OSTEOPOROSIS: PREVALENCE AND RISK FACTORS AMONG > 49 YEAR-OLD WOMEN IN PRIVATE PRACTICE ENVIRONMENT

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SUMMARY

Purpose: to evaluate the prevalence and risk factors for osteoporosis among women older than 49 years in a private practice environment. Methods: a cross-sectional study assessing 999 bone densitometry results examined at private laboratories in São Paulo, between 03/01/1998 and 06/01/1998. A questionnaire addressing socio-demographic, reproductive and lifestyle-related risk factors was employed previously to bone mineral density measurements. The independent variables were age, ethnicity, body mass index (BMI), age at menarche, time elapsed since menopause (TESM), use and length of hormone replacement therapy (HRT), lifestyle habits (smoking, exercising, coffee consumption) and history of previous fracture. Univariated analysis employed the x2 test and linear trend x2 test. Multivariate analyses were performed with logistic regression. A p value of < 0.05 was adopted.
Results: the mean age of studied women was 61.6 (SD=8.5). The mean time elapsed since menopause was 13.2 years (SD= 8.6). Osteoporosis prevalence was 32.7%. The following variables were associated to osteoporosis: age (61/70 and 71/96 years), TESM (6/10 and 11/49 years), ethnicity (Caucasian or yellow), late menarche (13/15 and 16/21 years). The greater BMI, the lower the risk of osteoporosis. Conclusion: reproductive and anthropometric variables are more important than lifestyle-related risk factors for osteoporosis

Keywords: *Osteoporosis; Menopause; Bone density; Mass screening; Risk factors*

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INTRODUCTION

Osteoporosis is a serious global issue. It is estimated that world's annual incidence of hip fracture will increase from 1.26 million cases in 1990 to 2.6 million by 2025 and to 4.5 million by 2050[1]. Studies based on hospital data from countries such as Colombia, Chile, Brazil, Mexico, Panama, Peru and Venezuela report 40-362 hip fractures/ 100,000 people above the age of 49[2]. Based on 1994's IBGE data, it is estimated that 2.5 million Brazilian individuals live with osteoporosis and 105 thousand hip fractures occur each year, resulting in a cost of approximately R$ 630 millions[3].
Osteoporosis is regarded as "a disease characterized by microarchitectural deterioration of the bone tissue, with bone mass reduction to insufficient levels for providing support, having as a consequence a high risk of fracture"[3]. About 50% of hip fracture patients lose the ability to live independently, and up to 10% die within 6 months [4]. Many factors are regarded as risks for osteoporosis: female gender, Caucasian or Asiatic ethnicity, family history, early menopause (including ooforectomy); reduced ovarian function previous to menopause (athlete's amenorrhea, hyperprolactinemia, nervous anorexia, etc); inappropriate diet (sedentariness, alcohol abuse, tobacco use).
Some risk factors are better evidenced than others, with factors' influence varying among individuals. In general, the use of factors to predict an individual's risk to fractures is limited. A cross-sectional national study with 473 menopausal women showed an osteoporosis prevalence of 14.7%, which was associated to variables such as lower education level, increased age, late menarche, early menopause and lower body mass index[5].
The objective of this study is to measure the prevalence of osteoporosis and its correlation with risk factors (socio-demographic and lifestyle), in a sample of women above the age of 49.

METHODOLOGY

A cross-sectional study was conducted between March and June 1998, by means of the analysis of 999 consecutive bone densitometry tests performed in a private laboratory (Elkis

Study conducted at the Department of Bone Densitometry, Elkis Furlanetto Laboratory (This laboratory is currently named DIAGNÓSTICOS DA AMÉRICA).

