



## Original Article

# Evaluation of Osteoporosis in Elderly with Novel Diagnostic Tools

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## ABSTRACT

**Introduction:** *The morbidity of osteoporosis is under recognized as well as less studied. It is a current world wide socioeconomic problem with an increasing severity and frequency due to the progressive aging of the world's population.*

**Aim and Objectives:** *1. To evaluate osteoporosis in elderly population by BMD and FRAX score. 2. To study various causes and risk factors of osteoporosis in elderly. 3. To correlate clinical features with BMD values in patients of osteoporosis.*

**Material and Methods:** *In our study we analysed risk factors for osteoporosis in 100 patients and fracture risk in relation to level of BMD with the help of FRAX tool and peripheral dual energy x-ray absorptiometry.*

**Results:** *Average value of T score was -2.9. Range of T score was -2.5 to -3.95. Average BMD value was 373.68 with SD of 67.18. Future 10 years probability of osteoporotic fracture (FRAX score) for our study is 9.137.*

**Conclusions:** *The prevalence of osteoporosis is directly proportional to age and calcium levels of patients as independent predictors. Peripheral DEXA and FRAX score assess overall risk of fractures due to the high negative predictive value. Majority of patients had osteoporosis indicating that they have a higher risk for osteoporotic fractures and overall morbidity. The two tools namely peripheral DEXA and FRAX score are useful for screening in population for osteoporosis in resource limited settings as well as in treatment of osteoporosis.*

**KEYWORDS:** *BMD (bone mineral density), FRAX (fracture risk assessment score), Osteoporosis, Peripheral DEXA (dual energy x ray absorptiometry).*

## INTRODUCTION

Osteoporosis is one of the major cause of disability, morbidity and mortality in older people. It is a current world wide socioeconomic problem with an increasing severity and frequency due to the progressive aging of the world's population.

The health of bones depends on the genes, the level of hormones in the body, physical activity and diet of an individual. Osteoporosis is a disease characterized by low bone mineral density, bone fragility and increased susceptibility to fractures mainly of the hip, spine and wrist. It does not

become clinically apparent until a fracture occurs. Screening of at-risk populations is therefore essential<sup>[1]</sup>.

Osteoporosis causes more open and porous bones resulting in fractures. It is of primary or secondary type. There are two types of primary osteoporosis: Type I and Type II. Type I occurs only in women (menopausal) due to decreased estrogen and increased osteoclast activity, from age 50 to 70. Type II most commonly affects men and women over the age of 75 due to decreased osteoblast activity and decreased bone formation<sup>[2,3]</sup>. Secondary osteoporosis, is secondary to other underlying diseases, a few of which are: secondary hyperparathyroidism, diabetes, glucocorticoid intake, excessive thyroid hormone therapy, hypogonadism, hypoestrogenemia, and tamoxifen. Currently, there is no accurate measure of global bone strength. Bone mineral density (BMD) is often used as an estimate measure for bone strength while it only accounts for 70% of bone strength. BMD results are represented as T-scores and Z-scores. In our study we have analysed risk factors for osteoporosis in 100 patients and fracture risk in relation to level of BMD with the help of FRAX tool and peripheral dual energy x ray absorptiometry.

## MATERIAL AND METHODS

This prospective randomised cross sectional study was done after the formal approval from the institutional ethical committee of Bharati Vidyapeeth Medical College, Hospital and Research Centre, Pune, Maharashtra, India. 100 patients above 65 years who were clinically suspected to have osteoporosis were selected with inclusion criteria i.e leg, bone, muscle pains, backache, fractures, falls and exclusion criteria of vehicular or domestic trauma cases, then subjected to peripheral bone mineral density testing by a peripheral bone densitometry machine and then enrolled for study with the T score and BMD levels. Detailed history and clinical findings were noted and all data was taken for analysis. FRAX

score was also calculated. Serum calcium and other biochemical tests were done in study by standard methods (Arsenazo method for calcium estimation).

