Pan-Indian Reference Database for the Diagnosis of Osteoporosis: A Need Indeed

Osteoporosis is a public health problem in the elderly age group and is associated with significant morbidity and mortality. Osteoporosis is defined as low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in the bone fragility and susceptibility to fracture.[1] The bone mass or the bone mineral density (BMD) is commonly estimated by the DEXA (dual energy x-ray absorptiometry) scan. The population risk of fracture is estimated by the FRAX (fracture risk assessment) tool that incorporates a multitude of factors in addition to the BMD.[2] In a nutshell, DEXA evaluates the initial part of the definition, whereas FRAX deals with the second half of the definition.

DEXA scan acts like a fulcrum in the management of osteoporosis and is used for screening, diagnosis, and monitoring of the disease. DEXA involves estimation of the BMD using the x-rays and plotting the same with reference to the population database. *T*-score indicates the comparison with young adults, whereas a *Z*-score indicates the comparison with the age-matched population. In statistical terms, osteoporosis and osteopenia are diagnosed in patients with BMD <2.5 SD (standard deviation) and between −1 and −2.5 SD, respectively. The persons with a BMD *T*-score between −1 and +1 SD are defined as normal. There are many factors that affect the normative BMD data derived from the population.[3] These include the race, ethnicity, bone surface area, vitamin D and K, calcium intake, protein intake, peak bone mass, sun exposure, climatic conditions, physical activity, and body mass index.

Though low BMD explains the majority of fractures, a significant percentage of patients with fractures have normal BMD. The factors beyond BMD include the bone geometry, volumetric density, trabecular bone score, microarchitecture, and the estimated bone strength.[4] Newer techniques like hip structural analysis look into these aspects to derive a more meaningful estimate of the BMD and fracture risk estimation. Researchers have developed the FRAX tool based on the country specific epidemiological and clinical risk factors. The availability of Indian specific database for the FRAX is a major development in the field of osteoporosis. The ethnic differences in the BMD and fractures are the areas of interest in the last couple of decades. Blacks are known to have a lesser consumption of calcium and vitamin D but have stronger bones than the whites. The bone mineral content of children with European ancestry is lower than children with African lineage.[5] Age-adjusted fracture risk is higher in persons with White ethnicity, when compared with Asians and Africans. The ethnic variations are contributed by the genetics, skeletal size, environmental factors, lifestyle, body composition, and other factors. Humans have been classified into various ethnicities depending on the area of residence and origin of the ancestors. The genetic similarities may not be truly representative in the current era of the population migration and interracial marriages. Epidemiological studies have shown that having a first-degree relative with fracture and a previous history of fracture is predictive of future fracture leading to the aphorism "fracture begets fracture." Many population-based studies involving families and monozygotic twins have demonstrated that the bone density has a high heritability factor.[6]

India is a vast country with many ethnic and regional variations. In this issue of the journal, Cherian KE, *et al*. have highlighted the influence of different reference databases on the categorization of low BMD in a cohort of South Indian women.[7] The authors have used four different databases (North Indian, American, Korean, and Italian) for the prevalence estimates. The major finding in the study is a perfect agreement between the North Indian and American database for the diagnosis of osteoporosis at both spine and femur. This study re-emphasized the importance of population-specific reference database in the diagnosis of osteoporosis. The reference database is also important in the assessment of the BMD in premenopausal women. In these patients, guidelines recommend the use of ethnic- and race-adjusted *Z*-scores to define "low BMD for the chronological age." Men generally have large bones, and since DEXA is size dependent, men have a higher BMD than women. This also necessitates a discussion, whether the population reference range should be gender specific.

The pivotal role of DEXA scan emphasizes the need to have a robust test that has good sensitivity, specificity, and predictive value. Incorrectly performed DEXA can lead to misdiagnosis, inappropriate referral, and treatment, all of which are responsible for increasing the healthcare expenditure. On the contrary, an incorrect interpretation could overlook a serious condition that could prevent a fracture, with a far-reaching economic consequence. It is pertinent to mention that short stature is another endocrine disorder, where the normative data play an important role in the diagnosis. The demographic transition and the epidemiological trends have led to frequent revision of the growth charts used for the diagnosis of short stature in Indian children.[8]

The number of patients with osteoporosis is increasing exponentially with an increase in the life expectancy. In view of the aforementioned facts, the major challenge is to accurately diagnose the osteoporosis by DEXA scan, using the specific population database. A population-based data derived

from the longitudinal studies are required to plot the change in the BMD of the Indian population. It is essential to correct all the modifiable risk factors that affect the BMD in the study population. A collaborative, epidemiological research involving all the states of India is essential in this regard and requires active participation from all the stakeholders involved in the healthcare delivery. A genuine, healthy, population-based, country-specific reference database is the need of the hour to accurately diagnose the osteoporosis.

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