

Bone Mineral Density in Symptomatic Patients with Comparison to Asymptomatic Patients

Muhammad Akhtar, Sidra Zaheer

Department of Radiology, Pakistan Naval Ship, Shifa Hospital, Karachi Pakistan

ABSTRACT

Objective: To evaluate bone mineral density in symptomatic and asymptomatic patients.

Study design: Cross-sectional study.

Place and Duration of Study: Radiology Department, Pakistan Naval Ship, Shifa Hospital, Karachi Pakistan, from Aug 2017 to Aug 2019.

Methodology: The symptomatic individuals included in this study were those referred by a treating physician with complaints related to the skeletal system, such as bone pain. Asymptomatic individuals that were included were volunteers who had no symptoms related to bones. These individuals were evaluated by using dual-energy X-ray absorptiometry (DEXA).

Results: Five hundred twenty-nine individuals were included. Our study showed that the percentage of osteopenia and osteoporosis was 39.61% and 37% in symptomatic and asymptomatic individuals, respectively. These observations show that asymptomatic patients also suffer from osteopenia and osteoporosis. The percentage of asymptomatic patients suffering from osteopenia and osteoporosis was 2.0% and 35%, respectively.

Conclusion: The frequency of osteopenia and osteoporosis is increasing in symptomatic and asymptomatic patients in Pakistan. An alarming fact is that most of these positive asymptomatic patients are below 50 years.

Keywords: Bone mineral index, Bone pain, Dual-energy x-ray absorptiometry, Osteoporosis, Osteopenia.

How to Cite This Article: Akhtar M, Zaheer S. Bone Mineral Density in Symptomatic Patients with Comparison to Asymptomatic Patients. *Pak Armed Forces Med J* 2023; 73(4): 1075-1078. DOI: <https://doi.org/10.51253/pafmj.v73i4.8134>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Osteopenia is defined as decreased bone density. At the same time, osteoporosis has been characterized by low bone mass and deterioration of bone architecture, which increases bone fragility and susceptibility to fractures¹. Dual-energy x-ray absorptiometry helps evaluate bone quality by indirectly analysing the micro- and macro-architecture of the bone, which can predict the risk of fracture². A DEXA scanner generates low-dose X-rays having two energies for separating mineral and soft-tissue components of the body and a high-resolution multidetector array³. It calculates the bone mineral density (BMD) in grams per square centimetre.⁴ In adults, two regions are scanned, namely the lumbar spine and proximal femur, while in young patients (younger than 20 years of age), it is advisable to scan only the lumbar spine because the femur is still not mature till this age.^{5,6}

The main parameter of this scanner is the T-score, which represents the standard deviation by which the BMD varies from the mean BMD of a young adult reference population of the same ethnicity and sex, and the Z-score, which is the standard deviation by which the BMD differs from the mean BMD of a healthy

population of the same ethnicity, sex, and age as the person who is undergoing DEXA.^{7,8}

In Pakistan, we lack national registries and have only sparse published data on the prevalence of osteoporosis in Pakistan⁶. Most available data is about the bone density measurement inferred from heel ultrasound. DEXA scan is available only in a few large medical centres in Pakistan, which is one reason for less available published data. Considering that there is much need for data regarding the prevalence of osteopenia and osteoporosis in Pakistan, we formulated and conducted this study. This will help researchers to further look into the causes of decreased bone density in our population. It will also help us to guide the general population regarding the risks and harmful effects of osteopenia and osteoporosis on health.

METHODOLOGY

The cross-sectional study was conducted at Radiology Department, PNS Shifa Hospital, Karachi, from August 2017 to August 2019 after IERB approval. A sample size of 529 patients was calculated with the value of osteoporosis as 28.6% in adults.⁹

Inclusion Criteria: Patients of either gender, presenting for a BMD scan, whether they had symptoms of skeletal deformity or not, were included in the study.

