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Original Article

Prevalence of Osteoporosis in Women in Buenos Aires Based on Bone Mineral Density at the Lumbar Spine and Femur

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Abstract

The aim of the study was to report values for osteoporosis (OP) prevalence in Buenos Aires. Bone mineral density (BMD) at different skeletal sites was measured from November 2012 to July 2014. Participants were recruited through a newspaper advertisement inviting women at least 50 yr of age to receive free BMD measurement. After signing an informed consent form, 5448 women living in Buenos Aires and surrounding districts were studied. Lumbar spine (L1–L4), femur neck, and total hip BMDs were measured (Lunar Prodigy, software version 12.3 GE, Madison, WI, USA). OP was defined as a *T*-score ≤–2.5 at the lumbar spine or the femoral neck. Results showed that 1021 out of 5448 studied subjects (18.7%) had OP at the lumbar spine or the femoral neck. Comparison of age of the population sample with reference data for the general population showed a moderate (+0.6%) increase in prevalence. Prevalence of OP was low, up to the age of 70 yr when based on femoral neck BMD only. Conversely, the prevalence of OP at the lumbar spine, which was reportedly high in women up to the age of 70 yr, tended to level off over that age. The results of the total femur only added a slight (+0.7%) nonsignificant increase to the OP prevalence. A total 346,500 out of 1,853,000 women aged 50+ yr in Buenos Aires had OP at the lumbar spine or femoral neck, whereas only 163,500 had OP at the upper femur, reducing the number by 53%. The present study assessed OP prevalence in the most densely populated urban area in Argentina. The results are similar to those reported for Caucasian populations in the United States and Canada. As measurement of only the BMD of femoral neck overlooks the diagnosis in half of the women, future studies should include measurement of the lumbar spine in combination with the femoral neck for a more accurate estimation of OP prevalence.

Key Words: Femoral neck; lumbar spine; osteoporosis prevalence; total hip.

Introduction

Although densitometric estimation of bone mineral density (BMD) has long been used to detect osteoporosis (OP), a number of recent studies on the prevalence of OP in different countries *(1–4)* have contributed new data to the already existing body of knowledge *(5–10)*. In this regard, there is some controversy as to which BMD measurements should be used to determine prevalence of OP *(11–13)*.

The aim of the present study was to report values for OP prevalence in a densely populated area in Argentina with no previous available data. In addition, OP prevalence based on the BMD of each of the measured skeletal sites and the prevalence based on the combination of two is reported. The discordance in the diagnosis on the basis of BMD at different skeletal sites is discussed.

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Materials and Methods

Recruitment

From November 2012 to July 2014, our institution implemented a campaign to detect OP by means of a newspaper advertisement inviting ambulatory women at least 50 yr of age to receive free BMD measurement. Subjects with a body weight over 110 kg were excluded. A total 7086 women were given an appointment over the telephone and 5511 came for the study. On presentation for assessment, the volunteers signed an informed consent form and filled in a brief questionnaire inquiring about their medical record and history of previous bone fractures. Results corresponding to approximately 1% (n = 63) of studied women were disregarded and excluded from the final analysis for different reasons: inability or refusal to fill in the questionnaire, presence of a prosthesis or vertebroplasties that did not allow performance of the complete assessment, or history/presence of severe systemic disease secondarily affecting bone mineralization. Subjects with Parkinson's disease, rheumatoid arthritis, celiac disease, and severe renal insufficiency were excluded. The results of 5448 women were included in the final analysis.

The vast majority of women were of Caucasian and European descent. The study was approved by the ethics committee of the institution.

Population

All the women lived in the city of Buenos Aires or in the surrounding districts. According to the 2010 National Census, the total population of women over the age of 50 in the area was 1,852,000.

Measurements

BMDs of lumbar spine (L1–L4), femoral neck, and total hip were measured using standard techniques. As previously reported, the peak bone mass of young women in Buenos Aires does not differ from that observed in a US Caucasian population *(14,15)*.

