The limitations of current study remain in the entailment of sole inclusion of women and not men and children. Our cohort belongs to the city of Islamabad hence the findings cannot be generalized to entire Pakistani population.

CONCLUSION

Decreased bone density was found to be a common occurrence affecting postmenopausal females in Pakistan. There is increase in degenerative bone loss with increasing age and both lumbar spine and hip regions bone mineral density values have a positive correlation. These findings can be used to bring about modifications in the therapeutic interventions, preventive measurements and early treatment initiation.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

AZ: Conception and study design, analysis and interpretation of data, drafting the manuscript, critical review, approval of the final version to be published

MSW: Conception and study design, critical review, approval of the final version to be published.

NR: Acquisition of data, drafting the manuscript, approval of the final version to be published.

SG: Analysis and interpretation of data, critical review, approval of the final version to be published

MMU: Acquisition, analysis and interpretation of data, drafting the manuscript, approval of the final version to be published.

SB: Study design, drafting the manuscript, critical review, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.