Original Article

Asymptomatic Osteoporosis in Indian Geriatric Population

Magesh Rajendran*, Jayanthi Swaminathan, Udhaya Balasubramaniam, Balasubramaniam Ramakrishnan, Sathyanarayana Kondati

Abstract

Background : Present study is a retrospective analysis of three years data obtained from Bone mineral density scan (DEXA) done as per the established WHO guidelines from 956 diverse Indian geriatric study subjects enrolled in senior citizen health package offered by Apollo Hospitals, Chennai.

Materials and methods: Densitometric abnormalities, BMD abnormalities of the DEXA scan data obtained from femoral head and neck region, lumbar spine region were calculated using established methods from both genders. Gender specific comparison of data was done at $P<0.05$ level of statistical significance.

Results: Of the enrolled 956 study subjects 49.4% were men and 50.6% were women. Gender wise comparison of the data revealed a statistically significant level of osteoporotic changes ($p<0.05$) and osteopenia changes of the enrolled study subjects in spine region and femoral neck region. Data obtained from spine region revealed 37.5% osteopenic changes in male when compared to female who had 45.6%. Osteoporotic study data revealed 24% in male and female population had a slightly higher change 29%. In femoral neck region male had 48.3% and female had a high prevalence of 57.1% osteopenia changes. Osteoporotic changes of femoral neck region revealed 19.2% in male and 17.2% in female population.

Conclusion: Since this study revealed high prevalence of osteoporosis in Indian males, we recommend follow up studies to address its significance. We conclude that Bone density (DEXA) scan in geriatric health

(Journal of The Indian Academy of Geriatrics, 2017; 13:101-105)

INTRODUCTION

Osteoporosis *"Porous bones"* is a slowly progressive bone disease associated with reduction in bone mass, disruption of bone architecture thus enhancing the chance of bone fractures resulting in diminished life quality leading to premature death in affected individuals.[1] Many evolving clinical factors that influence the risk of osteoporotic changes such as poor exposure to sun light, nutritional factors especially calcium deficiency, vitamin D deficiency, post-menopausal hormone mediated metabolic ailments and low Bone Mineral Density (BMD). This impacts bone metabolism and leads to osteoporosis associated health problems.[2,3,4] With increasing life expectancy throughout the world, regardless of gender the prevalence and incidence of osteoporosis and osteoporosis driven fractures shows a rising trend in the elderly individuals.[5,6] Two thirds of the world population live in Asia who are frequently exposed to the various underlying pre–disposing conditions leading to osteoporosis.[7] In a recent multi-centric study involving more than 2500 subjects in south India it was identified that apparent involvement of osteo-porosis (42.7%) is evident at spine and hip regions.[8] It is evident from the demographic statistics of India that the size of the population aged 50 years or older will increase markedly during the next several decades, thus the direct and indirect consequence of osteoporosis will

Apollo Hospitals Educational and Research Foundation (AHERF), 55 Greams Road, Chennai (Madras), Pin code # 600006, Tamil Nadu, India.
**Corresponding author: mageshdr@gmail.com*

be expected to pose a serious public health concern. Low BMD is one of the strongest risk factor for osteoporotic fracture. This can easily be determined by dual X-ray absorptiometry (DEXA) and used to predict the risk of fractures in elderly population. Clear understanding of pathophysiology, early and timely therapeutic intervention strategies can prevent the geriatric population from osteoporotic deterioration of skeletal structures and will be very helpful in avoiding risk factors, morbidity and mortality. Pilot study on patients above the age of 60 years who underwent screening by senior citizen health check at Apollo Hospitals, Chennai to ascertain the prevalence of asymptomatic osteoporosis had revealed that 30% of the study subjects showed prevalence of osteoporosis. This significant pilot study data persuaded us to further study the prevalence of osteoporosis and osteoporosis associated changes in a larger population size by way of doing a retrospective analysis of three years data. In the present study the prevalence and incidence of asymptomatic osteoporosis in diverse geriatric Indian population participating in our senior citizen health check offered under Apollo Hospitals preventive health program at various centers based in Chennai (India) was analyzed.

