

Research Article

Association of OSTA index with bone mineral density (BMD) and its comparison with calcaneal quantitative ultrasound for the prediction of low BMD in peri-menopausal Indian women

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ABSTRACT

Background: Osteoporosis is characterized by low bone mineral density (BMD) and an increased risk of fractures with advancing age in postmenopausal women. BMD measurements with dual energy X-ray absorptiometry (DEXA) are costly and not widely available. The Osteoporosis Self-Assessment Tool for Asians (OSTA) index is a simple tool based on age and body weight to predict low BMD and identify women at risk of osteoporosis. The objective was to study the association of OSTA index with BMD (T-score) and to validate OSTA index in comparison with calcaneal Quantitative Ultrasound (QUS) for the prediction of low BMD in peri-menopausal Indian women.

Methods: This was a prospective, cross-sectional, descriptive study carried out in department of physiology of a tertiary care teaching hospital (Navi Mumbai). Seventy two peri-menopausal women between 40 to 55 years with no previous diagnosis of osteoporosis were included. Participants' socio-demographic detail, anthropometric measurements, OSTA index and QUS-based BMD was recorded. Pearson's correlation test was used. Sensitivity, specificity, positive and negative predictive value was calculated.

Results: OSTA index did not correlate with BMD in the entire samples. On subgroup analysis, OSTA index significantly correlated in a positive direction with BMD (T-score) in women in the age group of 50-55 years. OSTA index had a sensitivity of 70 %, and specificity of 84.62 % at T-score cutoff value of < -1.

Conclusions: OSTA index is a simple risk assessment tool that can be used to identify women with low BMD in the age group of 50-55 years.

Keywords: Osteoporosis, Osteopenia, OSTA index, Calcaneal, Quantitative ultrasound, Bone mineral density, Peri-menopausal women

INTRODUCTION

Osteoporosis is the most common metabolic bone disease in humans and the consequence of fracture represents one of the major public health problems not only in Western countries but also in Asian countries.^{1,2} It is characterized by low bone mass and an increased risk of fracture. It is a major cause of morbidity and mortality with advancing age in postmenopausal women.^{3,4} Thus, there is interest

in identifying individuals at high risk who should receive targeted therapeutic intervention with agents affecting bone metabolism.⁵ It is widely accepted that bone mineral density (BMD) measurement measured by dual energy X-ray absorptiometry (DEXA) is the golden standard of diagnosis for osteoporosis⁵ but it remains expensive and is not widely available in India. Furthermore, studies have shown that mass screening for osteoporosis using DEXA is not cost effective.^{6,7}

The Osteoporosis Self-assessment Tool for Asians (OSTA) is a formula based index to predict low BMD, simply on the basis of age and weight.⁸ It was firstly proposed by Koh et al, which had a sensitivity of 91% and specificity of 45% in identifying women of high risk when compared with final results of femoral neck BMD measurement in postmenopausal Asia women.^{8,9}

Body weight is positively associated with BMD. This relationship is known to be stronger in older women in whom both weight has been shown to explain a large proportion of the variance in BMD.^{10,11,12,13} Thus, OSTA index offers a reliable tool to predict low BMD in post menopausal women

There exists paucity of literature on OSTA index in prediction of low bone mineral density in peri-menopausal Indian women. Therefore the purpose of this study was to investigate the association of OSTA index with bone mineral density and to validate OSTA index in comparison with calcaneal Quantitative Ultrasound (QUS) for the prediction of low bone mineral density in peri-menopausal Indian women aged 40 to 55 years, so as to guide clinicians in the evaluation of risk of osteoporosis in this susceptible population.

METHODS

It was a prospective, cross-sectional, non interventional, descriptive study carried out in the month of July (2014) in the department of physiology of a tertiary care teaching hospital in Navi Mumbai (Maharashtra, India). Permission from Institutional Ethical Committee was obtained prior to the conduct of this study. Apparently healthy women between the age group of 40 to 55 years with no previous diagnosis of osteoporosis were included after obtaining informed consent and a detailed medical history. We excluded women with a previous diagnosis of osteopenia / osteoporosis or secondary osteoporosis, women on hormone replacement therapy, women with history of metabolic disease, the presence of bone metastasis, significant renal impairment, history of previous bilateral oophorectomy, history of previous hip fracture, history of prior use of bisphosphonate and women on long standing glucocorticoids therapy.

Participants' socio-demographic detail, anthropometric measurements, OSTA index and bone mineral density (T-score) was evaluated.

Anthropometry Measurement

Participant's weight was measured in kilograms (kg) on a calibrated weight scale, wearing light clothing and without shoes. Standing body height was measured with the use of height measuring stand with shoulders in a relaxed position, arms hanging freely and without shoes. Body Mass Index (BMI) was calculated using the formula; body weight in kilograms divided by square of the body height in meters.

OSTA Index Calculation

OSTA Index = 0.2 x (Weight in kg – Age in years)

OSTA Index scoring:

Low risk group (index > -1)

Intermediate risk group (index -1 to -4)

High risk group (index < -4)

Bone Mineral Density (BMD) assessment

Bone mass density was assessed by Calcaneal Quantitative Ultrasound (QUS) device. For all participants, QUS was performed on the left leg (calcaneum). The T-score was recorded by using the above device with specifications set for Asian females.

Grading based upon T-score:

Normal (T-score > -1)

Osteopenia (T-score -1 to -2.4)

Osteoporosis (T-score < -2.5)

Statistical Analysis: Statistical analysis was done with Statistical Package for Social Sciences (SPSS) 17.0 version. Descriptive statistics was performed (percentage, mean and standard deviation). Pearson's correlation test was used. The sensitivity, specificity, positive and negative predictive value was also calculated. (*P* value less than 0.05 was considered statistically significant).

