Mini Review: Open Access

A Study of Osteoporosis Demography - DXA or Vitamin D3? Which is a Preferential Prognosis Predictor?

Suhasish Ray[*]

Ramakrishna Mission Seva Pratishthan, Vivekananda Institute of Medical Sciences and Woodlands Multispeciality Hospital, India.

ABSTRACT

Aim: We aim to establish the association correlating the levels of vitamin D, T and Z scores through the method of using Dexa BMD in patients with chronic low back pain (CLBP) to search which of these factors is an essential investigation for a person with chronic back pain.

Methods: 299 subjects (female/male: 154:145) with chronic back pain, who have their ages lying within the range of 20 and 60 years (mean: 45.05 ± 8.14), were included in the study. Patients were grouped in three sets based on their serum vitamin D levels, T scores and Z scores: SPSS version 20 (IBM Inc.) was the tool of statistical analysis.

Results: T and Z score evaluation through Dexa BMD was a better predictor for assessment than Vitamin D3.

Conclusion: DEXA BMD is suggested to be an inevitable tool to assess osteoporosis than Vitamin D3 irrrespective of age, sex and body weight. Level of Evidence: Level IV, Retrospective record based study.

Keywords: DXA-BMD, Vitamin D3, T score, Z score, CLBP, Retrospective record based study

INTRODUCTION

Low back pain is one of the most prevalent complaints in musculoskeletal pain, and is a serious condition that may result in loss of functionality as well as labor [1-3]. In chronic cases, by producing a number of pathological changes, it may lead to difficulty in the performance of routine tasks [4]. In their studies, Russel et al. [3] observed muscle atrophy in patients with vitamin D deficiency, and the biopsies they conducted on atrophic muscles provided evidence that atrophy rates were significantly higher in type II-a muscle fibers. A review of the relevant literature reveals that research into the relationship between chronic musculoskeletal pain and vitamin D are few in number, with contradictory findings. In this study, it was aimed to investigate the better diagnostic criteria between vitamin D levels, T score and Z score in CLBP. Dual energy X ray absorptiometry (DXA) scans to measure bone mineral density (BMD) at the spine and hip have an important role in the evaluation of individuals at risk of osteoporosis and in helping clinicians advise patients about the appropriate use of anti-fracture treatment. Central DXA examinations have three major roles, namely the diagnosis of osteoporosis, the assessment of patients' risk of fracture and monitoring response to treatment. The reasons for preferring to use central DXA include: the fact that the lumbar BMD is the most reliable measurement for predicting hip fracture risk [3-5]; the use of the spine for monitoring treatment [5,6];

and the consensus that spine BMD measurements in urban population of Bengal, India should be interpreting the WHO T-score definitions of osteoporosis and osteopenia **(Table 1)** [7-10]. The WHO definition of osteoporosis and osteopenia from DXA scan of Lumbar spine are as follows:

<div align="center">**Table 1.** WHO T-score definitions.</div>

Terminology	T-score definition
Normal	$T \geq -1.0$
Osteopenia	$-2.5 < T < -1.0$
Osteoporosis	$T \leq -2.5$
Established osteoporosis	$T \leq -2.5$ in the presence of one or more fragility fractures

T Score is defined as [11]:

Measured BMD - Young adult mean BMD

Young adult population SD

Z score is defined as [12]:

Mean BMD - Age matched mean BMD

Age matched population SD

Current standard approach for diagnosing osteoporosis is the estimation of bone mineral density (BMD) using dual energy X-ray absorptiometry (DEXA). Low serum 25(OH) D concentrations have been reported in community-dwelling Bengali Indians with no previous history of osteoporosis. Varying effects of 25(OH) D concentrations on bone mineral density (BMD) were reported in these studies [12-14]. However, very few studies have investigated the status of vitamin D in adults with prevalent low BMD have been reported in these investigations [15-18]. Another such study on Southeast Asians included very few Indian subjects (3.1% of total study subjects). The objectives of this study were to assess the correlation among 25(OH) D levels and BMD in a population of Indian patients presenting for the evaluation of low BMD. In the light of this study the aim of our study is to compare and study whether DXA-BMD or Vit D3 is a better predictive criterion for declaring osteoporosis in urban Bengal population.

METHODS

After prior approval by institutional ethics committee, laboratory data and files belonging to patients who attended our polyclinic for CLBP over the period of November 2012 to December 2017 were retrospectively analyzed. 299 subjects (female/male: 154:145) with CLBP (defined as back pain more than 3 months refractory to conservative measures), aged between 20 and 60 years (mean age: 45.05 ± 8.14), participated in the study. Inclusion criteria All patients who had a low BMD defined as a T-score (determined by DEXA) < −1.0 SD at the lumbar spine and Vit D3 <12 ng/ml were included in the study. Patients with or without fragility fractures were included. Patients excluded were with conditions associated with malabsorption of vitamin D, such as inflammatory bowel disease, chronic pancreatitis or a history of gastric or small bowel resections, patients taking medication(s) that could

adversely affect bone metabolism and thus contribute to a decreased BMD by causing vitamin D deficiency with creatinine clearance ≤ 50 ml/min, with secondary osteoporosis, prolonged glucocorticoid intake (defined as use of prednisolone in a dosage of more than 5 mg/dl for at least 3 months) or significant hepatic, thyroid dysfunction or abnormal blood markers. All participants in the study were nonsmokers, denied alcohol consumption, were ambulatory and were not receiving anti-osteoporosis agents, subjects were put into three groups according to their result estimation-Vit D3 (measured by radioimmunoassay (DiaSorin Inc., Stillwater, Minnesota), T score, Z score. (DXA BMD- Lunar iDXA, GE Inc.). BMI was calculated in all the subjects [17]. Osteopenia was defined with T-score between −1 and −2.5 and osteoporosis was defined with T-score less than −2.5 [17]. Patients were classified according to three categories- Vit D estimation (n=111), T score estimation (n=98), Z score estimation (n=89). Findings were expressed in mean and standard deviation (mean ± SD). All data compiled was analyzed on SPSS 20.0 (SPSS Inc., Armonk, New York, USA) software. Statistical significance value was set at p<0.05 with CI 95%.

