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Osteoporosis and Prevalent Fractures among Adult Filipino Men Screened for Bone Mineral Density in a Tertiary Hospital

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Background: Osteoporosis in men is markedly underdiagnosed and undertreated despite higher morbidity and mortality associated with fractures. This study aimed to characterize adult Filipino men with osteopenia, osteoporosis and prevalent fractures.
Methods: A cross-sectional study of 184 Filipino men ≥50 years screened for bone mineral density was performed. Age, weight, body mass index (BMI), Osteoporosis Self-Assessment Tool for Asians (OSTA) score, smoking status, family history of fracture, diabetes mellitus, physical inactivity, and T-score were considered.
Results: Of the 184 patients, 40.2% and 29.9% have osteopenia and osteoporosis. Sixteen (21.6%) and 18 (32.1%) osteopenic and osteoporotic men have fragility hip, spine, or forearm fractures. Men aged 50 to 69 years have the same risk of osteoporosis and fractures as those ≥70 years. While hip fractures are higher in osteoporotic men, vertebral fractures are increased in both osteopenic and osteoporotic men. Mere osteopenia predicts the presence of prevalent fractures. A high risk OSTA score can predict fracture. A BMI <21 kg/m^2 (P<0.05) and current smoking are associated with osteoporosis.
Conclusion: A significant fraction of Filipino men with osteopenia and osteoporosis have prevalent fractures. Our data suggest that fractures occur in men <70 years even before osteoporosis sets in. Low BMI, high OSTA score, and smoking are significant risk factors of osteoporosis.

Keywords: Fracture; Osteoporosis; Men

INTRODUCTION

Osteoporosis in men has become a major global health problem over the last decade. In 2050, the incidence of hip fracture in men is expected to increase by 310% worldwide [1]. Despite its increasing incidence along with prolonged life span, it is still markedly underdiagnosed and undertreated. The morbidity and mortality rates associated with fragility fractures are higher in men than in women [2].

The prevalence of osteoporosis and fractures varies with gender, race, and ethnicity. For males, osteoporosis prevalence among industrialized countries ranged from 1% to 4% based on total hip bone mineral density (BMD) and from 3% to 8% when spine BMD data were included [3]. Although the female-to-male ratio among Caucasians is about 3 to 4:1, the ratio is much closer to 1:1 or even higher in Asia [4].

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Current knowledge and clinical practice guidelines available are mostly derived from Western studies. Even guidelines for osteoporosis screening in men from various societies are not uniform. The National Osteoporosis Foundation and Endocrine Society recommend screening for men aged ≥70 and men aged 50 to 69 who have risk factors [5]. In contrast, the American College of Physicians recommends individualized screening decisions based on risk but offers no specific algorithm [6].

There is paucity of data on osteoporosis and fractures among Asian males. The importance of gathering local data arise from the projection that by 2050, 50% of hip fractures will occur in Asia because of its growing and enduring population [7,8]. Osteoporosis in men will soon become a significant burden on society and healthcare systems of developing Asian countries such as the Philippines.

The objectives of the study were to identify predictors of osteoporosis and osteopenia among adult Filipino men and to determine the concurrent prevalence of fractures between these subgroups. There are established risk factors of osteoporosis and fracture in women, but there is only a paucity of data among men, especially in the Asian region. Osteoporosis is a clinically heterogeneous disease affected by ethnic, genetic, and sexual differences [9]. It is thus imperative to have specific data available for every race and gender.

The postulated hypothesis was that there are some variations that distinguish adult Filipino men with osteoporosis and fracture. This investigation may contribute to the growing knowledge about osteoporosis in men, particularly among Asians, which may individualize screening among this population. The outcome of this study can contribute to the refinement of current views on osteoporosis and fracture among men. More robust screening and treatment may be justified in certain subgroups of patients.