MATERIALS AND METHODS

The DEXA scan data presented here were captured from Health Check records in Apollo Hospitals, Chennai. Data captured were analyzed after approval of the ethical committee. Patients attending the senior citizen health check (above 60 years of age) of both the gender were included in this study. Subjects in the age group of 40 to 60 years were included for age-specific and gender specific comparison of involvement of asymptomatic osteoporotic changes. Subjects without any symptom of low back pain, neck pain, fragility on fracture, not taking treatment for calcium deficiency were included in this study. Patients with chronic illness, taking treatment for calcium deficiency, known case of osteoporosis, neck pain, low back pain, previous fragility fractures and patients with advanced form of osteoporosis or radiological evidence of severe joint damage were excluded from this study. Pregnant women were excluded from this study. Detailed medical, obstetrical, menstrual and medication history were obtained from participating subjects. All precautionary measures were taken to maintain the confidentiality of the patients. Subjects enrolled were positioned by experienced radiographers and the positioning was ensured before the onset and during the process of scanning. WHO guidelines were followed during the entire DEXA scan procedure. Image obtained from the DEXA scan is evaluated for the presence of artifacts, surgical clips, navel rings, barium sulphate, metal coin and other metallic objects. Densitometric abnormalities, BMD abnormalities were interpreted by physicians involved in this study. DEXA scan data obtained from femoral head and neck, lumbar spine. BMD (Bone mineral mass density) was calculated using established method in all the regions.

The T-score -1 SD and above was considered as normal bone density. T-score between -1 SD and -2.5 SD was considered as osteopenia (low bone density) while T-score below -2.5 SD was kept as criteria for diagnosis of osteoporosis in the present study (Table1).

Table 1: WHO definition of Osteoporosis and Osteopenia

T-Score	Definition
-1 SD & above	Normal bone density
Between -1 SD and -2.5 SD	Osteopenia (low bone density)
Below -2.5 SD	Osteoporosis

Statistical analysis and interpretation of results

All the continuous variables were represented as Mean ± SD. Categorical variables were represented as percentages. Comparison of categorical variables was done by Chi-square test. Comparison of continuous variables was done by independent sample t-test. Pearson correlation coefficient was computed to assess the association of continuous variables. Scatter plot was also drawn. Data entry was done in MS-Excel spread sheet. Data analysis was carried out by SPSS version 16.0 Chicago. All 'p' values < 0.05 was considered as statistically significant.

RESULTS

A total of Nine hundred and fifty six (956) were included in the study of which 49.4% were (n=472) male and 50.6% (n=484) were female. 14.5% (n=139) were below the age of 60 years, 61.1% of the study participants (n=584) were ranging between the age group of 61 to 70 years and 24.4% (n=233) were above the age of 70 years (Table 2).

Table 2: Baseline demographics of the patients

Variable	Number	(%)
Age group (Years)		
<= 60	139	(14.5%)
61-70	584	(61.1%)
>70	233	(24.4%)
Gender		
Male	472	(49.4%)
Female	484	(50.6%)

Overall prevalence of Osteoporosis was 27.1%, 18.2%, 11.1% and 12.3% in spine, femoral neck, trochenter and total hip regions respectively (Table 3).

Table 3: Overall Mean T-Score

Variable	Min	Max	Mean	SD	Nor-mal	Osteo-penia	Osteo-porosis
Spine	-5.7	3.3	-1.6	1.4	293 (31.3%)	389 (41.6%)	253 (27.1%)
Femoral Neck	-4.7	5.1	-1.5	1.2	272 (29.1%)	493 (52.7%)	170 (18.2%)
Trochanter	-4.4	9.0	-0.8	1.3	509 (54.5%)	321 (34.4%)	104 (11.1%)
Total hip	-4.5	3.4	-0.9	1.2	459 (49.1%)	361 (38.6%)	115 (12.3%)

It is significant to note that the Osteopenia and osteoporotic changes in the trochanter region was giving a higher value 36.9% (n= 171) in male population when compared to female population who had 31.8% (n=150) and same difference was noted between male and female (13.4% and 8.9%) in osteoporosis ($p<0.05$). High prevalence of Osteopenia 57.1% (n= 269) was observed in female study subjects compared to male subjects 48.3% (n=224) in the femoral neck region ($p<0.05$). (Table 4)

Table 4: Prevalence of Osteopenia & Osteoporosis between male and female in different sites

		Male	Female
Spine #	Normal	177 (38.1%)	116 (24.6%)
	Osteopenia	174 (37.5%)	215 (45.6%)
	Osteoporosis	113 (24.4%)	140 (29.7%)
Femoral Neck#	Normal	151(32.5%)	121 (25.7%)
	Osteopenia	224 (48.3%)	269 (57.1%)
	Osteoporosis	89 (19.2%)	81 (17.2%)
Trochanter #	Normal	230(49.7%)	279 (59.2%)
	Osteopenia	171(36.9%)	150 (31.8%)
	Osteoporosis	62 (13.4%)	42 (8.9%)
Total hip*	Normal	234 (50.6%)	221 (47.1%)
	Osteopenia	170 (36.8%)	191 (40.7%)
	Osteoporosis	58 (12.6%)	57 (12.2%)

# $p<0.05$ (Significant); * $p>0.05$(Not significant)

The osteopenic changes observed in the total hip region was higher in female population 40.7% (n=191) when compared to male population 36.8% (n=170) which was not statistically significant ($p=0.461$). Osteoporotic changes in the spine area was 29.7% in female population (n=140) when compared to 24.4% in male (n=113). In the femoral neck region, male had slightly increased (19.2%) osteoporotic changes than female (17.2%).