Correspondence: Dr Sidra Zaheer, Department of Radiology, Pakistan Naval Ship, Shifa Hospital, Karachi Pakistan
Received: 08 Feb 2022; revision received: 25 Mar 2022; accepted: 29 Mar 2022

Exclusion Criteria: Patients with exuberant lumbosacral osteophytes formation, gross lumbosacral deformity (congenital or acquired), secondary causes of osteopenia/osteoporosis (known malignancy, infection or trauma) and patients with metallic lumbosacral and femoral implants were excluded.

All the patients were included through simple random sampling, attending OPD of the Department of Orthopedics and referred to the Radiology department for assessment of BMD. Included patients were explained the purpose of the study and were ensured of the confidentiality of their details. Patients were divided into symptomatic and asymptomatic. Symptomatic patients presented to a physician with complaints of bone pain and were referred for BMD estimation. Asymptomatic patients who voluntarily wanted to be part of the study were included. All these patients underwent dual-energy x-ray absorptiometry, and their bone density was calculated using Medix DR.

Statistical Package for Social Sciences (SPSS) version 21.0 was used for the data analysis. SPSS version 21 was used to enter and analyze the data. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Independent sample t-test and Chi-square test were applied to explore the inferential statistics. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

Five hundred twenty-nine individuals were included. The mean age of patients was 52.79±15.11 years. There were 429 (81.1%) patients who had symptoms (symptomatic), while 100 (18.9%) patients did not have symptoms (asymptomatic). The mean BMD of all patients was -1.16±0.91 (Table-I).

Table-I: Demographics of Patients included in the Study (n=529)

Parameters	n(%)
Age (Mean±SD)	52.79±15.11 years
Gender	
Male	113(21.4%)
Female	416(78.6%)
Symptoms related to skeletal system	
Yes	429(81.1%)
No	100(18.9%)
Bone Mineral Density (Mean±SD)	-1.16±0.91

There were 207 (39.13%) patients with reduced BMD, while 322 (60.87%) patients had normal BMD (Figure).

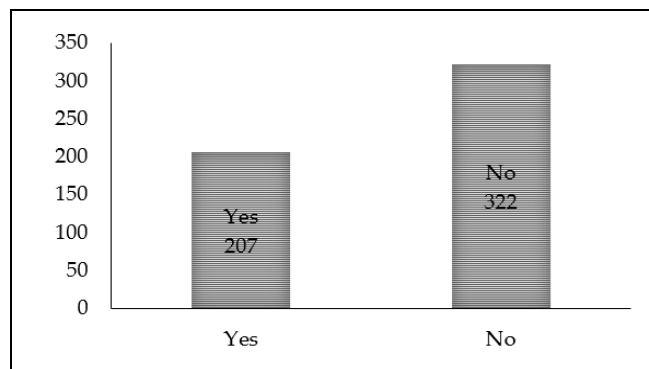


Figure: Distribution of reduced Bone Mineral Density (n=529)

In symptomatic patients, the mean BMD was -1.200±0.95; in asymptomatic patients, the mean BMD was 0.989±0.71. The difference between both groups was significant (*p*<0.05). In symptomatic patients, 170 (39.6%) had reduced BMD, while in asymptomatic patients, 37(37.0%) had reduced BMD (*p*>0.05). In symptomatic patients, 259 (60.4%) had normal BMD, 109(25.4%) had osteopenia, and 61(14.2%) had osteoporosis. In asymptomatic patients, 63 (63.0%) had normal BMD, 35 (35.0%) had osteopenia, and 2 (2.0%) had osteoporosis (*p*<0.05) (Table-II).

DISCUSSION

Our study aimed to find out the bone mineral density in symptomatic patients compared to asymptomatic patients using DEXA. Our data showed that 39.6% of the symptomatic patients had decreased bone density. Moreover, out of these patient majority were females and above 50 years of age. This is relatable to already available data.^{10,11} Another part of our data included asymptomatic patients. In this group, decreased bone density was recorded in 37% of the individuals. This shows that many people in our part of the world have reduced bone density but have not been diagnosed yet. This could be because they have not yet developed any symptoms.