The determinations were made using GE Lunar Prodigy equipment with software version 12.3 GE, Madison, WI, USA. Internal quality control was performed daily and external control every 4 mo. As shown in a previous study conducted at our laboratory, precision was 1.5% at lumbar spine and 1.5% at the femoral neck *(16)*.

Diagnostic Criteria

OP was defined as a T-score of ≤−2.5 at any of the studied sites. The National Health and Nutrition Examination Survey (NHANES) III database was used as reference standard for hip T-score and the manufacturer's database was used for the spine T-score. The cutoff values for diagnosis of OP were as follows: lumbar spine (L1–L4) = 0.880 g/cm^2, femur neck = 0.690 g/cm^2, and total hip = 0.693 g/cm^2.

Age Distribution

The age distribution of the population of the present study compared to the total population of women over 50 yr of age in Buenos Aires (Census 2010) disclosed some underrepresentation in the 50–59 and 80–89 age bands (see below).

Data were processed using the Postgre SQL (version 9.3).

Results

Overall OP Prevalence

Of the 5448 studied women (18.7%), 1021 had a T-score of ≤−2.5 at the lumbar spine or the femoral neck, at least. A slight nonsignificant increase was observed when adding total hip values to the remaining 2 studied areas (+0.7%).

The prevalence of OP in the present group (18.7%) was adjusted considering an age distribution identical to that of the general population. A moderate +0.6% increase was observed.

The prevalence of OP according to decade of life and measured site, and the according to the combination of both variables, is shown in Table 1.The high prevalence of OP at the lumbar spine in the 5th and the 6th decade of life tended to level off after that age. Conversely, the low prevalence at the femoral neck and total hip in the first studied decades increased sharply after the 7th decade. Thus, prevalence was found to vary widely among the different age bands (Fig. 1).

The average age and T-score considering OP prevalence at the different sites are shown in Table 2. A posterior analysis of lumbar spine determinations ruled out 4.5% of measurements on account of the presence of artifacts (average age of this subset: 74.6 yr). The results corresponding to these subjects were not considered when calculating the average values shown in Table 2.

Magnitude of OP

Out of a population of 1,853,000 women over 50 yr of age living in the area of Buenos Aires, and considering BMD

Table 1
Osteoporosis Prevalence by 10-yr Age Band and 50–80+ yr at the LS, FN, TH, and at the LS or FN

Age (yr)	LS	FN	TH	LS or FN
50–59	6.8	1.1	2.6	7.0
60–69	17.0	5.5	4.4	18.6
70–79	22.7	11.5	10.2	27.4
80+	21.4	28.6	14.3	44.7
50–80+	16.0	6.7	5.8	18.7
50–80+ adjusted	14.9	8.0	6.2	19.3

Note: Lower line: 50–80+ adjusted for an age distribution identical to that of the general populations.
Abbr: FN, femoral neck; LS, lumbar spine; TH, total hip.

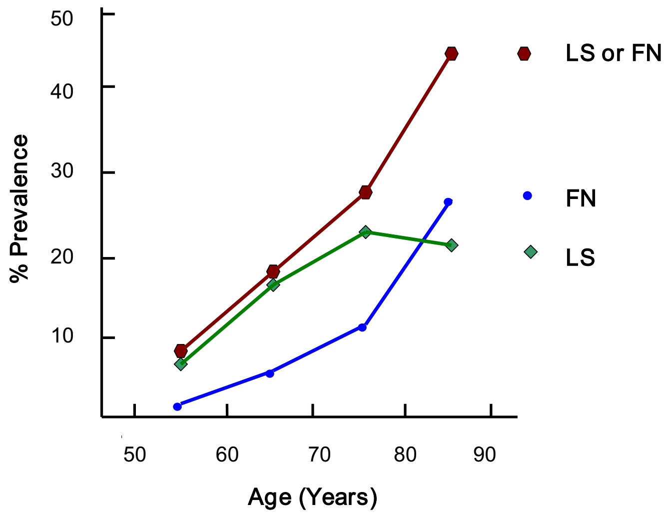

Fig. 1. Prevalence of osteoporosis per decades of age at the lumbar spine (LS), femoral neck (FN), and at the LS or FN in our population.