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Furlanetto) in São Paulo city. All women had spontaneously sought the service by their doctors' referral (usually, a gynecologist). Only the test results of women above 49 years old were included in the study. A questionnaire asking for socio-demographic and lifestyle data was applied by a trained individual previously to the tests. The survey included: socio-demographic and reproductive data (ethnicity, age, menarche, weight, height, BMI – measured by the formula BMI = weight/height^2 – amenorrhea, time of amenorrhea in years) and lifestyles and habits (sedentariness, frequency of physical activity/ week, tobacco use, coffee drinking, number of cigarettes and cups of coffee a day). The form addressed a question about Hormonal Replacement Therapy (HRT) (kind and duration in months) and previous fractures history. Bone densitometry was measured by a Lunar brand machine, where femoral and lumbar spine sites were assessed. Bone Mineral Density (BMD) was measured by employing a double-beam X-ray absorptiometry technique (DEXA). Osteoporosis was defined as the bone mass reduction of at least 2.5 standard deviations to the average bone mass of young adults, according to a standard curve, at the femur or hip densitometry test[6].

The prevalence of osteoporosis was estimated along with the confidence interval. The ORs (odds ratios) and the 95% confidence intervals were estimated on the evaluation of the correlation between osteoporosis (end-point) and the remaining explicative variables (risk factors). The univariate analysis was performed by means of the Pearson's chi-square test or the tend chi-square, whenever appropriate. In the multivariate analysis, logistic regression was used, considering as candidates the variables with $p <= 0.20$. A $p < 0,05$ value was regarded as statistically significant. The statistical analysis was performed by using the Stata 8 software. The study was approved by the Committee on Ethics in Research.

RESULTS

Ages ranged from 50 to 96 years, with an average of 61.6 (SD=8.5). The vast majority of women were Caucasians (93.5%), with a small percentage of Asian (4.1%) and black (2.4%). The average menarche age was 12.9 years (SD =1.7), ranging from 8 to 21. The average amenorrhea time was 13.2 years (SD = 8.6), ranging from 1 to 49 years. BMI ranged from 16.0 to 55.8, with an average of 27.15 (SD = 4.73). About 85.0% and 29.0% of women did not report tobacco use or coffee drinking habits, respectively. Three hundred twenty women (32.7%) presented with osteoporosis. The ratio of women with and without HRT use history was 3:1, 742 of them (74.3%) had previously used HRT some time in life, while 257 (25.7%) were HRT naive.

In the univariate analysis, the following variables were correlated to osteoporosis: age groups (61/70 and 71/96 years), time of amenorrhea (6/10 and 11/49 years), ethnicity (Caucasian and Asian), late menarche (13/15 and 16/21 years) and previous fracture. Increasing BMI ranges (20.1-25.0; 25.1-30.0; 30.1-56.0) showed correlation to a lower risk for osteoporosis. The HRT use was marginally correlated to osteoporosis (p=0.06) (table 1).

In the final model after logistic regression, the following variables were shown to be significant: age groups (61/70 and 71/96 years), time of amenorrhea (6/10 and 11/49 years), lower BMI ranges (15.0-20.0), ethnicity (Caucasian), late menarche (16/21 years) (table 2).

DISCUSSION

In this study of 999 bone densitometry results in women above the age of 49, the prevalence of osteoporosis was 32.7%. This endpoint was correlated to older age groups, longer amenorrhea durations, lower BMI, Caucasian ethnicity and late menarche. The other variables concerned to lifestyle, such as sedentariness, tobacco use and coffee drinking were not shown to be statistically significant in the final logistic model. Only previous fracture and HRT were (marginally) correlated to osteoporosis in the univariate analysis. The results show an increased significance of the reproductive and anthropometric variables over factors related to lifestyle. Women above the age of 70 and in amenorrhea for more than 10 years are three times more susceptible to osteoporosis. On the other hand, obese women (BMI > 30.0) and black women show over 90% less risk of osteoporosis. Late menarche (after 16 years old) was shown to increase the risk of the endpoint by two-fold.

