Short Communication

Assessment of bone mineral density and osteoporosis status in elderly Indian population

Biplob Chowdhury

Department of Physical Education, Visva Bharati University, Santiniketan, West Bengal, India

Abstract

This was a cross-sectional prospective study conducted to investigate the incidence and their interrelationship between major osteoporotic fracture risk (MOFR), hip fracture risk (HFR) and bone mineral density (BMD) in Indian population. One hundred and eighty-seven healthy females and 176 males aged 50-year or more after obtaining written informed consent were selected as osteoporotic using WHO fracture risk assessment tool (FRAX) India tool to measure the MOFR and HFR probability. Age, MOFR and HFR had an independent contribution to BMD in both women and men. Considering FRAX risk scores without BMD would be beneficial in the assessment of low bone density in the elderly population.

Key words: Bone mineral density, elderly, fracture risk, fracture risk assessment tool, osteoporosis

Received: 13th February, 2014; ***Revised:*** 12th August, 2014; ***Accepted:*** 17th August, 2014

INTRODUCTION

Osteoporosis is very common in older adults, and is associated with bone micro-architectural deterioration, which ultimately leads to morbidity and mortality.[1] It is projected that by the year 2050, about 50% of the osteoporotic hip fractures in the world will occur in Asia.[2] Though, dual X-ray absorptiometry score is a valid method[3] for diagnosis of osteoporosis, due to cost and unavailability this method is not very effective in many low economic countries.

The fracture risk assessment tool (FRAX®) is a computer-based algorithm developed by WHO for the recognition of individuals with high risk of fracture.[4] The output of FRAX calculates the next 10-year probability of a major osteoporotic fracture risk (MOFR) and hip fracture risk (HFR).[5,6] This probability is calculated from age, sex, body mass index (BMI) and risk factors such as prior fragility fracture, parental history of hip fracture, current tobacco smoking, long-term oral glucocorticoid use, rheumatoid arthritis, other causes of secondary osteoporosis and high alcohol consumption. Therefore, the present study was conducted for the assessment of bone density using MOFR and HFR in elderly Indian population.

Access this article online	
Quick Response Code:	Website: www.ijcep.org
	DOI: 10.4103/2348-8093.143513

MATERIALS AND METHODS

The study was conducted in the Department of Physical Education, Visva Bharati University, Santiniketan, India. Subjects aged above 50-year with osteoporosis having a bone mineral density (BMD) T-score – 2.5 standard deviation (SD) below the young normal sex-matched BMD, in the distal radius (forearm) were included in the study.[7] After obtaining ethical clearance and written informed consent from the institute, 363 subjects fulfilled the inclusion criteria (187 women and 176 men). FRAX questionnaire was administered to them. A questionnaire was used to collect information on age, gender, residence, fracture history, the use of a walking aid, the level of daily physical activity, and mobility. The BMI was calculated from height and weight measured by standard weighing machine and stadiometer. BMD was obtained using ultrasound bone densitometry (Sunlight omnisense bone sonometer 7000S, sunlight medical Ltd., United States) at distal radius by the experts and technicians to get the BMD T-score.

Subjects with normal BMD, osteopenia, cardio-vascular disease, visual and auditory deficiency, other

Address for correspondence: Dr.Biplob Chowdhury, Department of Physical Education, Visva Bharati University, Santiniketan, Kolkata, West Bengal, India. E-mail: bcvbpe@gmail.com

contraindications or vestibular alteration such as person who used assisted walking devices or who were unable to walk independently >10 m were excluded from the study.

As per WHO criteria and modified by International Osteoporosis Foundation, osteoporosis can be diagnosed by BMD values as follows: (i) Normal - BMD not >1 SD below young adult mean (T-score > −1), (ii) osteopenia - BMD between 1 and 2.5 SD below young adult mean (T-score between −1 and −2.5), (iii) osteoporosis - BMD 2.5 SD or more below young adult mean (T-score at or below −2.5). The statistical analysis of data using Student's *t*-test and multiple regression analysis were carried out using SPSS version 17.0 IBM corporation (Chicago, USA).

RESULTS

The mean and SD for Age, BMI, BMD (T-score), MOFR and HFR in both men and women were depicted in Table 1. There was a significant correlation between age, height, weight, BMI with BMD in the elderly population [Figure 1]. From all the variables entered into the equation using multiple regression analysis, BMD was found to be significantly associated with age, contributing 51.0% (P = 0.003) in women and 49.0% (P = 0.002) in men. Thereafter, other variables such as MOFR with 69.0% (P = 0.001) in women and 58% (P = 0.001) in men and HFR with 63.0% (P = 0.001) in women and 24% (P < 0.03) in men were associated with BMD, respectively.