Table 2
Average Age and *T*-Score for Each Group With Diagnosis of OP at the LS, FN, and at the LS or FN

			Average *T*-score		
Site	Averages age (yr)	n	LS	FN	TH
LS	68.3	873	−3.12	−2.04	−1.95
FN	71.6	362	−2.71	−2.81	−2.57
LS or FN	69.0	1021	−3.00	−2.27	−2.06

Note: n indicates the number of women in each group.
Abbr: FN, femoral neck; LS, lumbar spine; OP, osteoporosis; TH, total hip.

values corresponding to lumbar spine or femoral neck, the number of affected women would be 346,500. If the upper femur (femoral neck or total hip) had been used to estimate OP prevalence, only 163,500 women would have been found to have OP. Thus, underestimation of diagnosis would approach 53% of the cases.

Because Argentina is a large country, extending from latitudes 22°S to 55°S, and has a wide variety of climates, it is hazardous to extrapolate the present results to the whole country. Nevertheless, and keeping this limitation in mind, extrapolation of the lumbar spine and femur neck prevalence results obtained in the present study, to the total population of women over the age of 50 yr (5,223,000 according to the 2010 National Census), 976,700 women would be diagnosed with OP.

Discussion

Previous reports in the literature showed similar lumbar spine and femoral neck peak bone mass in women in Buenos Aires and the United States *(14,15)*, whereas the frequency of hip fracture in 4 different regions of Argentina *(17–20)* was found to be moderately lower than that reported in the United States *(21)* but higher than values reported in other Latin American countries *(15)*.

The method used to recruit subjects, a newspaper advertisement inviting women to receive free BMD measurement, could be considered a limitation to the study. It is likely that women with risk factors for OP felt more inclined to participate. In this regard, we adjusted the somewhat distorted age distribution of our study population according to the distribution of the general population in the studied area, following which a slight +0.6% increment in OP prevalence was observed. In addition, it must be pointed out that the large size of the study sample (n = 5448) decreases possible statistical errors, and that the overall and per-decade results are in keeping with data reported recently by the NHANES 2005–2008 *(1)*, when considering OP prevalence at the femoral neck or the lumbar spine (Fig. 2).

In the population studied here, the prevalence of OP at the lumbar spine and at the femoral neck according to decade of life was in agreement with estimates in the United States *(1)* for those same skeletal regions, as well as to data for women aged 50–80+ yr in the United States *(1)* and in Canada *(11)*. A higher prevalence was reported in Valencia (Spain) *(3)*, and a markedly high prevalence was found in Korea, despite the study not including the over-80-yr age band *(4)* (Fig. 2). These wide differences emphasize the need to collect accurate data to establish local OP prevalence and to compare prevalence among populations.

Figures 3 and 4 show the site-specific prevalence of OP at the lumbar spine or at the femoral neck, in different countries. Because the data reported for Australia *(7)* did not include values for all 50- to 80+-yr age bands or combined values of the femoral neck and the lumbar spine, we did not include these data in our analysis.

The lumbar spine values obtained here are similar to results reported for Canada *(9)*, whereas 2 different studies from Spain reported an average of ~25% OP prevalence *(3,8)*. OP prevalence has been reported to be higher than 30% for populations in East Asia, despite the study not including subjects over the age of 79 yr (Fig. 3).

As regards OP prevalence at the femoral neck, 7%–11% prevalence was reported in 9 studies, including an estimate for Japan. The ~15% estimated for Valencia (Spain) *(3)* differs from a previous study on different areas of Spain reporting ~9.0% OP prevalence at this skeletal site *(8)*. According to the NHANES III *(5)*, the overall estimate of OP prevalence was 18%, with a 4-fold higher prevalence in white women (~20%) as compared to blacks (~5%). Interestingly, a recent NHANES study *(1)*, conducted almost a decade after NHANES III *(5)*, reported a 48% decrease in OP prevalence at the femoral neck, although the reason for this decrease remains unclear. Finally, the prevalence of OP at the femoral neck has been reported to be more than 20% in Sweden *(2)* and in South Korea *(4)* (Fig. 4).