## RESULTS

In our study, 96 out of 100 clinically suspected patients who were selected had osteoporosis and 4 had osteopenia. Amongst 42 male studied, 14 were 65 to 70 yrs, 9 were more than 70 yrs. Among 58 females studied, 19 were between 65 to 70 yrs and 11 were above 70 yrs. 2 males and 2 females had osteopenia. In our study we found 13% patients were asymptomatic. Most common symptom was skeletal pain (20%), followed by pain in legs, backache, lumbar pain, tingling numbness, joint pain, muscular weakness and hip pain [Fig 1]. Various risk factors and interacting factors were evaluated [Fig 2]. With reference to BMD, in our study, the highest BMD value was found to be 472 and lowest value was 229. Average BMD value was 373.68 with SD of 67.18. The peak value 472 and low was 229 [Table 1]. As regards to T-Score, in our study of 100 patients, the average value of T-Score was -2.9. Patients with age between 60-70 yrs were found having T-Score -2.5. Range of T-Score -2.5 to -3.95 [Table 2]. This study correlates with other studies<sup>[3]</sup>. Low body mass index (BMI) is also said to be common risk factor for development of osteoporosis. In our study, 52% cases showed BMI between 18-20 kg/m<sup>2</sup> and 40% showed BMI 20-23 kg/m<sup>2</sup> [Table 3]. In our study, male to female ratio is of 4.2:5.8. Future 10 years probability of osteoporotic fracture (FRAX score) for our study is 9.137. Males have 7.145 % greater risk of fracture and females are at greater risk of 9.958 % for osteoporotic fractures.[ Table 4,5] Low serum calcium level is supposed to be associated with osteoporosis and osteomalacia. In our study, 68% patients having total calcium level less than 8mg% and 26% of patients have 8-8.2mg

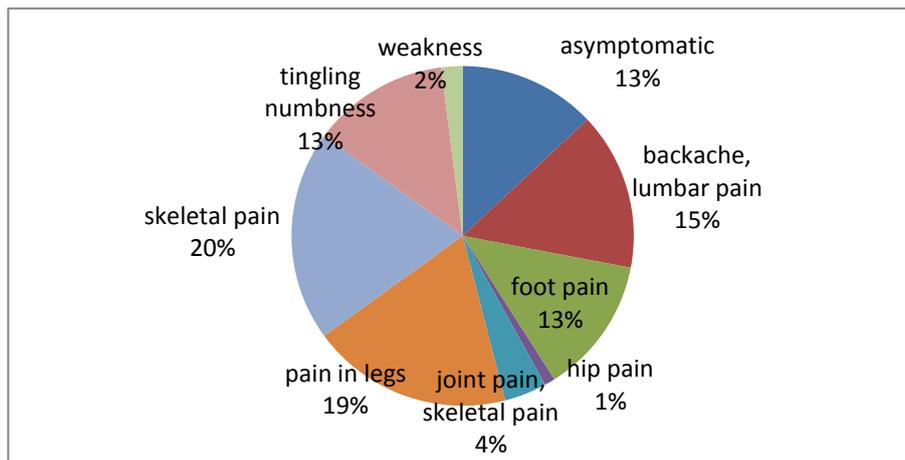


Figure 1 : Graphical representation of patients with respect to clinical presentation

