

Prevalence and predictors of low bone mineral density among adults aged 50 years and above in Chandigarh, India

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ABSTRACT

Background: Osteoporosis, defined as skeletal disorder characterized by reduced bone density and strength, is prevalent in both developing and developed countries. Dual energy X-ray absorptiometry (DEXA) is an effective tool to diagnose low bone mineral density (BMD). **Objective:** This study objective was to know the prevalence and predictors of low BMD in a community-based screening program among the adult population using DEXA scan. **Methods:** In this community-based study conducted between January and June 2016, a population-based screening program was offered to both males and females of age 50 years and above. BMD was measured to derive T-scores and classify as normal, osteopenic, and osteoporotic individuals. **Results:** A total of 455 subjects were enrolled where 62.4% proportion was women; 42.6% subjects were in the age group of 50 to 59 years. The prevalence of osteoporosis and osteopenia was 20.9% and 48.1%, respectively. Hypertension (23.7%) and diabetes (8.4%) were common comorbidities. Age and gender (female) were independent predictors of low BMD. **Conclusion:** Osteoporosis/osteopenia is present in both genders with increasing trend with age advancement. Institution of timely screening will prevent the morbidity associated with fractures due to low BMD.

Keywords: DEXA, low bone mineral density, osteopenia, osteoporosis, screening

Introduction

Osteoporosis is a growing health problem recognized in both developed and developing countries. It is characterized by reduced bone mass and the progressive and systemic disruption of bone architecture that results in increased risks of fragility fractures, which are the main consequences of the disease.^[1] Osteoporosis can be termed as the “silent disease” because

bone loss occurs without symptoms. In many cases, the first “symptom” is a fractured bone. Main types of osteoporosis fractures are wrist fracture, vertebral fracture, and hip fracture. These fractures are associated with substantial pain, suffering, disability, and possibly even death for the affected patients.^[2,3]

Worldwide, osteoporosis causes more than 8.9 million fractures annually including 1.66 million hip fractures, resulting in an osteoporotic fracture every 3 s. Osteoporosis is greatly underdiagnosed and undertreated in Asia, even in the most high-risk patients who have already fractured. It is projected that more than about 50% of all osteoporotic hip fractures will occur in Asia by the year 2050.^[2] Women experience a significant bone

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loss during period of premenopausal and post-menopausal time period where in men, there occurs consistent bone loss which is longitudinal and occurs throughout life.^[4,5]

As the second most populous country in the world, India is home to a very large aging population, which is at risk of osteoporosis. In most Western countries, while the peak incidence of osteoporosis occurs at about 70 to 80 years of age, in India, it may afflict those 10 to 20 years younger, at the age of 50 to 60 years. The awareness of osteoporosis is low in India with surveys indicating that only 10% to 15% are aware of the disease. Urbanization appears to be associated with an increase in the prevalence of osteoporosis due to lifestyle changes, lower physical activity, increase in indoor living, and lower sun exposure.^[6]

To diagnose osteoporosis, bone mineral density (BMD) is the most effective tool. Dual energy X-ray absorptiometry (DEXA) is considered a gold standard to measure BMD.^[7] This method has been found to be effective in the diagnosis and management of osteoporosis and other diseases with abnormal BMD. It also helps in monitoring the response of therapy given for these conditions. The major advantages of using this technique is that it is non-invasive, patient friendly, has low radiation exposure, and high precision.^[8]

In primary care settings, where adults with age-related bone health issues commonly present with, osteoporosis is a common health problem in both genders and complications and deformities arising due to it can be delayed by primary caregivers by instituting nutritive and lifestyle changes at the appropriate time. This study was conceived to know the prevalence and predictors of low BMD in apparently healthy adult individuals aged 50 years and above.

