*Journal of Clinical Densitometry: Assessment & Management of Musculoskeletal Health*, vol. ■, no. ■, 1–7, 2017

1094-6950/■:1–7/$36.00
http://dx.doi.org/10.1016/j.jocd.2017.01.003

**Original Article**

# Effectiveness of Osteoporosis Self-Assessment Tool for Asians in Screening for Osteoporosis in Healthy Males Over 40 Years Old in China

***Ji-Yuan Huang,* Wen-Zhong Song, and Mei Huang***

*Department of Nuclear Medicine, Sichuan Provincial People's Hospital, Sichuan Academy of Medical Sciences, Chengdu City, Sichuan Province, China*

## Abstract

In this study, we evaluated the effectiveness of the Osteoporosis Self-assessment Tool for Asians (OSTA) in screening for osteoporosis in the elderly male population in the Chengdu area, China. The Lunar Prodigy Advance bone densitometer was used to measure the bone mineral density of 11,039 healthy males over the age of 40 years. Men with OSTA scores of >–1, –4 < OSTA ≤ –1, or ≤–4 were assigned to the low-risk, moderate-risk, or high-risk group, respectively. The T-scores measured with dual-energy X-ray absorptiometry at the different sites were compared across the groups. The bone mineral density of the lumbar spines L1–L4, the left femur, and other sites decreased gradually with age. With increasing age, the screening sensitivity of OSTA for osteoporosis in the lumbar spine and femur gradually increased, whereas its specificity decreased. The areas under the receiver operating characteristic curves for the OSTA index in different age groups and at different sites were 0.644–0.831. Therefore, the OSTA index demonstrated some value in screening for osteoporosis in men over the age of 50 years. Significant differences in its effectiveness were observed among different age groups.

**Key Words:** Male; osteoporosis; Osteoporosis Self-assessment Tool for Asians; screening.

## Introduction

Osteoporosis and bone fracture have become global public health problems that greatly affect people's health and lives *(1,2)*. Epidemiological data indicate that the prevalence of osteoporosis exceeds 10% in men over the age of 50 in mainland China, and that the prevalence in women is even higher, at up to 31.2% *(3,4)*. The bone mineral density (BMD) of men aged over 30–40 years decreases gradually, but is slower than the BMD loss in postmenopausal women, so male osteoporosis is often ignored *(5)*. Around 900 million new cases of osteoporosis fracture are reported around the world each year, of which 30% are hip fractures and 39% are vertebral fractures in men *(6)*. The hip fracture rate in men over the age of 50 in Beijing has increased 1.61-fold in 10 years *(7)*. Data show that the mortality rate from bone fracture is significantly higher in men than in women *(8–11)*, so male osteoporosis also should be paid attention. A screening tool to identify populations at high risk of osteoporosis has great practical value for the early detection, diagnosis, and treatment of osteoporosis. Osteoporosis screening tools have been developed by both domestic and foreign scholars based on data from different populations. Among these, the Osteoporosis Self-assessment Tool for Asians (OSTA) is one of the most popular. The effectiveness of OSTA in screening postmenopausal women for osteoporosis has been verified in many Asian countries *(12)*. In the Malaysian Clinical Guidance on the management of osteoporosis in 2015, OSTA

Received 08/26/16; Revised 12/22/16; Accepted 01/6/17.
Conflicts of interest: Ji-Yuan Huang, Wen-Zhong Song, and Mei Huang declare that they have no conflict of interest.
*Address correspondence to: Ji-Yuan Huang, MD, Department of Nuclear Medicine, Sichuan Provincial People's Hospital, Sichuan Academy of Medical Sciences, No. 32 West Second Section First Ring Road, Chengdu City, Sichuan Province 610072, China. E-mail: huangjiyuan88@163.com

was used to identify women and men who may be at high risk of osteoporosis and require a BMD measurement *(13)*. Oh et al used the Korean Osteoporosis Risk-Assessment Model for Men as a prescreening tool to identify Korean men over 50 years or older who needed dual-energy X-ray absorptiometry (DXA) tests. The said model showed improved reclassification over that of OSTA in Korean men *(14)*. Chinese guidelines on the management of osteoporosis have been published in the 2011 issue of the journal "CHIN J OSTEOPOROSIS & BONE MINER RES"; the OSTA was used as a screening tool for people who were at high risk of osteoporosis. Zha et al studied the performance of OSTA in 472 Chinese men with a mean age of 78.0 years. The cutoff OSTA index of –3.5 yielded a sensitivity of 47.3%, a specificity of 76.8%, and an area under the curve (AUC) of 0.676 *(15)*. But there have been a few large-sample studies of risk assessment of male osteoporosis; the effectiveness of OSTA in males requires further investigation. In this study, we investigated the effectiveness of OSTA in screening healthy elderly men for osteoporosis in the Chengdu area of China to obtain reference data for the prevention and treatment of osteoporosis in men.