Table 1: Baseline characteristics of the subjects

Characteristics	Women (*n*=187)	Men (*n*=176)	*P*
Age, (years)	63.70±10.29	62.55±10.34	0.047
BMI, (kg/m^2)	24.59±5.25	22.69±2.48	0.024
BMD, (T-score)	−2.96±1.35	−2.68±1.47	0.049
MOFR, (%)	26.39±20.49	11.86±4.54	0.015
HFR, (%)	17.87±20.63	5.27±3.44	0.027

Data expressed as mean±SD. P<0.05 was considered statistically significant. BMI: Body mass index, BMD: Bone mineral density, MOFR: Major osteoporotic fracture risk, HFR: Hip fracture risk, SD: Standard deviation

Table 2: Multiple regression analysis of BMD (as dependent variable) with various other associated factors (as independent variables) in osteoporosis

Independent variables	Women		Men	
	Standardized β (95% CI)	*P*	Standardized β (95% CI)	*P*
Age	1.51 (1.10-1.55)	0.003	1.49 (1.18-2.09)	0.002
MOFR	1.69 (1.50-1.91)	0.001	1.58 (1.39-2.31)	0.001
HFR	1.63 (1.42-1.87)	0.001	1.24 (1.03-1.54)	0.031

The P<0.05 were considered as statistically significant. BMD: Bone mineral density, MOFR: Major osteoporotic fracture risk, HFR: Hip fracture risk, CI: Confidence interval

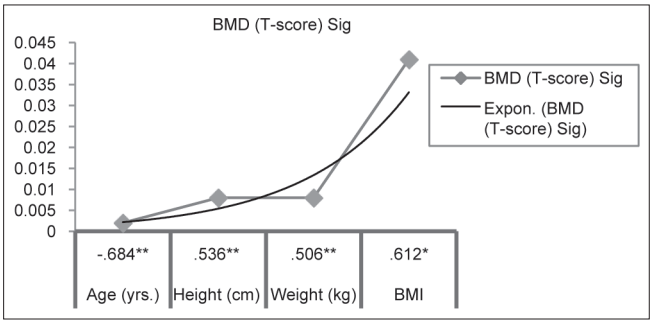

Figure 1: Correlation of bone mineral density with age and body mass index. BMD: bone mineral density, BMI: body mass index, Expon: Exponential line, Correlation is significant at *P < 0.05 level, and **P < 0.01 level

DISCUSSION

Results from the present study demonstrate significant association of BMD with increasing FRAX risks scores which are used in the assessment of osteoporotic severity. Women were more prone to MOFR and HFR when compared to men [Table 1]. This study also reveals the inter-relationship between BMD and FRAX scores, which may be helpful for the diagnosis and treatment of osteoporosis in the elderly population, who are at high risk. Van den Bergh *et al*. have reported that BMD test predictive value is higher than the use of FRAX tool without BMD[8] but several other works[9-13] in accordance to the results of our study have reported FRAX tool without including BMD is effective in identifying the high risk subjects with low BMD. Moreover, the BMD values decreased with increasing 10-year probability of fracture.[14] This study revealed that MOFR and HFR *per se* are strongly associated with BMD. Both BMD and MOFR were strongly associated with age, and the association remained significant after adjustment for age [Table 2]. The results suggested that this study could be applied as a practical method of quantifying BMD for the elderly population, especially in the rural areas of India to generate greater public awareness in this regard. Nevertheless, further prospective studies should be conducted to identify the independent contribution of each risk factor to the low bone mass and severity of the fracture in these subjects.

CONCLUSION

The bone density and FRAX risk scores appear to be very closely related to the prognosis of osteoporotic fracture. Therefore, taking FRAX risk scores into consideration would be beneficial in the assessment of osteoporosis and HFR. However, given the limitations in terms of study design, a large-scale prospective cohort study

including the clinical risk factors used in FRAX and BMD for predicting the osteoporotic status is warranted.

ACKNOWLEDGMENTS

The author gratefully acknowledges the invaluable assistance of Dr. Pratyush Chatterjee, orthopedic surgeon, AMRI, and is indebted to the University of Visva-Bharati, whose cooperation made this work possible.

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How to cite this article: Chowdhury B. Assessment of bone mineral density and osteoporosis status in elderly Indian population. Int J Clin Exp Physiol 2014;1:232-4.

Source of Support: Nil, **Conflict of Interest:** Nil.