Material and Methods

This community-based study was conducted in apparently healthy individuals attending a free opt-in type of screening programme which is done weekly at Urban Health Training Centre attached to our institute. The screening is offered in a mobile van with their demographic details entered before screening. This study is retrospective analysis of data collected over a period from January to June, 2016. Data collected from patients include age, gender, history of diabetes mellitus or hypertension, smoking, alcohol, medications (steroids), joint problems, bone-related complaints, thyroid disorders, and any other risk factor for osteoporosis.

The BMD was measured at the lumbar spine (LS) (L1 to L4) and T-scores were calculated by the DEXA machine software which uses reference databases. On the basis of the Indian normative data, T-score (ratio between patients BMD and that of young adult population of same sex and ethnicity) were characterized patients having osteoporosis and osteopenia. T-score of >-1 was taken as normal, between -1 and -2.5 as osteopenic, and <-2.5 as osteoporotic.^[9]

Scanning of subjects was done using Hologic Discovery A Qdr series, Hologic Inc., USA, using a dual energy, switched-pulse with exposure dose and time of 0.07 mGy and 30 s, respectively. Guidelines by the vendor for operating the machine were followed and the same technician performed all the examinations. Calibrations of the DEXA machine were done to avoid measurement bias on all screening days. All the participants who were found to have osteopenia/osteoporosis were counseled for diet and treatment for the same was instituted.

Inclusion criteria

1. Individuals voluntarily opting for DEXA scan
2. Subjects with age of 50 years and above.

Exclusion criteria

1. Already diagnosed cases of osteoporosis and osteopenia taking treatment.

Ethical statement

No individual patient level data were utilized for the purpose of this study and the data were fully anonymized before analysis. As this was retrospective record-based study, ethical approval was exempted.

Statistical analysis

Data were analyzed using SYSTAT software version 13.2 for Windows (San Jose, CA: Inpixon Inc.). Quantitative variables were tested for normality using Kolmogorov–Smirnov test before statistical comparisons were made. Continuous data were presented as mean and standard deviation and comparison was done using student t-test. Categorical data was presented as frequency and proportions. Chi-square test was employed to test differences between categorical variables. Binary logistic regression was applied to know the predictors and their strength of association with dependent variables. Point of statistical significance was considered when *P* value was less than 0.05.

Results

A total of 455 individuals were included in the study. Females nearly comprised 2/3rd of the subjects with a proportion of 62.4%. Average age of the participants was 61.40 years. Age group ranged from 50 to 89 years with 42.6% in the 50 to 59 years age group. More than two-third (69%) of subjects were found to have low BMD. A total of 141 (31.0%) had normal BMD; 219 (48.1%) participants had osteopenia while 95 (20.9%) had osteoporosis. Various comorbidities were present in study subjects with hypertension (23.7%) and diabetes mellitus (8.4%). Females were significantly in higher proportion among low BMD as compared with normal subjects. Table 1 shows the distribution of demographic characteristics among healthy and osteopenic/osteoporotic subjects. Figure 1 shows the distribution of males and females with respect to bone density.

Table 2 shows the BMD among males and females with age less than and more than 60 years. There was a significant difference

Table 1: Demographic and comorbid characteristics of study subjects

	Osteopenia/ Osteoporosis (n=428)	Normal bone mineral density (n=251)	P
Age (overall)	61.70±8.35	60.73±8.13	0.249
Males	64.19±9.46	63.89±8.94	0.839
Females	60.45±7.45	57.95±6.17	0.010
Gender (Female)	209 (66.6%)	75 (53.2%)	0.006
Education (upto primary)	60 (19.1%)	28 (19.9%)	0.851
Arthritis	23 (7.3%)	10 (7.1%)	0.929
Coronary artery diseases	17 (5.4%)	8 (5.7%)	0.910
Thyroid disorders	18 (5.7%)	4 (2.8%)	0.183
Hypertension	78 (24.8%)	30 (21.3%)	0.409
Diabetes mellitus	23 (7.3%)	15 (10.6%)	0.237