Before discussing results, some considerations must be made about the limitations of the study. First, this was a longitudinal study thus limiting considerations on cause-effect relationship. We could not distinguish cases of primary osteoporosis (post-menopausal osteoporosis and senile osteoporosis) from secondary osteoporosis, usually resulting from other diseases and factors, such as endocrine-metabolic disorders, rheumatic, renal, digestive, neoplasic conditions and use of certain drugs (steroids, anticonvulsants, antacids, among others). Thus the results cannot be generalized for other groups of women. The women in this sample were referred to this service by their gynecologists or GPs for BMN assessment, according to their clinical criteria, which are not addressed by our analysis. Because this is a private clinical and imaging laboratory, one may assume that these women should have risk factors to osteoporosis in their clinical histories that ultimately led their physicians to request a densitometry test. In this case, the prevalence of osteoporosis may have been overestimated compared to other populations. We must also consider that, because this is a private laboratory designed for women counting on health insurances, the socio-demographic profile of this sample are not representative of other Brazilian women groups. However, osteoporosis in this segment, as shown by the results of the present study, is also a highly prevalent issue. Second, our results are based on data collected by means of interviews. Many women may have forgotten to mention some information. Moreover, it would be easier for women who are supposedly aware of their osteoporosis diagnosis to remember the so-called risk factors, such as previous fractures and HRT use, thus enhancing the power of the correlation among studied variables and osteoporosis. The questionnaire employed here addressed the major risk factors to osteoporosis. Although it does not address information on duration of individual habits, it reflects women's current status, which, most of times, are indicative of previous habits. Finally, the number of missing data varied according to the explicative variables, with age at menarche, ethnicity and time of amenorrhea, with 945, 956 and 982 reports, respectively, presenting the highest number of missing data. Nevertheless, the percentage of missed data was 4.3% of total at most, such as for 'age at menarche' variable (43 missing data). Despite of these limitations, sample size and standardized criteria adopted for densitometry-based

Explicative Variable	Total (n)	Cases (%)	OR	CI (95%)	Descriptive Level	Order of Entry
Age					0.00	1
50/60	507	103 (20.3)	1.00			
61/70	338	137 (40.5)	2.67	1.95 : 3.66		
71/96	153	87 (56.8)	5.17	3.42 : 7.79		
Time of amenorrhea (years)					0.00	2
1/5	165	29 (17,6)	1.00			
6/10	239	65 (27.2)	1.75	1.06 : 2.87		
11/49	458	211(46.1)	4.06	2.53 : 6.32		
BMI					0.00	3
15.0/20.0	31	23 (74.2)	1.00			
20.1/25.0	338	138 (40.8)	0.24	0.10 : 0.56		
25.1/30.0	394	113 (28.7)	0.13	0.05 : 0.33		
30.1/56.0	235	53 (22.5)	0.10	0.04 : 0.25		
Ethnicity					0.00	4
Caucasian	894	301 (33.7)	1.00			
Asian	39	10 (25.6)	0.67	0.32 : 1.41		
Black	23	1 (2.4)	0.08	0.01 : 0.67		
Previous fracture					0.01	5
No	817	254 (31.1)	1.00			
Yes	181	73 (40.3)	1.49	1.07 : 2.09		
Age at menarche (years)					0.01	6
8/12	384	111 (28.9)	1.00			
13/15	498	170 (34.1)	1.27	0.95 : 1.70		
16/21	63	29 (46.0)	2.09	1.21 : 3.62		
HRT use					0.06	7
No	257	72 (28.0)	1.00			
Yes	742	255 (34.4)	1.34	0.98 : 1.83		
Time of HRT use (months)					0.17	
0/11	469	169 (36.0)	1.00			
12/33	26	6 (23.1)	0.53	0.20 : 1.35		
Coffee drinking					0.62	
No	292	98 (33.6)	1.00			
Yes	706	229 (32.4)	0.82	0.39 : 1.75		
Number of cups of coffee a day					0.62	
1/9	669	218 (32.6)	1.00			
10/40	35	10 (28.6)	0.82	0.39 : 1.75		
Tobacco use					0.81	
No	848	276 (32.5)	1.00			
Yes	149	51 (34.2)	1.07	0.74 : 1.55		
Number of cigarettes a day					0.81	
1/9	53	20 (37.7)	1.00			
10/19	33	11 (33.3)	0.82	0.32 : 2.06		
20/40	62	20 (32.3)	0.78	0.36 : 1.70		
Sedentariness					0.74	
No	414	138 (33.3)	1.00			
Yes	584	189 (32.4)	0.96	0.73 : 1.25		
Frequency of activity (times a week)					0.26	
1/3	171	50 (29.2)	1.00			
4/7	151	53 (35.1)	1.30	0.81 : 2.09		

Table 1 - Total sample, number and percentage of osteoporosis cases, odds ratio, 95% confidence interval, descriptive level (p value) and order of entry at the multivariate model for each explicative variable

diagnosis of osteoporosis, in tests performed by the same team, are positive aspects of the present study.