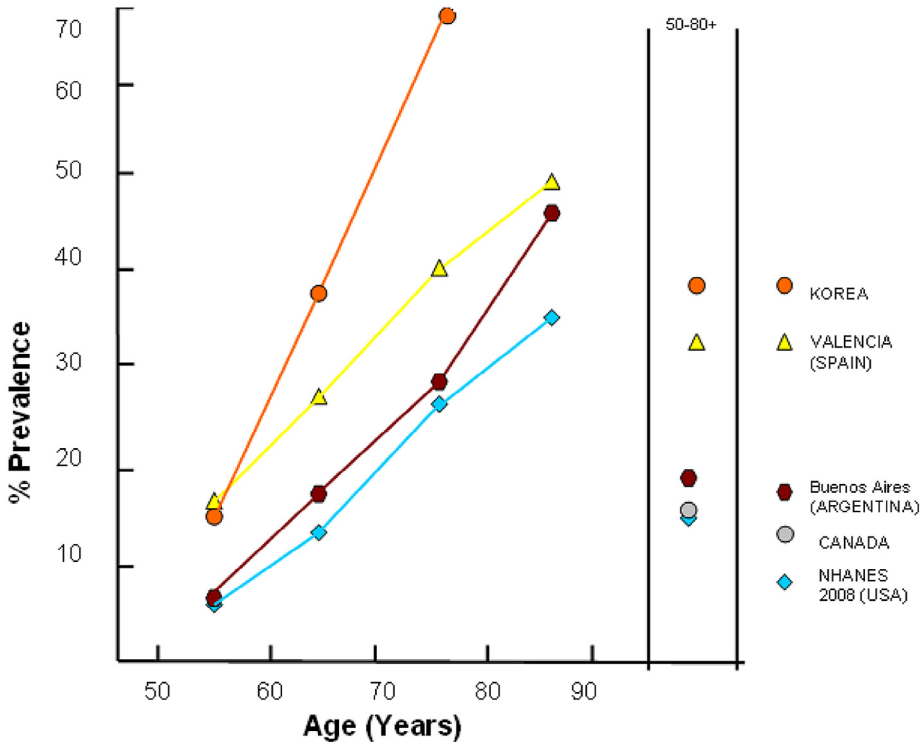

Fig. 2. Prevalence of osteoporosis at the lumbar spine or femoral neck per decades of age, and total 50–80+ yr prevalence in 5 different studies from Korea *(4)*, Valencia, Spain *(3)*, Buenos Aires, (Argentina), United State *(1)*, and Canada *(9)*. On this latter study only the overall results were given. NHANES, National Health and Nutrition Examination Survey.

The discrepancy on the prevalence of OP in various regions could be partially explained by the ethnic origin of the population, such as the high prevalence observed in women of oriental origin *(4,6)* or in white women compared to black women in the United States *(5)*. On the other hand, the causes of some marked differences observed among Caucasians populations are not clear. Future studies, under similar conditions, could bring

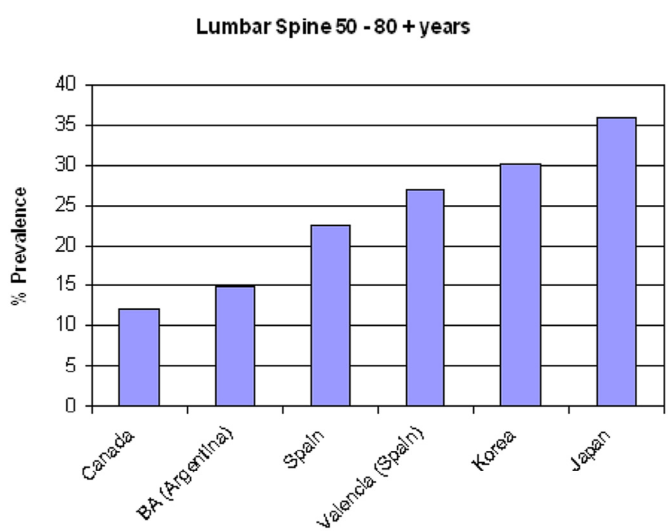

Fig. 3. Osteoporosis prevalence at the lumbar spine observed in Buenos Aires (BA) compared to 5 other studies from Canada *(9)*, Valencia (Spain 3), Spain *(8)*, Korea *(4)*, and Japan *(6)*.

