OBJECTIVE: To evaluate the epidemiological profile of patients with osteoporotic fractures compared to patients with osteoarthritis (OA) and identify factors that diminish adherence to secondary prevention. Methods: A total of 108 patients with osteoporotic fractures (OF) were compared to 86 patients with OA. Results: Patients in the OF group were older (p < 0.001); had a lower body mass index (p < 0.001); were less literate (p = 0.012); were more frequently Caucasian (p = 0.003); were less frequently married (p < 0.001); experienced more falls, cognitive deficiency, previous fractures, old fracture, falls in the last year, and fall fractures; needed more help and took more medicine for osteoporosis (p < 0.05); and showed less pathology in the feet, muscle weakness, less vitamin D intake, and lower Katz & Lawton scores (p < 0.001). Factors that increased the chance of nonadherence included older age (p = 0.020), falls (p = 0.035), cognitive deficiency (p = 0.044), and presence of depression/apathy/confusion (p < 0.001). Conclusion: Patient age, ethnicity, marital status, previous falls, foot pathologies, muscle weakness, previous fractures, use of vitamin D, use of osteoporosis drugs, and lower Katz & Lawton scale score defined the OF group. Factors that increased the chance of nonadherence included older age, sedative use, cognitive disorders, and symptoms of depression/apathy/confusion. Level of Evidence III, Case-control.

Keywords: Osteoporotic Fractures. Osteoporosis. Epidemiology. Prevalence. Secondary Prevention.

INTRODUCTION

Osteoporosis, the most common bone disease, is characterized by a progressive decrease in bone mass that leads to a decrease in bone strength and higher risk of fractures and considered a public health problem responsible for the expenditure of R$ 290 million from 2008 to 2010 by the Brazilian Unified Health System. As the Brazilian population ages, the incidence of osteoporotic fractures (OF) is increasing. The number of proximal femoral fractures is estimated to increase from 80,640 in 2015 to 198,000 in 2040. In addition to the economic impact, OF have a great social cost since they are associated with an increased mortality rate, decreased independence, loss of self-esteem, depression, and distortion of body image. Although osteoporosis treatment has been available since the 1990s, up to 80% of eligible patients do not receive...
treatment. This treatment failure is associated with the disastrous socioeconomic consequences of OF, especially proximal femoral fractures. This led to the development of secondary prevention programs aiming at reducing the incidence of OF, especially proximal femoral fractures. Although these programs are cost-effective and capable of reducing mortality rates, they have not been able to reduce the incidence of new proximal femoral fractures, which may be due to low treatment adherence.

Unfortunately, studies on the epidemiology of patients with OF in Brazil are scarce, which makes it difficult to implement a program to reduce the impacts of osteoporosis. This study aimed to evaluate the epidemiological profile of the population affected by OF (proximal femoral fractures, proximal humoral fractures, distal radial fractures, and thoracolumbar spinal fractures) treated in an orthopedic tertiary care hospital over a 12-month period with or without a previous diagnosis of osteopenia or osteoporosis and compare this profile with that of patients with osteoarthritis (OA) treated in the same period and identify factors that may decrease the adherence rates of OF patients to a secondary prevention program.

OBJECTIVES
Primary objective
The primary objective of this study was to describe the epidemiological profile of patients with OF treated in a tertiary orthopedic care hospital and identify the possible factors associated with this fracture compared to patients with OA treated during the same period.

Secondary objective
The secondary objective of this study was to describe the characteristics associated with lower adherence rates to a secondary prevention program and the function of patients with OF.

MATERIALS AND METHODS
The Osteometabolic Diseases Group conducted this study upon receiving ethics committee approval (number 76629217.3/0000.0068). All patients signed an informed consent form after having their doubts clarified. The study included all patients admitted in the Orthopedic Institute for treatment of the OF in the period of twelve months and patients with knee OA (only those treated in the osteometabolic diseases group of a tertiary orthopedic care hospital).

Inclusion criteria: Study group (patients with OF): Patients > 45 years of age who had one or more of the following fractures: proximal femur, proximal humerus, distal radius, and thoracolumbar spine. Patients with high-energy fractures were not included.

Control group (patients with OA): Patients > 45 years of age with a clinical and radiographic diagnosis of knee OA isolated or not and with or without comorbidities.

Exclusion criteria: Patients < 45 years of age with suspected or confirmed pathological fractures; non-collaborative patients.

Interventions: The participants answered a questionnaire (Table 1) that was used to collect data such as demographic profile, fracture type, ethnicity, education level, personal history, previous fractures, physical activity level, mobility, place and time of the accident that caused the fracture, use of medications and behavioral measures to treat osteoporosis, and evaluation of functionality according to Katz and Lawton & Brody (12,13). Following the international protocol, all patients in the OF group were referred to a secondary prevention outpatient clinic.