METHODS

This was a retrospective single center analytical review conducted at the University of Santo Tomas Hospital. The Institutional Review Board of the hospital approved the study design (IRB-AP481-M-FRAC). Adult Filipino men (≥50 years old) seen in the clinics and screened for BMD from January 2008 to December 2013 because of at least one indication were included in the study. The subjects were relatively healthy individuals without previous diagnosis of osteoporosis or fracture. Although they did not have previous diagnosis of osteoporosis or fractures, they have at least one condition that causes or contributes to these aforementioned conditions based on the World Health Organization (WHO) technical report, but limited to current age, gender, and low body mass index (BMI). Traditional and emerging risk factors like Osteoporosis Self-Assessment Tools for Asians (OSTA) score, tobacco smoking, family history of hip fracture, type 2 diabetes mellitus, and physical inactivity were included. Of the 251 patients reviewed, 67 were not included because of the following reasons: consideration of secondary osteoporosis such as endocrine, kidney, or hematologic diseases (n=36), intake of exogenous steroids, thyroid hormones or any bone-mimetic drugs (n=18) and presence of traumatic fracture from high impact activity (n=13). Individuals who were taking calcium and vitamin D were included in the study.

Dual X-ray absorptiometry (DXA) was employed in the determination of BMD in the following sites: lumbar spine (L1-L4), proximal femur, and distal forearm. Osteoporosis and osteopenia were diagnosed using the T-score based on the WHO criteria and the International Society of Clinical Densitometry 2005. The center uses the Lunar DPX-IQ (General Electrics Healthcare, Little Chalfont, UK) bone densitometer that comes with automated clinical software for anterior-posterior spine, femur, total body, and tissue quantification. The precision error of the center's machine as calculated at the lumbar spine, femur, and forearm were the following, 0.95% coefficient of variation (CV), 1.71% CV, and 1.02% CV, respectively. Low impact or fragility fracture from mild to moderate trauma was defined as a fall from standing height or less. Radiographic evidences of atraumatic or low impact hip, spine, and wrist fractures were determined.

Variables gathered were age, weight, BMI, OSTA score, smoking status, family history of atraumatic hip fracture, diabetes mellitus, physical inactivity, and T-scores. The chosen cut-off for BMI was 21 kg/m^2 because of substantial evidence that below this parameter there is a two-fold increased risk of hip and other osteoporosis-related fractures [10,11]. Using a higher cut-off might miss individuals at risk. A simple risk index called OSTA score that is based only on two variables, age and body weight, was developed in 2011 and was first used among Asian women at increased risk for osteoporosis. It has a sensitivity of 90% and specificity of 45%. OSTA score were categorized as follows: low risk (>–1), intermediate risk (–1 to 4), and high risk (<–4). An OSTA score chart is available for reference from the same paper by Koh et al. [12]. Physical inactivity was based on the WHO definition of less than 150 minutes of moderate activity throughout the week. This was

elicited based on clinical history. Data were analyzed using the SPSS version 17.0 (SPSS Inc., Chicago, IL, USA). The tests of proportion determined which among the groups (normal, osteopenic, or osteoporotic men) have significantly greater proportion of members with hip, spine, wrist, and total fractures. A cut-off $P<0.05$ was considered significant. Odds ratio (OR) and simple logistic regression analysis were used to determine the association with the previously mentioned variables.

RESULTS

The characteristics of 184 adult males included in the study are summarized in Table 1. The mean age of the subjects was 67 years old, with a range from 50 to 96 years. The most common indications for DXA were age, family history of osteoporosis or fracture and intake of drugs known to be associated with decreased BMD. The mean T-score with range of the lumbar spine, proximal femur, and distal radius were –1.12 (–4.80 to 4.40), –1.31 (–6.5 to 3.6), and –1.09 (–3.6 to 1.9), respectively.

Fig. 1 shows the distribution of prevalent hip, spine, and wrist fractures in each category of BMD. Of the 184 patients, 40.2% and 29.9% have osteopenia and osteoporosis, respectively. The mean T-score with range of osteopenic and osteoporotic men were –1.71 (–2.4 to –1.1) and –3.18 (–6.5 to –2.5), respectively. Sixteen (21.6%) and 18 (32.1%) osteopenic and osteoporotic men have history of fragility hip, spine and forearm fractures at the time of screening.