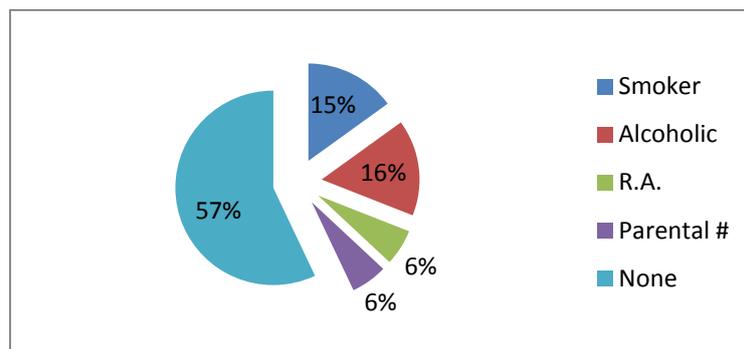


Figure 2 : Distribution of patients with respect to risk factors

Table 1 : Distribution of patients of osteoporosis(BMD) with reference to age

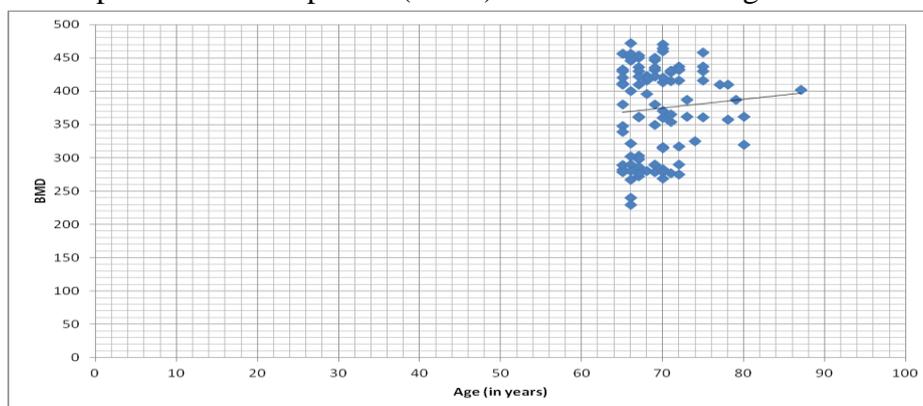
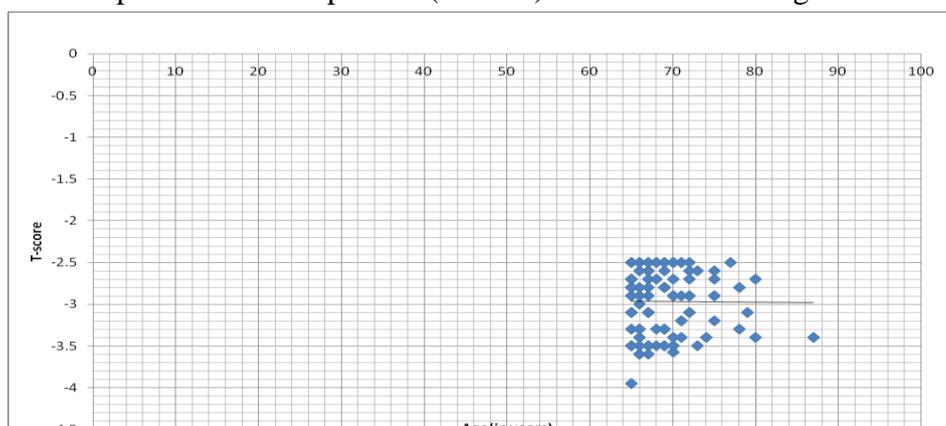
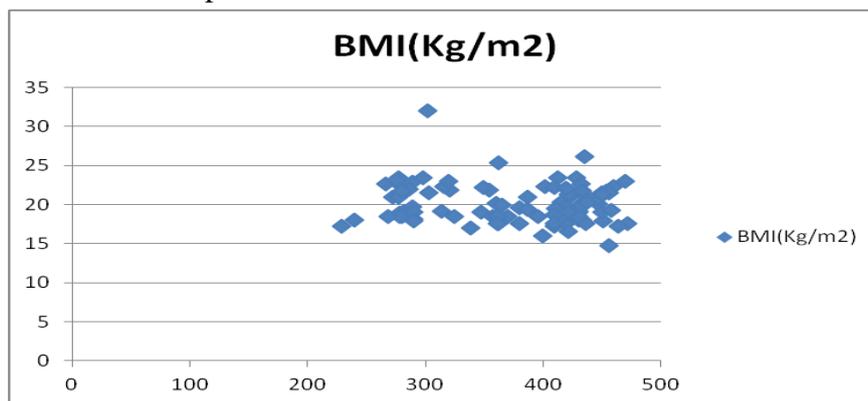


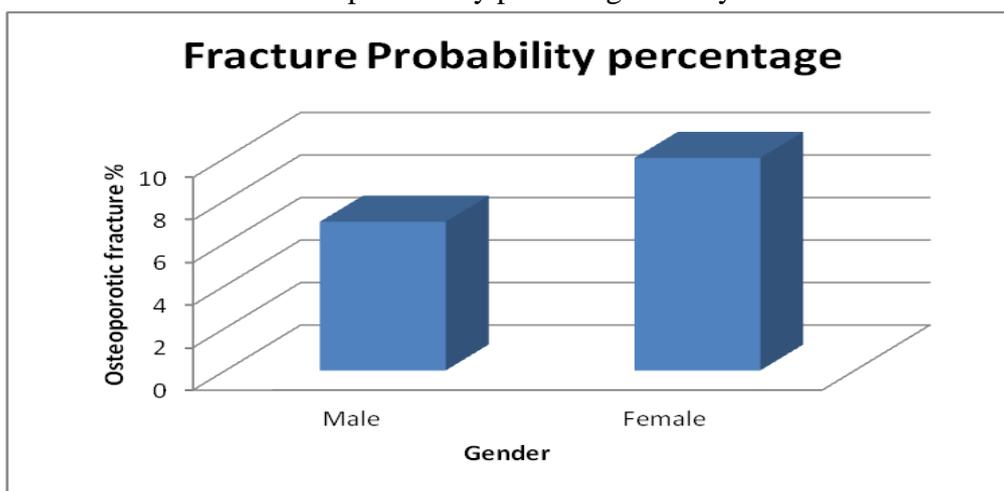
Table 2 : Distribution of patients of osteoporosis (T score) with reference to age