Regarding the employed technique, BMD measurement with DEXA is safe, accurate and precise[7]. A meta-analysis with approximately 90,000 people/ year of follow-up assessed BMD measurement's ability to predict fractures. The authors concluded that the BMD measurement van predict fractures, but is not able to identify which individual will have the condition, not recommending a systematic osteoporosis tracking program for menopausal women[8]. The use of fracture predictor models including BMD measurements with anthropometric data is advocated by a number of authors[9].

Explicative variable	Gross OR	CI (OR. 95%)	OR Adjusted	CI (OR. 95%)	Descriptive Level
Time of amenorrhea (in years)					
1/5	1.00				
6/10	1.75	1.06 : 2.87	1.66	0.96 : 2.88	0.06
11/49	4.06	2.53 : 6.32	2.83	1.61 : 5.02	0.00
Age					
50/60	1.00				
61/70	2.67	1.95 : 3.66	1.50	0.99 : 2.27	0.05
71/96	5.17	3.42 : 7.79	3.00	1.76 : 5.12	0.00
BMI					
15.0/20.0	1.00				
20.1/25.0	0.24	0.10 : 0.56	0.15	0.04 : 0.52	0.00
25.1/30.0	0.13	0.05 : 0.33	0.08	0.02 : 0.27	0.00
30.1/56.0	0.10	0.04 : 0.25	0.05	0.01 : 0.18	0.00
Ethnicity					
Caucasian	1.00				
Black	0.08	0.01 : 0.67	0.09	0.01 : 0.76	0.02
Menarche					
8/12	1.00				
16/21	2.09	1.21 : 3.62	2.00	1.04 : 3.84	0.03

Table 2 - *Estimates of the final model of logistic regression, obtained after multivariate analysis.*

The subject is controversial, and the suggestion of limiting BMD measurement to populations presenting risk factors is also questioned by Sheldon (1995). The author questions aspects related to the cost-benefit ratio for taking BMD measurements, arguing that there are no data supporting the idea that decisions on osteoporosis treatment that include BMD measurements can improve outcomes or reduce costs[10]. Apparently, there is a consensus among authors that although BMD is clearly correlated to risks of fractures in elderly women, other clinical factors are also important predictors of long-term risks. Preventive strategies should include these[11].

Regarding clinical risk factors, the results of the present study show the importance of socio-demographic and body measurement data. A study with 5195 women conducted in Spain showed that the major risk factors were early menopause (< 45 years old), family history of fractures, and low weight. In that study, consistent to our results, the prevalence of factors such as tobacco and alcohol use was also low [12]. It may be assumed that an obese individual is less susceptible to develop osteoporosis, since BMI is directly related to BMD[5]. A Brazilian study assessing 724 women reported that body weight is important for gaining and losing body mass, and causes an impact on BMD-age relationship[13].

Another well-determined risk factor is ethnicity. Black women present a lower risk potential to develop osteoporosis, as opposite to Caucasian and Asian women. An American study based on hospital discharge data showed that Afro-American women present lower risk for hip fractures [14]. Nonetheless, other authors found osteoporosis prevalence of 40.4% and 53.3%, for Afro-American and Caucasian women, respectively, considering that ethnicity should not be an exclusion criteria for osteoporosis tracking in Afro-American women.