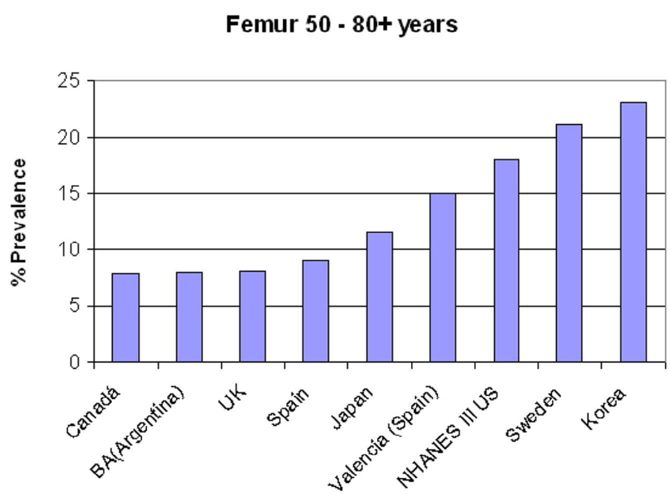

Fig. 4. Osteoporosis prevalence at the femoral neck observed in Buenos Aires (BA) compared to 8 studies from Canada *(9)*, United Kingdom *(10)*, Spain *(8)*, Japan *(6)*, Valencia (Spain) *(3)*, Sweden *(2)* Korea *(4)*, and National Health and Nutrition Examination Survey (NHANES) III, United States *(5)*.

information on the genetic, environmental, or others factors involved.

In keeping with the official positions of the International Society for Clinical Densitometry (13), we assessed and reported the prevalence of OP based on BMD determinations at the lumbar spine and the femoral neck The results presented herein clearly show that, in the vast majority of subjects aged 50–70 yr or in their early 70s, diagnosis of OP would have been overlooked if it had been based on femoral neck BMD only. In fact, 53% of women in our population would be underdiagnosed. According to Wright et al (1), the number of subjects diagnosed with OP decreased by 54% when diagnosis was based on femoral neck BMD only, as compared to the number of cases diagnosed based on lumbar spine and femoral neck.

Various studies have analyzed the *T*-score discordance between lumbar spine and femoral neck (22–24). The discordance observed (~40%) increased with age and menopausal status, resulting in underdiagnosis of OP when based solely on femoral neck, as it was found in the present study. Among the possible reasons for this discordance are the higher rate of trabecular bone loss as compared to cortical bone loss in the first postmenopausal decades, the presence of artifacts (osteophytosis, aortic calcification, end-plate sclerosis) in elderly subjects, and a different peak bone mass at the hip associated with genetic or environmental factors.

The suggestion that the femur neck should be the only site to determine OP prevalence (2) overlooks the need for clinicians to identify subjects with OP at the spine and to initiate treatment to prevent vertebral fractures. Strom et al (2) also state that the measure of only the femur neck is primarily intended for descriptive epidemiology. In fact, after an extensive study on the usefulness of measuring several sites for fracture prediction, Leslie et al (25) found a statistically significant ($p < 0.01$) improvement in spine fracture prediction when the results were based on the combination of total hip and lumbar spine BMD, and not on total hip BMD alone.

In conclusion, the prevalence of OP in the most densely populated urban area in Argentina was assessed. The results are similar to those reported for Caucasian populations in the United States and Canada.

According to the present results, OP would have been overlooked in almost 50% of cases if diagnosis had been based only on femoral neck BMD. It would therefore seem recommendable to use lumbar spine BMD combined with femoral neck BMD when screening for OP, or when assessing OP prevalence in a given geographical area.

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