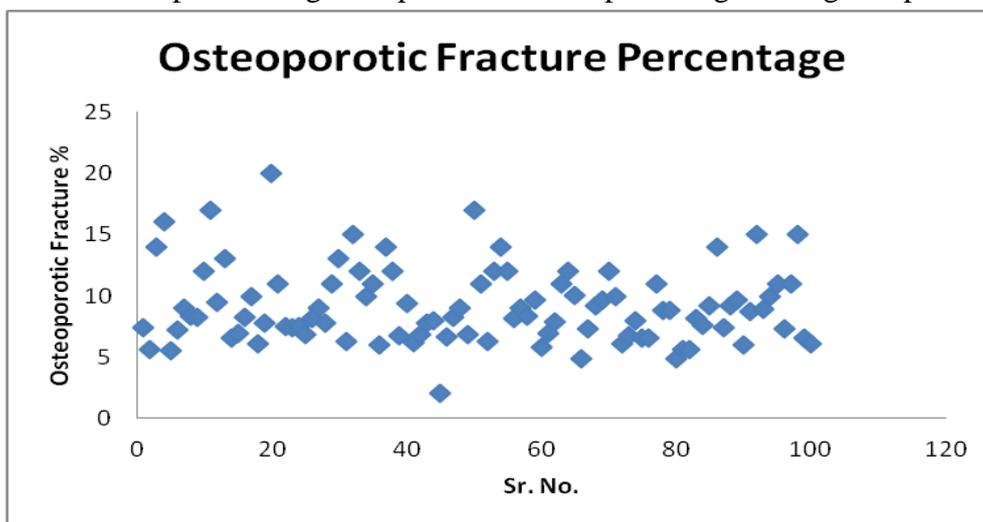
**Table 3 :** BMI in various patients with reference to BMD



**Table 4 :** Gender distribution of fracture probability percentage in 10 years.



**Table 5 :** Graph showing osteoporotic fracture percentage among 100 patients.



**DISCUSSION**

The criteria of the National Osteoporosis Foundation and World Health Organization are as follows [4,5,6]: Normal is a T-score of  $-1.0$  or higher whose bone density is within 1 SD ( $+1$  or  $-1$ ) of the young adult men. Osteopenia is defined

by Low bone mass whose bone density is between 1.0 and 2.5 SD below the young adult men ( $-1$  to  $-2.5$  SD). Osteoporosis is defined as  $-2.5$  or lower, meaning a bone density that is two and a half standard deviations below the mean of a thirty-year-old man/woman. Severe (established)

osteoporosis: Bone density is more than 2.5 SD below the young adult mean, and there have been one or more osteoporotic fractures.

**Fracture risk assessment score: FRAX score** [7]:

It is a diagnostic tool to assess the 10 year probability of bone fracture risk. It can be calculated with or without femoral neck BMD. The input for this software is individual patient details comprising of age (50 to 90 years), sex, weight (in kg) and height (cm), country (index or surrogate). Dichotomised risk variables are then entered regarding Previous fracture, Parent fractured hip, Current smoking, Glucocorticoids, Rheumatoid arthritis, Secondary osteoporosis due to type I (insulin dependent) diabetes, untreated long-standing hyperthyroidism, hypogonadism or premature menopause (<45 years), chronic malnutrition, or malabsorption and chronic liver disease.), Alcohol 3 or more units/day. Bone mineral density (BMD) data is optional. The software then gives an absolute fracture risk for 10 years. The current Osteoporosis Foundation guide recommends treating patients with FRAX 10 year risk score of > or =3% for hip fracture or > or =20% for major osteoporotic fracture, to reduce fracture risk. FRAX is country specific.

Peripheral DEXA technology is portable and less expensive. It can be used as the diagnostic tool when central DEXA is not available. In recently published Indian study peripheral DEXA had high sensitivity (88%) but low specificity (55%). The high negative predictive value makes it useful tool in population screening for osteoporosis. However, peripheral DEXA is less useful in predicting the risk of fractures than central (spinal and hip) DEXA measurements.

### CONCLUSIONS

Age, BMI, postmenopausal state, nutritional habits, smoking, alcohol, corticosteroids use are influencing and interacting factors for osteoporosis. The prevalence of osteoporosis is proportional to the age and calcium levels of the patients as independent predictors. We had a vast majority of patients of osteoporosis than

osteopenia. 50% osteoporotic patients had obvious secondary risk factors. Peripheral DEXA can be used to assess osteoporosis and in turn overall risk of fractures. The high negative predictive value makes it useful tool for screening in population for osteoporosis. Also, FRAX score diagnosed at risk osteoporotic population. The two tools namely Peripheral DEXA and FRAX score are useful in resource limited settings and it can also be used in clinical decision making for treatment of osteoporosis.

**Limitations of Study** – Selection of patients was randomly done and not by systematic sampling. Central DEXA could not be done due to cost constraints, (though Peripheral DEXA readings are valid in FRAX scores). Larger sample size would be needed to draw larger conclusions.

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