Regarding lifestyle-related factors, our data showed no correlation to osteoporosis. However, some studies did not show correlation between those variables and osteoporosis. A prospective study with 9516 women with ages above 64 and no previous history of fractures addressed risk factors to hip fracture reporting that the incidence ranged from 1.1 (95% CI:0.5-1.6) to 27 (95% CI:20-34) for each 1.000 women a year, for women presenting up to 2 risk factors and normal age-matched calcaneal bone mass and for women presenting more than 5 risk factors and reduced calcaneal bone mass, respectively. According to the authors, many risk factors act by reducing bone mass. Nevertheless, in the final logistic model, after calcaneal bone density adjustment, the relative risk for hip fracture was not significantly changed for coffee drinking, walking (exercise), weight variations and history of fracture[15].

The effect of drinking coffee on osteoporosis seems to be influenced by the amount ingested, by genetic heritage, and so on. Thus, a prospective study with 96 women above the age of 65, followed up for 3 years, showed that caffeine ingestion above 300 mg/day hastened spinal bone loss. This risk is higher for women with vitamin D receptor gene polymorphism [16]. However, the effect of tow cups of coffee a day on hip and lumbar spine BMD among post-menopausal women aged 50-98 years, is minimized by lifetime milk drinking history[17].

The impact of tobacco use over bone mass is more acceptable to a number of authors. In order to study the effects of lifestyle and bone mass in women above the age of 60, 1080 men and women were prospectively assessed, in a population-based study (DOES). Tobacco use was correlated to a reduced BMD at the femur and spine in both genders, this effect being independent of calcium intake and body size. Ex-smokers presented an intermediate BMD rate compared to active smokers and non-smokers, suggesting that cigarette influence is partially reversible[18].

Other studies assessed, concurrently, risk factors such as tobacco use and physical activity. Thus, the bone hardness degree as evaluated by ultrasound in a group of 2727 premenopausal women is determined by age, weight at the age of 25, and daily calcium intake. Physical activity was positively correlated to bone resistance, while tobacco use showed an opposite effect[19]. On the other hand, a cross-sectional study with 9704 65 year-old Caucasian women reported that BMD was not correlated to physical activity, but only to

the number of cigarettes and tobacco use [20]. A prospective study with 9704 Caucasian women older than 65 showed that higher levels of leisure and sports activities and less time on sat position significantly correlated to a lower relative risk of hip fracture after adjustment for age, diet, number of falls and health status. Women physically more active had 36% fewer hip fractures when compared to less active women. However, this data was not significant for wrist or vertebral fractures[21].

One risk factor frequently described in literature is previous history of fractures. A study conducted in the United Kingdom with 4292 women above the age of 70 assessed risk factors to fracture, during a period of 24 months, pointing out that previous fracture was an important predictor of non-vertebral fracture (OR= 2.67, 95% CI:2.10-3.40), hip fracture (OR=2.31, 95% CI:1.31-4.08) and wrist fracture (OR=2.29, 95% CI:1.56-3.34). In that study, tobacco use did not correlate to increased risk of fracture [22].

Concerning the association with HRT, our results showed that women with osteoporosis were 34% more likely to be HRT users. Although there is a large number of studies showing reduced osteoporosis risk in HRT users, our data can potentially reflect the kind of treatment that many women with osteoporosis are receiving. In this sense, the low duration of HRT use among the 495 users calls our attention. Only 5% of these women used HRT for more than 11 months, and none of them used it for more than 33 months. Similarly, another study showed that, even tracked women presenting higher risk to develop osteoporosis, only 40% remained on HRT after 8 months [23]. The fact is that, even in the early 1990's, before the publication of more recent studies showing unfavorable treatment outcomes, the compliance to HRT was poor. Concerns towards developing cancer and future complications are the causes most frequently mentioned for dropping out HRT. If, on one hand, women are influenced to initiate HRT and change their lifestyles, after an unfavorable bone densitometry outcome, there is a great chance to drop out treatment after a short period of time.

Notwithstanding the concerns about risk factors, some related to women's lifestyles, a quite curious data is reported by Sandison et al[4]. In that study with 320 women above the age of 50, those with the highest number of risk factors were the ones who changed their lifestyles the least. Moreover, the women most willing to receive information about osteoporosis were those presenting the lowest risk to develop the disease. Thus, it seems clear that information is important, but it is not enough to change certain patients' behaviors.

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