Using tests of proportions, adult Filipino men with osteoporosis and osteopenia have a greater number of total fractures compared to those with normal BMD ($P<0.05$). While hip fractures are significantly higher in osteoporotic men ($P<0.05$), vertebral fractures are similarly increased in both osteopenic and osteoporotic men.

Table 2 shows the variables associated with osteoporosis. A BMI of less than 21 or being a present smoker is associated with increased risk of osteoporosis. The presence of type 2 diabetes mellitus seems to confer a greater BMD. Table 3 shows

Table 1. Patient Characteristics

Variable	No. (%) (n=184)
Age, yr	
50–69	115 (62.5)
≥70	69 (37.5)
Body mass index, kg/m^2	
<21	32 (17.4)
≥21	152 (82.6)
OSTA score	
Low	108 (59.7)
Moderate	49 (26.6)
High	27 (14.7)
Smoking	
Never	136 (73.9)
Past	19 (10.3)
Present	29 (15.8)
Family history of hip fracture	
Present	21 (11.4)
Absent	163 (88.6)
Diabetes mellitus, type 2	
Present	30 (16.3)
Absent	154 (83.7)
Physical inactivity	
Present	18 (9.8)
Absent	166 (90.2)
Bone mineral density	
Normal	55 (29.9)
Osteopenia	74 (40.2)
Osteoporosis	55 (29.9)

OSTA, Osteoporosis Self-Assessment Tool for Asians.

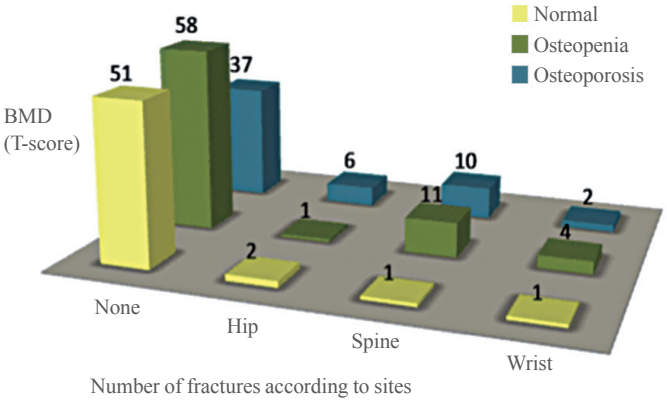

Fig. 1. Distribution of prevalent fractures among men with normal bone mineral density (BMD), osteopenia, and osteoporosis.

Table 2. Risk Factors Associated with Osteoporosis

Variable	No. (%) (n=55)	OR	P value
BMI <21	23 (41.8)	3.69	0.042
Present smoker	15 (27.3)	3.09	0.048
Diabetes mellitus, type 2	3 (5.4)	0.09	0.025

OR, odds ratio; BMI, body mass index.

Table 3. Risk Factors Associated with Prevalent Fractures

Variable	No. of (%) (n=38)	OR	P value
Osteopenia	16 (42.1)	4.55	0.006
Osteoporosis	18 (47.4)	5.30	0.014
High OSTA score	14 (36.8)	3.37	0.011

OR, odds ratio; OSTA, Osteoporosis Self-Assessment Tool for Asians.

the variables associated with prevalent fractures. Osteopenia and osteoporosis as well as high OSTA score are associated with increased risk of fracture.

DISCUSSION

There is greater proportion of fractures among adult Filipino men with low bone mass. Our data underscores that osteoporosis and fracture occur in the study population even before 70 years. Filipino men aged from 50 to 69 have the same prevalence of osteoporosis and fracture as those aged 70 years and above. In another study among Japanese men, the prevalence of vertebral fracture for younger (65 to 74 years) and older (≥ 75 years) were 36.6% and 37.6%, respectively. Also in this study, comparative prevalent vertebral fracture was 18% in women compared to 36.6% in men of the same age [13]. Our findings favor a lower threshold for screening Filipino men for osteoporosis even before the age of 70.