Whereas the t-score data of trochanter region showed osteoporosis in 13.4% (n=62) in male when compared to 8.9% (n=42) in females which is statistically significant at $P<0.05$ level. Osteoporotic changes were slightly higher in male 12.6% (n=58) compared to female 12.2% (n=57) in total Hip measurements. Thus the data is not conclusive about gender specific difference in osteoporotic pattern in the enrolled geriatric study population (Table 4).

Table 5: Age Vs Neck mean

Correlations

		Age	neckmean
Age	Pearson Correlation	1	-.137**
	Sig. (2-tailed)	.	.000
	N	956	935
neckmean	Pearson Correlation	-.137**	1
	Sig. (2-tailed)	.000	.
	N	935	935

**. Correlation is significant at the 0.01 level (2-tailed).

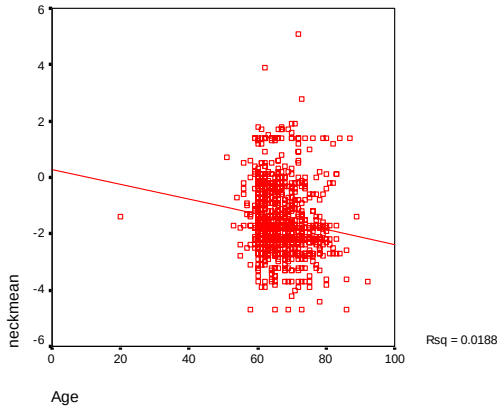

Figure1: Correlation of Age and Neck Mean

Figure 1 depicts the association of age and femoral neck mean t score. There was negative association between age and neck mean t score which means that as the age of the patients goes up, mean t scores are coming down either they got osteopenia or osteoporosis. This was statistically significant ($p = 0.0001$) with correlation coefficient ($r=0.137$).

Table 6. Age Vs Total Mean

Correlations

		Age	total
Age	Pearson Correlation	1	-.118**
	Sig. (2-tailed)	.	.000
	N	956	931
total	Pearson Correlation	-.118**	1
	Sig. (2-tailed)	.000	.
	N	931	931

**. Correlation is significant at the 0.01 level

Figure 2 denotes the association between age and total mean. We found negative association which was also statistically significant (p = 0.0001, r = -0.118). As the age increases the total mean t score is coming down. This indicates a high chance of detecting either osteopenia or osteoporosis on the DEXA scan.

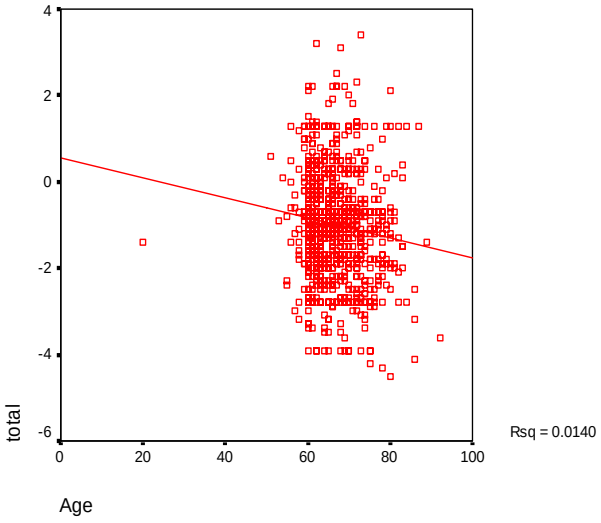

Figure 2: Correlation of Age and Total Mean

Table 7. Age Vs Spine Mean

Correlations

		spinemean	Age
spinemean	Pearson Correlation	1	-.062
	Sig. (2-tailed)	.	.057
	N	935	935
Age	Pearson Correlation	-.062	1
	Sig. (2-tailed)	.057	.
	N	935	956