## Subjects and Methods

### *Subjects*

A total of 11,039 healthy men aged 40–96 years receiving health examination in our hospital during the period from October 2009 to December 2014 were included in the study. The subjects were divided into 5 age groups: 40–49, 50–59, 60–69, 70–79, and >80 years. Patients with the following conditions were excluded from the study: (1) a history of fractures (patients with fractures of the vertebrae on X-ray were excluded); (2) multiple diseases that would lead to secondary osteoporosis, such as diabetes, thyroid gland diseases, parathyroid gland diseases, and other chronic conditions; (3) use of medicines that affect bone metabolism; or (4) severe impairment of liver or kidney function, including hepatocirrhosis, hepatic failure, and chronic renal failure.

### *Measurement of BMD and Quality Control*

The Prodigy Advance DXA instrument produced by GE LUNAR (Madison, WI, USA) was used in the study, and the measuring instrument was calibrated daily for routine quality control to ensure that the coefficient of variation was less than 1%. A spine phantom was scanned very week to confirm the long-term precision of the instrument. To determine its short-term precision, 30 patients were selected and each skeletal site was measured twice with each measurement to calculate the coefficient of variation *(16)*. The sites for BMD determination included the lumbar spine L1–L4, left femoral neck, greater trochanter, Ward's triangle, shaft, and total hip; the coefficients of variation were 0.87%, 0.93%, 0.89%, 1.60%, 0.97%, and 0.99%, respectively.

### *Diagnosis of Osteoporosis and OSTA Calculation*

The diagnostic criteria of the World Health Organization were used: a T-score ≤ –2.5 was classified as osteoporosis; –2.5 < T-score < –1 was classified as osteopenia; and a T-score ≥ –1 was considered normal BMD. The lowest T-scores for the lumbar spine (L1–L4), the femoral neck, and the total hip were selected as the diagnostic standards *(16)*.

The OSTA score was calculated based on age and body weight using the following formula *(12)*:

$$\text{OSTA} = 0.2 \times (\text{weight [kg]} - \text{age [years]})$$

An OSTA score ≤–4 represented a high risk (corresponding to osteoporosis); –4 < OSTA < –1 represented a moderate risk (osteopenia); and OSTA > –1 represented a low risk (normal bone mass). Patients with OSTA > –1 and OSTA ≤ –1 were assigned to the low- and high-risk groups, respectively.

### *Statistical Analysis*

The results were collected and analyzed with SPSS 17.0 statistical software. BMD T-score was used as the gold standard for the diagnosis of osteoporosis, and was used to calculate the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the AUC of the receiver operating characteristic (ROC) curve for OSTA as a diagnostic index for osteoporosis. A $p$ value <0.05 was considered statistically significant.

## Results

The BMD of the lumbar spine L1–L4 and the left femur decreased gradually with age, in parallel with a gradual increase in the rate of osteoporosis detection in the lumbar spine and left femur. There was no significant difference in the BMD of the lumbar vertebrae between patients aged 70–79 years and >80 years (Table 1, Figs. 1 and 2).

The proportions of men with OSTA indices corresponding to the low-, moderate-, and high-risk groups were 85.2%, 10.5%, and 4.3%, respectively. The prevalence of lumbar spine and hip osteoporosis was 1.6% and 1.7%, respectively, in the OSTA low-risk group; 9.1% and 12.2%, respectively, in the OSTA moderate-risk group; and 21.5% and 30.9%, respectively, in the OSTA high-risk group (Fig. 3).

As the OSTA index increased, the screening sensitivity and NPV of OSTA for osteoporosis in the lumbar spine and femur gradually increased, whereas its specificity and PPV decreased gradually. In patients with the same OSTA score, the screening sensitivity and NPV of OSTA in those with T-score ≤ –2.5 were higher, whereas the screening specificity and PPV were lower than those in patients with T-score < –1.0 (Table 2).

As the age of the individual increased, the screening sensitivity of OSTA for lumbar and femoral osteoporosis increased gradually, whereas its specificity decreased gradually.