Statistical analysis
We describe the characteristics of the patients using absolute and relative frequencies by groups for qualitative variables and verified the association using chi-square tests or Fisher’s exact test. We calculated summary measurements (mean and standard deviation or median, minimum, and maximum) by groups for quantitative variables and compared the groups using Student’s t-test or the Mann-Whitney U-test. In fractured patients, the characteristics were described according to adherence or loss of follow-up and the same tests were performed as previously described. The unadjusted odds ratio of each variable was used to estimate the chance of OF; in the fractured patients, the chance of loss of follow-up was determined with the respective intervals at a 95% confidence level. Multiple logistic regression models were estimated to explain the group of osteoporotic fractures; in the fractured patients, loss of follow-up, selecting the variables that were significant in the bivariate tests and using stepwise backward regression to select the variables with criteria for entry and exit of variables at 5% (p < 0.05). SPSS for Windows version 20.0 was used to perform the analyses and the data were entered in Microsoft Excel 2003. The tests were performed using a significance level of 5%.
Table 1. Description of patient characteristics by group and results of the unadjusted analyses.

| Variable | Control (n = 86) | Osteoporosis (n = 108) | Total (n = 194) | OR | 95% confidence interval | p |
|----------|-----------------|------------------------|----------------|----|-------------------------|---|
| Gender (male), n (%) | 68 (79.1) | 78 (72.2) | 146 (75.3) | 0.69 | 0.35 | 1.34 | <0.001** |
| Father or mother with hip fx, n (%) | 27 (31.4) | 56 (51.9) | 83 (43.3) | 1.31 | 0.74 | 2.32 | 0.351 |
| Foot patologies, n (%) | 15 (17.4) | 29 (26.9) | 44 (23.2) | 0.70 | 0.40 | 1.25 | 0.239 |
| Age (years), mean ± SD | 73.7 ± 42 | 66.9 ± 13.7 | 69.9 ± 14.3 | 0.97 | 0.95 | 1.00 | <0.01 |
| Alcohol consumption, or smoking was observed as described in our previous studies.

DISCUSSION

We found that patients with OF were older, weighed less, had a lower mean BMI, and were more likely to be Caucasian, findings that are in agreement with the results of other studies.14 Moreover, no great influence of glucocorticoid consumption, alcohol consumption, or smoking was observed as described in the literature.14 We found a protective relationship against OF in married patients compared to those with other marital statuses (Table 1) as in our previous studies.15

Patients with osteoporosis had more previous falls, a greater number of falls in the last year associated with bone fragility, old fractures (>1 year), and more previous fractures. The OF group used more medication for the treatment of osteoporosis, needed more help, and had lower Katz & Lawton’s ADL and IADL scores. The greater number of falls can be explained by higher age and eventual

Table 2. Results of the joint model to explain the fracture group by osteoporosis according to evaluated characteristics.

| Variable | OR | 95% confidence interval | p |
|----------|----|-------------------------|---|
| Age (years) | 1.08 | 1.03 | 1.13 | 0.002 |
| Ethnicity (Caucasian) | 6.58 | 5.81 | 7.45 | 0.006 |
| Civil status | Married | 1.00 | 1.31 | 0.42 | 0.02 |
| Widower | 4.27 | 1.22 | 15.02 | 0.024 |
| Other | 31.35 | 5.35 | 183.61 | <0.001 |
| Previous fall | 8.15 | 1.15 | 56.07 | 0.002 |
| Foot patologies | 0.09 | 0.02 | 0.42 | 0.002 |
| Muscle weakness | 0.08 | 0.02 | 0.32 | 0.002 |
| Vitamin D use | 4.45 | 1.45 | 14.24 | 0.009 |
| Katz & Lawton ADL | 0.62 | 0.47 | 0.82 | 0.001 |

Multiple logistic regression.
Table 3. Description of the characteristics of the fractured patients according to loss of follow-up and result of the unadjusted analyses.

