Reumatología Clínica

Original Article

Differences in the frequency of osteoporosis according to the skeletal site evaluated. Analysis in 987 Spanish postmenopausal women referred to a bone densitometry unit

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ARTICLE INFO

ABSTRACT

Objective: To analyze the differences in the frequency of osteoporosis according to the skeletal site evaluated in a group of Spanish postmenopausal women.

Methods: We reviewed the data of 987 postmenopausal women (mean age, 53.8 [5.5 years]). BMD status was evaluated by DXA. We used the WHO thresholds to classify the patients. T-score was obtained from the single evaluation of each lumbar vertebra (L2, L3, and L4), the mean value of lumbar spine (L2-L4), femoral neck and total hip.

Results: In 144 (14.7%) women, discrepancies were observed when we considered the single vertebral analysis versus the L2-L4 analysis; 62 (6%) women who presented osteoporosis in at least 1 vertebra would have been due to the osteopenia category when L2-L4 value was selected. In 271 (27.8%) women, discrepancies were observed when we considered the total hip analysis versus the femoral neck analysis. The frequency of osteoporosis ranged from 3% when only the analysis of the total hip was considered to 16% when the results of L2-L4 and proximal femur (total hip or femoral neck) measurements were selected.

Conclusions: Frequency of osteoporosis varies notably according to the skeletal zone considered.

Diferencias en la frecuencia de osteoporosis según la región esquelética evaluada. Análisis de 987 mujeres posmenopáusicas remitidas a una unidad de densitometría

RESUMEN

Objetivo: Analizar, en un grupo de mujeres posmenopáusicas, las diferencias en la frecuencia de osteoporosis según la localización anatómica utilizada para realizar el diagnóstico.

Métodos: Se recopilaron las características demográficas y los valores de la densidad mineral ósea (DMO) de 987 mujeres posmenopáusicas (media de edad, 53,8 ± 5,5 años). La DMO se evaluó mediante absorciometría fotónica dual de fuente de rayos X (DXA). Se utilizaron las categorías de la OMS para clasificar a las pacientes. Se calcularon los *T-score* de cada vértebra lumbar de forma individualizada (L2, L3 y L4), del valor medio del análisis de la columna lumbar (L2-L4), del cuello femoral y de la cadera total.

Resultados: En 144 (14,7%) mujeres, se observaron discrepancias entre el análisis individualizado de cada vértebra lumbar y el análisis de L2-L4; 62 (6%) mujeres que presentaban osteoporosis en al menos una vértebra se adscribían a la categoría osteopenia al considerar el valor medio del análisis de L2-L4. En 271 (27,8%) mujeres, se observaron discrepancias entre el análisis de la cadera total y el cuello femoral. La frecuencia de osteoporosis osciló entre el 3% cuando se consideró sólo los resultados de la cadera total y el 16% cuando se tuvo en cuenta los valores del análisis de L2-L4 y del tercio proximal del fémur (cadera total o cuello femoral).

Conclusiones: La frecuencia de osteoporosis varía notablemente según la región esquelética considerada.

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Introduction

The value of the bone mineral density (BMD) evaluated through Densitometry x-ray absorbtiometry (DXA), is strongly related to the risk of fracture. This is increased when the BMD is reduced, but the cut point at which there is a clear difference between individuals who will develop a fracture and those who will not has not been defined.

It has been perfectly established that the bone mineral density is not the only determinant of the risk of fracture.[1] However, the operative diagnosis of osteoporosis is based on the application of the WHO categories,[2] which classify postmenopausal women in normal, osteopenic or osteoporotic according to the relative situation of their BMD with respect to that of the young adult population (*T-score*).

There is no unanimous consensus between health authorities on what skeletal region to consider when establishing the diagnosis of osteoporosis. The International Osteoporosis Foundation (IOF) and the National Osteoporosis Foundation (NOF) established that the point of reference should be the proximal third of the femur.[3,4]

The International Society for Clinical Densitometry (ISCD)[5,6] has striven to standardize the diagnosis of osteoporosis from the value obtained in the analysis of the femoral neck. However, it assumes that in postmenopausal women, osteoporosis can be diagnosed if the BMD is ≤−2.5 standard deviations (SD) from the *T-score* in the lumbar spine, total hip or femoral neck.

On the other hand, the mean value of the lumbar spine (L1-L4 o L2-L4) analysis is usually considered when making assumptions on the state of the BMD. This circumstance obviously levels the playing field in terms of the risk of fracture of each one of the vertebrae evaluated and may underestimate the frequency of the diagnosis of osteoporosis.

Clinical practice manifests some discrepancies regarding the frequency of the different WHO categories when the established cut points are applied in different skeletal regions. Therefore, we designed a study with the objective of analyzing the magnitude of the difference of a numerous group of women referred to this densitometry unit.

Patients and methods

Nine-hundred eighty-seven postmenopausal women were sent to the densitometry unit from different Women's Health Units and were considered for this study.

The densitometry unit analyzes, in a systematic manner, the BMD (g/cm^2) of the lumbar spine (L2-L4) and the proximal third of the femur (femoral neck and total hip) through DXA (Hologic, Waltham, United States). The T-score and the Z-score are established from data obtained in the mulcentric trial of evaluation of bone mass in Spanish population (MRPO),[7] carried out with equipment from Hologic®. The WHO diagnostic criteria were applied[2] to classify patients as normal (T-score >−1 SD), osteopenia (T-score between −1 and −2.5 SD) y osteoporosis (T-score <−2.5 DE).