RESULTS

Mann-Whitney U test, Friedman's two way ANOVA was not significant for the hypothesis (p>0.05). For the comparison of the groups Spearman's rank order correlation, Kendall's tau b and Pearson had significant correlation (p<0.05). Also paired T test gave significant correlation between Vit D3, T and Z score (p<0.05) Hence it was concluded though there was a good correlation between Vit D3 and T and Z score expressed as SD , there was no significance in estimating only Viramin d3 as a sole predictor of osteoporosis. BMD DEXA with T and Z scores is inevitable in predicting and therapeuting treatments accordingly. Discussion Bone density estimation is done mainly nowadays using the technology of Dual X-ray Absorptiometry because it complies with WHO definition of osteopenia and osteoporosis as well FRAX scores determined using the firmer scores can predict fracture pattern if an individual. Thus to say DXA is a highly effective tool to target fracture or refracture prone individuals and start appropriate treatments to reduce the fracture incidents. The future clinical algorithms as per

NICE guidelines focus and emphasize on BMD DXA Scan more than anything else.

CONCLUSION

T and Z scores estimated through DXA BMD have a better predictive value of osteoporosis in urban Bengali polation than Vitamin D3 estimation. The above article had no conflict of interest and was funded by the two authors.

CONFLICT OF INTEREST

None

REFERENCES

1. Atkinson JH, Slater MA (1992) Behavioral medicine approaches to chronic low back pain. In: Rothman RH, Simeone FA, eds. The Spine. Philadelphia: WB. Saunders Company 1992: 1961-1981.

2. Stone KL, Seeley DG, Lui LY, Cauley JA, Ensrud K, et al. (2003) BMD at multiple sites and risk of fracture of multiple types: Long-term results from the study of osteoporotic fractures. J Bone 18: 1947-1954.

3. Russell JA (1994) Osteomalacic myopathy. Muscle Nerve 17: 578-580.

4. Marshall D, Johnell O, Wedel H (1996) Meta-analysis of how well measures of bone mineral density predict occurrence of osteoporotic fractures. BMJ 312: 1254-1259.

5. Johnell O, Kanis JA, Oden A, Johansson H, De LC, et al. (2005) Predictive value of BMD for hip and other fractures. J Bone Miner Res 20: 1185-1194.

6. Eastell R (1998) Treatment of postmenopausal osteoporosis. N Engl J Med 338: 736-746.

7. Gluer CC (1999) Monitoring skeletal change by radiological techniques. J Bone Miner Res 14: 1952-1962.

8. Kanis JA, Gluer CC (2000) An update on the diagnosis and assessment of osteoporosis with densitometry. Osteoporos Int 11: 192-202.

9. Kanis JA, Delmas P, Burckhardt P, Cooper C, Torgerson D (1997) Guidelines for diagnosis and treatment of osteoporosis. Osteoporos Int 7: 390-406.

10. Cummings SR, Melton LJ (2002) Epidemiology and outcomes of osteoporotic fractures. Lancet 359: 1761-1767.

11. Kanis JA, Black D, Cooper C, Dargent P, Dawson-Hughes B, et al. (2002) A new approach to the development of assessment guidelines for osteoporosis. Osteoporos Int 13: 52736.

12. Rahman SA, Chee WS, Yassin Z, Chan SP (2004) Vitamin D status among postmenopausal Malaysian women. Asia Pac J Clin Nutr 13: 255-260.

13. Wat WZ, Leung JY, Tam S, Kung AW (2007) Prevalence and impact of vitamin D insufficiency in Southern Chinese adults. Ann Nutr Metab 51: 59-64.

14. Nakamura K, Tsugawa N, Saito T, Ishikawa M, Tsuchiya Y, et al. (2008) Vitamin D status, bone mass and bone metabolism in home-dwelling postmenopausal Japanese women: Yokogoshi Study. Bone 42: 271-277.

15. Raso AA, Navarra SV, Li-Yu J, Torralba TP (2009) Survey of vitamin D levels among postmenopausal Filipino women with osteoporosis. Int J Rheum Dis 12: 225-229.

16. Lips P, Duong T, Oleksik A, Black D, Cummings S, et al. (2001) A global study of vitamin D status and parathyroid function in postmenopausal women with osteoporosis: Baseline data from the multiple outcomes of raloxifene evaluation clinical trial. J Clin Endocrinol Metab 86: 1212-1221.

17. Kuchuk NO, van Schoor NM, Pluijm SM, Chines A, Lips P (2009) Vitamin D status, parathyroid function, bone turnover and BMD in postmenopausal women with osteoporosis: Global perspective. J Bone Miner Res 24: 693-701.

18. Serhan E, Newton P, Ali HA, Walford S, Singh BM (1999) Prevalence of hypovitaminosis D in Indo-Asian patients attending a rheumatology clinic. Bone 5: 609-611.