| Variable                                      | Adhere (N = 87) | Loss of contact (N = 14) | Total (N = 101) | OR (95%) | CI (95%) | p     |
|-----------------------------------------------|-----------------|--------------------------|-----------------|----------|----------|-------|
| Gender (female), n (%)                        | (N = 87)        | (N = 14)                 | (N = 101)       | Lower    | Superior |       |
| Age (years), mean SD                          |                 |                          |                 | 0.88     | 0.36     | 2.11  | 0.754 |
| Height (cm), mean SD                          |                 |                          |                 | 1.02     | 0.98     | 1.06  | 0.020**|
| Weight (Kg), mean SD                          |                 |                          |                 | 0.98     | 0.94     | 1.02  | 0.344**|
| BMI (Kg/m²), mean SD                          |                 |                          |                 | 1.02     | 0.95     | 1.09  | 0.611**|
| Education (literate), n (%)                   |                 |                          |                 | 0.91     | 0.80     | 1.05  | 0.190**|
| Education (school years), median (min., max.) |                 |                          |                 | 91 (90.1)| 0.36     | 1.13  | >0.999|
| Ethnicity (Caucasian), n (%)                  |                 |                          |                 | 8 (8.18)| 0.90     | 1.13  | 0.653⁸|
| Married                                       |                 |                          |                 | 31 (30.7)| 0.26     | 2.54  | 0.406 |
| Alcohol use > 3 doses per day, n (%)          |                 |                          |                 | 31 (30.7)| 0.26     | 1.88  |       |
| Previous fractures, n (%)                    |                 |                          |                 | 65.2     | 0.63     | 1.45  | 0.815⁸|
| Sedatives, n (%)                              |                 |                          |                 | 0.95     | 0.56     | 2.09  | 0.486⁸|
| Family history of fractures, n (%)            |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Visual impairment, n (%)                      |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Lower limb impairment, n (%)                  |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Foot pathologies, n (%)                       |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Change in balance, n (%)                      |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Muscle weakness, n (%)                        |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Muscular atrophy, n (%)                       |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Dizziness, n (%)                              |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Depression/apathy/confusion, n (%)            |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Diabetes, n (%)                               |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| SAH, n (%)                                    |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Hypothyroidism, n (%)                         |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Previous fractures, n (%)                     |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Old age (> 65 years), n (%)                   |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Physical activity before fracture, n (%)      |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Fear of falling, n (%)                        |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Falls int he last 12 months, n (%)            |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Fracture due to fall, n (%)                   |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Help, n (%)                                   |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Previous diagnosis of osteoporosis, n (%)     |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Calcium use, n (%)                            |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Scurbathe 3x week, n (%)                      |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Vitamin D use, n (%)                          |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Osteoporosis drug use, n (%)                  |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Katz & Lawton DLA, median (min., max.)        |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |
| Katz & Lawton IDL, median (min., max.)        |                 |                          |                 | 1.14     | 0.42     | 2.25  | 0.103 |

Chi-square test; *Fishier’s exact test; **Student’s t-test; *Mann-Whitney’s U-test.

Table 4. Results of the joint model to explain follow-up loss of fracture patients according to evaluated characteristics.

| Variable                | OR    | CI (95%) | p     |
|-------------------------|-------|----------|-------|
| Age (years)             | 1.10  | 1.02     | 1.19  | 0.012 |
| Sedative use            | 8.69  | 1.36     | 55.45 | 0.022 |
| Depression/apathy/confusion | 8.50  | 2.19     | 33.09 | 0.002 |

Multiple logistic regression

sarcopenia,¹⁶,¹⁷ and possible sequelae of previous fractures due to pain and changes in alignment reducing the frequency of physical activity, which leads to decreased bone and muscle mass, which predisposes patients to further falls and fractures.¹⁸ Patients with OF had fewer foot pathologies and muscle weakness and took less vitamin D. We believe that this is a bias since the patients in the OA group are currently in outpatient follow-up associated with a holistic multiprofessional educational program for the treatment of OA,¹⁹ which enables these patients to recognize deformities, pathologies, and muscle weaknesses. Moreover, they are actively studied for

Tabla 4. Resultados del modelo conjunto para explicar la pérdida de seguimiento de los pacientes fracturados según las características evaluadas.

| Variable                | OR    | CI (95%) | p     |
|-------------------------|-------|----------|-------|
| Age (years)             | 1.10  | 1.02     | 1.19  | 0.012 |
| Sedativa use            | 8.69  | 1.36     | 55.45 | 0.022 |
| Depresión/apatía/confusión | 8.50  | 2.19     | 33.09 | 0.002 |

Análisis múltiple logístico
vitamin D deficiency. It is worth mentioning that muscle weakness was self-reported; we did not perform functional objective tests. Approximately 14% of patients with OF refused to participate in the secondary prevention program. The variables identified as risk factors for follow-up loss were age, use of sedatives, cognitive deficit, greater number of falls, and presence of depression/apathy/confusion. The greatest number of falls may be associated with the use of sedatives and cognitive disorder, although we cannot confirm this with our data. Using multiple logistic regression, we found that: the chance of follow-up loss increased 10% with each 1-year increase in patient age; the use of sedatives increased the chance of follow-up loss by 8.69 times; symptoms of depression/apathy/confusion increased the chance of follow-up loss by 8.5 times.

To improve adherence to the secondary prevention program of this subgroup, patients and their families may need an intensive educational program that has already reduced falls, increased the frequency of physical activity, improved adherence to drug treatment, and increased the overall quality of life in patients with osteoporosis.

CONCLUSION

Together, patient age, ethnicity, marital status, previous falls, foot pathologies, muscle weakness, previous fractures, use of vitamin D, use of osteoporosis drugs, and Katz & Lawton IADL scale score define patients with OF. The risk factors for non-adherence to the secondary prevention program are patient age, sedative use, cognitive disorder, and the presence of depression/apathy/confusion.

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