RESULTS

Seventy two peri-menopausal women between the age group 40 to 55 years were included in the study. The mean age of the participants was 46.08 ± 5.4 years. Participant's characteristics are summarized in table 1.

Table 1: Characteristics of women in the age group between 40-55 years.

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	72	40.00	55.00	46.08	5.41
Menopause Age (years)	30	45.00	51.00	47.44	1.43
Weight (kg)	72	35.00	90.00	56.55	10.08
BMI	72	15.05	36.28	24.05	4.21
OSTA index	72	-1.80	8.00	2.08	2.53
T-score	72	-1.90	.80	-.83	.61

In the entire sample, as per the OSTA index, 62 (82.1%) women were identified as low risk and 10 (13.88%) women were identified as intermediate- high risk group. When the T-score was calculated with Calcaneal Quantitative Ultrasound, 43 (59.2%) were identified as normal and 29 (40.27%) women were identified of having osteopenia.

The correlation of OSTA index with T-score was not statistically significant (P=0.053) in the entire sample. Further, on subgroup analysis by age (Table 2), we found a positive correlation between OSTA index and T-score only in the age group 50-55 years, which was statistically significant (P=0.044).

Table 2: Correlation of OSTA index with T-score among different age groups.

OSTA Index				
Group	Parameter	N	Pearson Correlation (r)	Sig. (2-tailed) P value
Entire sample (40-55years)	T-score	72	0.229	.053
Subgroup analysis				
Age group 40-44 years	T-score	32	.320	.074
Age group 45-49 years	T-score	16	-.424	.102
Age group 50-55 years	T-score	24	.415	.044*

(** Denotes P <0.01)

The percentage of osteopenic subjects in the age group of 50-55 years by OSTA index was 37.5% (9) and 62.5% (15) was low risk. By Calcaneal-QUS, 41.66% (10) were identified as osteopenic and 58.33% (14) identified as normal.

Table 3: OSTA index versus calcaneal QUS when cut off T-score was taken as ≤ -1(age group 50-55 years).

OSTA index	BMD (calcaneal QUS)		Total
	Abnormal (T-score < -1)	Normal (T-score ≥ -1)	
OSTA ≤ -1	7	2	9
OSTA > -1	3	12	15
Total	10	14	

In the age group of 50-55 years, when QUS T-score cutoff value was taken as ≤ -1, there were 7 true positive, 2 false positive, 3 false negative and 12 true negative cases (table 3). The OSTA index had a sensitivity of 70.00 % and specificity of 85.71 %. The positive

predictive value was 77.78 % and negative predictive value was 80.00 %.

DISCUSSION

The Osteoporosis Self-Assessment Tools for Asians women (OSTA) index has been found to be a reliable and simple tool for the identification of women with osteoporosis risk.⁸ Dual energy x-rays absorptiometry is considered as the gold standard method for BMD assessment and fracture prediction.⁵ DEXA is expensive and not widely available in India, thus OSTA index which is derived from age and body weight may be a useful screening tool to identify women with low BMD and at risk of osteoporosis.

In the present study, an attempt was made to study the association of OSTA index with BMD in Indian perimenopausal women. In our study, BMD (T-score) was assessed using calcaneal QUS. Several studies have documented the reliability of calcaneal QUS in assessing low BMD.^{14,15,16,17,18}

In our study, OSTA index did not correlate with BMD (T-score) when the entire sample was analyzed. However, on subgroup analysis based upon age, OSTA index significantly correlated positively with BMD in women in the age group of 50-55 years.

In the present study, the percentage of osteopenic subjects in the age group of 50-55 years by OSTA index was 37.5% (9) and 62.5% (15) was low risk. By calcaneal QUS, 41.66% (10) were identified as osteopenic and 58.33% (14) identified as normal.

The results in women aged 50-55 years group showed that for the T-score of calcaneal QUS at a cutoff value of < -1, the OSTA index had a sensitivity of 70.00 % and specificity of 85.71 %. The positive predictive value was 77.78 % and negative predictive value was 80.00 %.

Study conducted by Sherchan et al,¹⁹ from Nepal using calcaneal QUS, showed that OSTA index had a sensitivity of 85.2%, specificity of 89.1% at T-score cutoff value of < -1, which is comparable to our findings.¹⁹

Similar studies from other Asian countries utilizing DEXA to evaluate BMD, have shown that the sensitivity and specificity of OSTA index varied from 24% - 95% and 56% - 93% respectively, depending upon the age and cutoff values.^{20,21,22,23}

In the present study, positive and significant correlation between OSTA index and BMD was seen in women in the age group of 50-55 years only. This difference in relationship across different age groups may be probably due to the fact that we included younger women aged 40 years and above, irrespective of menstrual status, whereas other studies were conducted on post menopausal or women above 60 years of age.^{8,9,16,19,20,21,22,23}

The study demonstrates that OSTA, which is a simple, free and formula based index, can be used for routine screening of Indian women aged 50 to 55 years for low BMD and at risk of osteoporosis.

Limitation of the study

This was a pilot study and the sample size was small. T-score was measured by calcaneal QUS, due to non-availability and high cost of DEXA scan. Further studies with larger sample size are warranted to evaluate OSTA index in Indian women in the age group of 50-60 years

CONCLUSION

OSTA index is a simple and free risk assessment tool that can be used to identify women with low BMD in the age group of 50-55 years.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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