Table 2: Bone mineral density with respect to age in different age groups

Age	Subjects	Bone mineral density			P*
		Normal	Osteopenia	Osteoporosis	
<60 years	Males	20 (35.7%)	26 (46.4%)	10 (17.9%)	0.491
	Females	46 (33.3%)	75 (54.3%)	17 (12.3%)	
≥60 years	Males	46 (40%)	44 (38.3%)	25 (21.7%)	0.002
	Females	29 (19.9%)	74 (50.7%)	43 (29.5%)	

*Chi-square test

in the distribution of BMD among males and females in age more than 60 years. The proportion of males and females was 40% and 19.9% with normal BMD for the age group 60 years above, whereas this proportion was similar for the age group under 60 years.

Binary logistic regression was applied to see the relation of predictors with healthy and osteopenic/osteoporotic subjects. On univariate analysis, age was a significant predictor, whereas after adjustment for confounding variables, age and female gender had significantly higher odds of osteopenia/osteoporosis [Table 3].

Discussion

Given the large elderly population in Asia, osteoporosis is and will be a major health problem in the coming years. The cost-effective means of identifying and treating patients with high-risk fracture are necessary. Individuals having low BMD are at higher risk of developing osteoporosis and thus osteoporotic fractures. Adequate treatment at the right time can prevent long-term morbidities due to osteoporotic fractures. Using different radiometry tools and criteria, the prevalence of osteoporosis has been reported ranging from 4.7% among men (at hip)^[10] to about 53% among postmenopausal women.^[11] With increasing age, there is steady decline in the BMD too.

It has been documented in larger sample studies that fracture rate is higher in osteoporotic and osteopenic individuals as compared with normal BMD individuals with the risk of fracture ranging 4 times to 1.8 times, respectively.^[12]

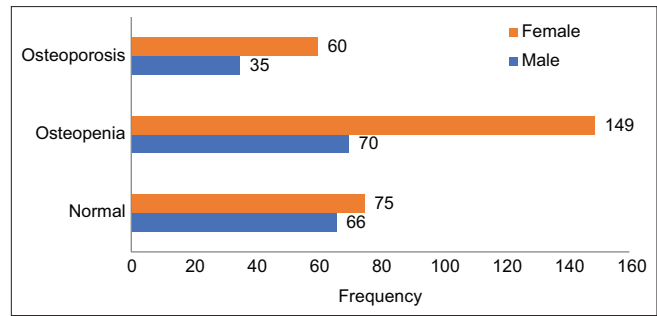


Figure 1: Distribution of gender with respect to bone density

In this study, 31% had normal BMD; 48.1% had osteopenia and 20.9% had osteoporosis. Similar results were also seen in the study conducted by Aggarwal *et al.*^[11] in the same population where low BMD (osteopenia and osteoporosis) was seen in 53% of the study population. In another similar kind of study conducted in Chandigarh, 18% of women aged 38 to 64 years were found to be osteoporotic, whereas 55% women were osteopenic.^[13] In a study conducted by Unni *et al.*,^[14] 40% women were found to be osteopenic and 23.2% osteoporotic at the LS level. Similar trend was seen in studies from Jammu and Pune as well.^[15,16]

Although more than half of the screened population had low mineral density predisposing them to the risk of fractures, bone-related complaints (arthritis) were cited by only 7.3% of the population. This highlights the silent nature of the disease and the first presenting symptom could be fracture only.

In this study, osteopenia and osteoporosis were significantly higher among females as compared with males in the age group of more than 60 years. In contrast to our study where 28.7% study population had normal BMD above the age of 60 years, Sharma *et al.*^[15] from Jammu found that hundred percent of population above 65 was either osteopenic or osteoporotic. In another study done in Mumbai, it was observed that BMD declined with every decade in both men and women with more decline observed amongst females. Also, the authors found a sharp decline of BMD during transition from 5th to 6th decade.^[17] It may be explained by the fact that the hormonal milieu in females is protective till the menopausal period; after that the protective cover is lost, thus making them more prone to osteoporosis/osteopenia. Study from Pakistan had a prevalence of osteoporosis of 13% in females of post-menopausal with mean age of 56.5 years,^[18] whereas in current study, females aged 60 years and above had prevalence of 29.5%. This finding may be explained by different dietary intake (predominantly vegetarian) in the Indian region.