A similar study in Pakistan evaluated bone density using broad-band ultrasound attenuation, which also showed an increased prevalence of osteopenia in premenopausal women.¹² Research done in Nepal showed that calcium intake is inversely related to osteoporosis, smoking negatively affects bone density, and vitamin D intake does not affect bone density.¹³

A study showed that individuals usually attain peak bone density at about 18-19 years of age, and females usually maintain it till 35 years of age, after which it declines. The same study should show that bone density is preserved till later in black men

compared to white people.¹⁴ A quantitative ultrasound technique to estimate bone density was used in Karachi to determine the bone density and risk factors for reduced density. It showed that osteopenia and osteoporosis were more common in individuals with less physical activity, less sun exposure, and less calcium intake and in smokers.¹⁵ A recent research took place in Pakistan to find out the percentage of women having awareness about the DEXA scan, and it showed that only one-third of the women included in the study had some knowledge about the DEXA scan.¹⁶

Known methods to combat bone resorption include fortification of diet via supplementation. Calcium and Vitamin D₃, in particular, effectively reduce fractures in specific subgroups.¹⁷ However, the Vitamin D status in younger people and the elderly differs broadly with the residents of the country, with a marked deficiency seen in the Pakistani population. Among a sample of 4830 randomly selected citizens, the percentage of vitamin D deficiency is 53.5%, 31.2% had insufficient vitamin D, and 15.3% had normal levels of vitamin D.¹⁸ Though no significant association between fractures and osteoporosis was assessed in the study, It is estimated that by the year 2050, 50% of all hip fractures in Asia will be a consequence of osteoporosis.¹⁹

We need to raise the awareness level in common individuals so that they know how important their bone health is and what adverse effects it can have on the overall health of an individual. Research must be undertaken to investigate the root causes of decreased bone density in the younger population, thus helping formulate guidelines to overcome this problem. Thus helping to set up a healthy society.

CONCLUSION

The frequency of osteopenia and osteoporosis is increasing in symptomatic and asymptomatic patients in Pakistan. An alarming fact is that most of these positive asymptomatic patients are below 50 years. Much importance should be given to increasing awareness among the youth to adopt healthy dietary habits and lifestyles. Bone pain should not be considered a criterion for referring patients to estimate bone density.

Conflict of Interest: None.

Authors Contribution

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

MA: Data analysis, drafting the manuscript, critical review, approval of the final version to be published.

SZ: Study design, drafting the manuscript, data interpretation, 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.