BMI is a consistent risk factor for osteoporosis (OR, 3.69; P<0.05). This study also supports that a BMI <21 kg/m^2 is a strong risk factor associated with osteoporosis and fractures [10,11]. Our results showed the same BMI threshold predictive of osteoporosis even in the absence of fracture. Hence, BMI below this threshold will identify men with low BMD and hence a high risk of fracture.

Another significant factor, namely current smoking, seems to be strongly associated with osteoporosis. Men who smoke tobacco have three times the risk to develop osteoporosis than men who do not. This may also be the reason why other predictive indices like the Predictive Index for Osteoporosis in Men (PIO) and Male Osteoporosis Risk Estimation Score (MORES) include current smoking status and history of chronic obstructive pulmonary disease, respectively [14,15]. Smoking is associated with worse BMD because it has shown to impair the function of bone vascular endothelium and delay bone healing [16,17].

The presence of type 2 diabetes mellitus appears to confer a decreased risk for osteoporosis. However, no similar association is seen for fracture prevalence. The most plausible mechanism that could explain the seemingly beneficial or neutral effect of diabetes mellitus on bone mass is hyperinsulinemia. Aside from the small number of subjects with diabetes, the magnitude of its effect in osteoporosis and fracture may be so small that it can be neutralized by other factors as explained in one meta-analysis [18]. Further, fracture occurrence in diabetic patients seems unrelated to the BMD [13]. Our findings suggest a lower prevalence of osteoporosis, especially if measured in the lumbar spine among diabetic patients, is in agreement with another study. One possible explanation for increased lumbar spine BMD in patients with type 2 diabetes could be an artificially high determination of BMD due to degenerative changes frequently found in such patients [19].

The total number of fractures is greater with osteopenic and osteoporotic men than men with normal BMD. Although hip fracture is significantly greater in osteoporotic men, spine and wrist fractures are the same in both osteopenic and osteoporotic men. This finding can be supported by the Rotterdam study that emphasizes the impact of osteopenia when their data showed that after 55 years, osteopenic men were more likely to sustain a vertebral fracture compared with osteoporotic men [20]. The occurrence of vertebral fracture is not only a significant cause of back pain and functional limitation, but is also predictive of new fractures. As with hip fracture, vertebral fractures are associated with progressive increases in mortality within 5 years [21].

The risk of fracture among men with osteopenia and osteoporosis are four to five times greater than men with normal BMD. In the absence of bone mass determination, a high OSTA score is associated with a risk ratio three times more than those with a low to moderate score. In a study by Li-Yu et al. [22] in 2005, the Osteoporosis Self-Assessment Tool for Asians (OSTA) was validated among Filipino men and women. The present study highlights the correlation between high OSTA score and presence of fracture.

In conclusion, a significant fraction of Filipino men with osteopenia and osteoporosis have prevalent fractures. Our data suggest that fractures may occur in men younger than 70 years old and even at higher BMD before osteoporosis sets in. A low BMI and high OSTA score are consistent risk factors for fracture, even in men, and tobacco smoking may be an emerging principal risk factor of osteoporosis, especially in men. The threshold for screening and treatment of osteoporosis and associated fractures must be lowered in men contrary to the usual

knowledge and practice.

To the best of our knowledge, the present study is the first to address osteoporosis and fractures among adult Filipino men. The study is an addition to the limited data regarding osteoporosis among Asian men. Our study has some limitations. As in other cross sectional-studies, selection bias and direct causation should be taken into consideration.

In future studies, observational studies among these subjects and their development of new fractures may be pursued. Comorbidities and treatments contributing to decreased bone mass may be included. Emerging risk factors such as vitamin D, calcium, parathyroid hormone, testosterone, estrogen, sclerostin, and osteoprotegerin levels show great promise in improving our understanding of osteoporosis in men since osteoporosis and fracture are complex and multifactorial diseases.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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