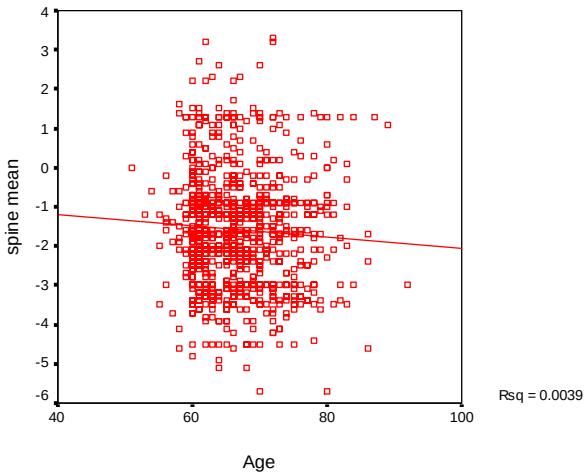

Figure 3: Correlation of Age and Spine Mean

Figure 3 also showed that negative association was found between age and spine mean but which was not statistically significant (p = 0.057, r = -0.062).

DISCUSSION

This retrospective study clearly indicates that middle aged and elderly population in India are highly prone for Osteopenia and Osteoporotic changes. Current level of awareness of osteoporosis is low in India. Indian population specific data base generated out of the multi-centric trials conducted by the Indian Council for Medical Research (ICMR) revealed that Indians have lower BMD than the North American counterparts. The results obtained from the present study clearly suggest a high prevalence of asymptomatic osteoporosis. The present retrospective study also revealed higher incidence of Osteopenia in adult males. The focus on bone health has been more in menopausal women. This study shows that DEXA screening for low Bone Mineral density, especially of Hip and spine is good in detecting Osteopenia or Osteoporosis in middle aged and elderly Indian men. Hence it may be possible to prevent the fractures associated with osteoporosis by expanding the screening for osteoporosis to include elderly males.

Currently, approximately 10% of Indian population is aged over 50 years.[9] Based on the current patterns of growth, India's population is expected to grow by 16% to reach 1.4 billion by the year 2025.[8] Expert audit conducted by the international osteoporosis foundation indicate that the affected number of osteoporosis patients in India will increases continuously.[10] As per the recent statistics nearly 50 million people in India are either osteoporotic or have low bone mass.[11]

High prevalence of vitamin D deficiency as seen in Indian population due to increased urbanization also contributes to low bone mass.[12] Hence Osteoporosis is a major concern in ageing Indian population. This study may imply that early diagnosis and treatment could prevent fractures. This could decrease the medical, social and economic burden of this public health problem. Hence, we recommend screening using DEXA scan in all asymptomatic senior citizens aged more than 60 years.

REFERENCES

1. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *The Lancet* 2002; 359:1761-1767.
2. Ann M Fehily. Dietary determinants of bone mass and fracture risk: a review. *J of Human Nutrition and dietics* 1989; 2(5): 299-313.
3. Calligari C, Lami F, Levantesi F, Anna Maria A, Tatali M, Miglioli M, Grundi S and Barabara L .Post-menopausa bone density, lactase deficiency and milk consumption. *J of Human Nutrition and dietics* 1990; 3 (5), 159-164.
4. Monolagas SC. Birth and death of bone cells: basic regulatory mechanisms and implications for the pathogenesis and treatment of osteoporosis. *Endocrine Rev* 2000; 21: 1132 – 1136.
5. WHO. Assessment of fracture risk and its application to screening for post-menopausal osteoporosis 1994. WHO: Geneva.
6. Laura Masi. Epidemiology of Osteoporosis, clinical cases *Miner Bone Metab* 2008; 5 (1): 11-13.
7. Osteoporosis in Asia: A call to action. *Curr Osteoporosis Rep* 2012; 10 (4): 245-247.
8. ICMR. Population based reference standards of peak bone mineral density of Indian male and female. ICMR bulletin 2011; 41 (4).
9. Haentjens P, Johnell O, Kanis JA, Bouillon R, Cooper C, Lamraski G, Vanderschueren D, Kaufman JM, Boonen S. On behalf of the Network on Male Osteoporosis in Europe (NEMO). Evidence From Data Searches and Life-Table Analyses for Gender-Related Differences in Absolute Risk of Hip Fracture After Colles' or Spine Fracture: Colles' Fracture as an Early and Sensitive Marker of Skeletal Fragility in White Men. *J Bone Miner Res* 2004; 19:1933-44.
10. IOF. International osteoporosis Foundation 2009; Annual report.
11. Malhotra N, Mittal A. Osteoporosis in Indian. *Ind J of Med Res* 2008; 127: 263-268.
12. Dhanwal DK, Sahoo S, Gautam VK, Saha R. Hip fracture in India have vitamin D deficiency and secondary hyperthyroidism, *Osteoporosis International* 2013; 24:553 -557.

.