REFERENCES

1. Camacho PM, Petak SM, Binkley N, Diab DL, Eldeiry LS, Farooki A, et al. American Association of Clinical Endocrinologists/ American College of Endocrinology clinical practice guidelines for the diagnosis and treatment of postmenopausal osteoporosis—2020 update. *Endocr Pract* 2020;26:1-46. <https://doi.org/10.4158/g1-2020-0524suppl>
2. Choi Y. Dual-Energy X-Ray Absorptiometry: Beyond Bone Mineral Density Determination. *Endocrinol Metab* 2016; 31(1): 25-30. <https://doi.org/10.3803/enm.2016.31.1.25>
3. Chen L, Prasath VS. Measuring bone density connectivity using dual energy X-ray absorptiometry images. *International J Fuzzy Log Intell Syst* 2017;17(4):235-244. <https://doi.org/10.5391/IJFIS.2017.17.4.235>
4. Tuna F, Yavuz S, Kabayel DDD, Sarikaya A. Effects of clinical reanalysis in dual energy X-ray absorptiometry reports. *Turk J Phy Med Rehab* 2017; 63(3): 201-206. <https://doi.org/10.5606/tftrd.2017.595>
5. Wright N, Looker A, Saag K, Curtis J, Delzell E, Randall S, et al. The Recent Prevalence of Osteoporosis and Low Bone Mass in the United States Based on Bone Mineral Density at the Femoral Neck or Lumbar Spine. *J Bone Mineral Res* 2014; 29(11): 2520-2526. <https://doi.org/10.1002/jbmr.2269>
6. Khan A, Jafri L, Ahmed S, Noordin S. Osteoporosis and its perspective in Pakistan: A review of evidence and issues for addressing fragility fractures. *Ann Med Surg* 2018; 29(1): 19-25. <https://doi.org/10.1016/j.amsu.2018.03.019>
7. Naeem ST. Bone turnover markers for osteoporosis status assessment at baseline in postmenopausal Pakistani females. *J Coll Physicians Surg Pak* 2016; 26(5): 408-412.
8. Nazir S, Sagheer U, Riaz S, Khan ZM. Frequency of Osteoporosis and Osteopenia and its associated factors among general population in Faisalabad. *Prof Med J* 2019; 26(12): 2216-2221.
9. Shahid MA, Khan AN, Nisar M, Shah MA, Roshan P. High frequency of osteopenia in young adults of Karachi. *Pak J Med Dent* 2019; 8(4): 20-24. <https://doi.org/10.36283/PJMD8-4/004>
10. Soomro RR, Ahmed SI, Khan M. Frequency of osteopenia and associated risk factors among young female students. *J Pak Med Assoc* 2017; 67(1): 365-368.
11. Bass M, Sharma A, Nahar V, Chelf S, Zeller B, Pham L, et al. Bone Mineral Density Among Men and Women Aged 35 to 50 Years. *J Am Osteopath Assoc* 2019; 119(6): 357-363. <https://doi.org/10.7556/jaoa.2019.064>
12. Ejaz S. Prevalence of Osteoporosis and Osteopenia among Pakistani Pre and Post-Menopausal Women. *IOSR J Dent Med Sci* 2012; 2(6): 12-17. <https://doi.org/10.6084/M9.Figshare.2686>
13. Chaudhary NK, Timilsena MN, Sunuwar DR, Pradhan PMS. Association of Lifestyle and Food Consumption with Bone Mineral Density among People Aged 50 Years and Above Attending the Hospitals of Kathmandu, Nepal. *J Osteoporos* 2019; 2019(1): 1536394. <https://doi.org/10.1155/2019/1536394>
14. Sezer A, Altan L, Özdemir Ö. Multiple Comparison of Age Groups in Bone Mineral Density under Heteroscedasticity. *Biomed Res Int* 2015; 2015(1): 426847. <https://doi.org/10.1155/2015/426847>
15. Haris S. To Determine the Risk Factors and Prevalence of Osteoporosis among Adult Pakistani Population Residing in Karachi Using Quantitative Ultrasound Technique. *J Commun*

Bone Mineral Density in Symptomatic

- Med Health Educat 2014; 4(4): 1-4. [https://doi: 10.4172/2161-0711.1000299](https://doi.org/10.4172/2161-0711.1000299)
16. Anwar F, Iftekhar H, Taher T, Kazmi S, Rehman F, Humayun M, et al. Dual Energy X-ray Absorptiometry Scanning and Bone Health: The Pressing Need to Raise Awareness Amongst Pakistani Women. *Cureus* 2019; 11(9): e5724. <https://doi.org/10.7759/cureus.5724>
 17. Feng X, McDonald JM. Disorders of Bone Remodeling. *Ann Rev Pathol* 2011; 6(1): 121-145. <https://doi.org/10.1146/annurev-pathol-011110-130203>
 18. Weaver CM, Alexander DD, Boushey CJ, Dawson-Hughes B, Lappe JM, LeBoff MS, et al. Calcium plus vitamin D supplementation and risk of fractures: an updated meta-analysis from the National Osteoporosis Foundation. *Osteoporos Int* 2016; 27(1): 367-376. <https://doi.org/10.1007/s00198-015-3386-5>
 19. Kung AW, Fan T, Xu K, Xia WB, Park IH, Kim HS, et al. Factors influencing diagnosis and treatment of osteoporosis after a fragility fracture among postmenopausal women in Asian countries: a retrospective study. *BMC Women Health* 2013;13:7. <https://doi.org/10.1186/1472-6874-13-7>
-