A cross sectional study in tertiary care hospital found that osteoporosis was present in 6.9% subjects (female, 11.1%; male, 4.2%) and osteopenia in 34% subjects (female, 40.3%; male, 29.9%) which was much lower than the proportion found in this study.^[19] Another study in urban population in Delhi found significant association of gender with T Score ($P < 0.001$), where 8.99% patients were osteoporotic, 59.55% were osteopenic, and

Table 3: Unadjusted and adjusted predictors of osteopenia/osteoporosis using binary logistic regression

Predictor variables	Unadjusted		Adjusted	
	Odd's ratio (95% C.I.)	P	Odd's ratio (95% C.I.)	P
Age (in years)	1.014 (0.990-1.040)	0.249	1.026 (1.020-1.052)	0.045
Gender (Female)	1.752 (1.168-2.627)	0.007	1.946 (1.276-2.968)	0.002
Education (up to primary)	0.953 (0.578-1.572)	0.851	0.904 (0.539-1.514)	0.701

the remaining 31.46% were of normal BMD.^[20] Below the age of 60 years, the prevalence of osteopenia was higher in females in this study but the prevalence of osteoporosis was more in males. These findings are supported by a study conducted in Pune, India, where significantly lower T-scores were observed at LS in men compared with premenopausal ($P < 0.05$). In the same study, at left femur, T-scores were significantly lower in men compared with premenopausal women ($P < 0.05$) but not postmenopausal women ($P > 0.1$).^[14] A study by Cilotti *et al.*^[21] also revealed the finding that males had lower prevalence of osteoporosis than in women but post hip fracture mortality was high. Similar studies conducted elsewhere in different Indian cities have also reported high prevalence of osteopenia in adult men and women indicating the need to target this population at risk for preventing the progression to osteoporosis in future.^[22-24]

A study conducted in North India among patients of hip fractures indicated no difference in occurrence between both males and females, although the sex ratio in different subgroups was variable, and not always in favor of men. Lower T scores in men could be attributed to urbanized lifestyle and low sunlight exposure due to long office hours. Thus, preventive strategies should be focused in both sexes regardless of age. Many strategies advocated earlier are education regarding osteoporosis to doctors, information in undergraduate medical curriculum, taking bone health programs as priority, and fortification of food items.^[25,26] This study revealed a higher risk of low BMD among females and subjects with increasing age. In a recent study, awareness regarding osteoporosis among post-menopausal women was found to be poor which also remains an area of concern.^[27] In primary care settings of rural and urban areas with no accessibility of diagnostic bone health facilities (DEXA scan), a preemptive step for addressing the bone health should be undertaken by primary care givers. Increasing age and female gender are known risk factors for low bone density which are reiterated and found significant in the present study. In rural and low cost settings, fracture risk assessment tool can be used which is inexpensive, easily available, does not need technical expertise, and can be used by health care workers as well as family physicians.^[28] Our findings were also supported by Aggarwal *et al.*,^[11] where age, exercise, low calcium, and postmenopausal status were significant predictors of low BMD.

Our study, however, had some limitations. First, dietary and exercise patterns of subjects were not taken into account. Second, this study was of short duration. Third, only LS level was taken into account for the estimation of T-score.

Conclusions

The study concluded that men and women both have an increasing trend of osteoporosis with increasing age predisposing them to fractures. Thus, emphasizing the importance of early diagnosis by screening the population for low BMD which would facilitate early initiation of treatment for osteoporosis and preventing long-term complications. Public health measures such as awareness generation for physical activity and dietary modifications are recommended in all patients regardless of BMD, as they are efficacious, safe, and cost-effective.

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Conflicts of interest

There are no conflicts of interest.

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