The present study considered the mean of L2-L4 and not L1-L4 as recommended by the ISCD[5,6] because these were the areas evaluated by the MRPO.[7] In that study, the group of women that constituted the reference population for the calculation of the T-score were aged 20–29, and the mean value of L2 was 1.008 (0.112) g/cm^2, for L3 it was 1.040 (0.11) g/cm^2 and for L4 it was 1.041 (0.109) g/cm^2; the mean evaluation value for L2-L4 was 1.031 (0.104) g/cm^2.

In the proximal third of the femur, the mean value of the total hip was 0.919 (0.097) g/cm^2 and the femoral neck was 0.840 (0.109) g/cm^2.

Statistical data was expressed as means and SD. Ninety-five per cent confidence intervals (CI) were calculated for the different T-scores.

Results

The mean age of the women was 53.8 (5.5) and the mean body mass index was 27.4 (3.9).

Table 1 shows the mean value of the L2-L4 evaluation, as well as for the femoral neck and total hip and their corresponding T-score.

In 144 (14,7%) women there were discrepancies between the individual analysis of each vertebrae and when analyzed together; 62 (6%) women who presented osteoporosis in at least one vertebrae were considered as osteopenic when considering the mean value of the L2-L4 analysis; 82 (8.4%) of women who presented osteopenia in at least one vertebrae were considered as normal when taking into account the mean value of the L2-L4 analysis.

In 271 (27.8%) women we found discrepancies between the total hip analysis and the femoral neck analysis; 11 (1.1%) women who presented osteoporosis upon consideration of the total hip were included into the osteopenia category according to the result of the femoral neck analysis. In an inverse way, 17 (1.7%) women with osteoporosis of the femoral neck presented osteopenia un the total hip analysis.

Table 2 shows the frequency of each one of the WHO diagnostic categories observed in the series when the lower T-score was considered in the different skeletal regions analyzed.

Discussion

With this study we have shown, from the analysis of numerous postmenopausal women sent to a unit of public sector densitometry, that the frequency of WHO categories varies notably according to the skeletal region considered when applying the different cut points based on the T-score.

There is controversy on which area of measurement should be the one employed for the diagnosis of osteoporosis according to the WHO criteria. The IOF and the NOF recommends reviewing the total hip and the ISCD, the worse of the lumbar spine or femur.

The ISCD recommends using the mean value of the L1-L4 analysis and states clearly that the categorization of the patients must not be done from the analysis of a single vertebrae. The results obtained in the present study, based on the evaluation of three vertebrae (L2-L4), show that when, considering the individualized analysis of a vertebrae against the total evaluation, discrepancies are not unusual. Establishing the categorization from the mean value of the analysis of L2-L4 leads to a notable decrease in the frequency of osteoporosis (14.7 vs 21%). However, it must be pointed out that the ISCD does not allow for the evaluation of a single vertebrae to establish a diagnosis of osteoporosis.[5,6]

There is a certain degree of ambiguity in the IOF and NOF guidelines on which should be the area of the proximal femur to be considered when applying the WHO diagnostic categories. One of the arguments to use the total hip measurement is its better reproducibility with respect to the femoral neck, because it includes a larger area of bone, although it has not been shown to improve the prediction of fracture with respect to the femoral neck.[8] In fact, using the FRAX tool, developed by Kanis et al[8] at the University of Sheffield, to calculate the risk of fracture, the values of the femoral neck are employed.

From the data obtained in the study presented here there seems to be no notable difference in the frequency of osteoporosis when considering the values of the femoral neck or total hip (3.6 vs 3%).

Osteoporosis is a systemic disease but the degree of bone loss is not the same in the different skeletal regions. Trabecular bone is more sensitive to hormonal changes and therefore, the lumbar spine is more sensitive to bone loss in the initial postmenopausal period than the proximal third of the femur. Therefore, in the series here presented, the frequency of osteoporosis was 14.7% when the

Table 1
Analysis of the lumbar spine (L2-L4), femoral neck, and total hip in 987 postmenopausal women

	Lumbar spine (L2-L4)	Femoral neck	Total hip
BMD, g/cm²	0.917 (0.146)	0.748 (0.109)	0.901 (0.126)
T-score (95% CI)	−1.09 (1.38) (−1.18 to −1)	−0.84 (1) (−0.91 to −0.78)	−0.18 (1.3) (−0.26 to 0.1)

Table 2
Frequency of the WHO categories observed when considering the lowest T-score value in the different skeletal regions under analysis

Skeletal region	Normal, %	Osteopenia	Osteoporosis
Vertebrae L2	42.2	42.7	15
Vertebrae L3	46.8	39.4	13.8
Vertebrae L4	50.2	37.9	12
Mean value of L2-L4	44.7	40.6	14.7
Any vertebrae	36.3	42.7	21
Total hip	73	24	3
Femoral neck	53.4	43	3.6
Any value for the proximal third of the femur	50.7	44.6	4.7
Mean value of L2-L4 + any value of the proximal third of the femur	35.1	49	15.9
Any vertebrae + any value of the proximal third of the femur	29.2	49.1	21.7

analysis of L2-L4 was considered, of 4.7% when only the analysis of the proximal third of the femur was evaluated and 15.9% when the worst of these evaluations was taken into account. In a similar way, Moayyeri et al,[9] in a high risk population for bone loss, with a mean age of 53,4 (11.8) years, found a similar distribution in the osteoporosis category (24.7, 12.4, and 27.8%, respectively).

Obviously, the relationship between BMD and the risk of fracture is better described as a gradient than from the application of cut points. However, the WHO diagnostic categories are useful in daily practice because they provide information on the prognosis of the patient. In addition, the BMD is the main factor when reaching a decision on therapeutic intervention.

Therefore, independently of the fact that the densitometry analysis of the lumbar spine and femoral neck will still be used in a systematic way, it seems necessary to review the anatomical region in which the WHO categories are applied. Knowing the frequency of osteoporosis is essential when designing strategies directed to improving the cone health of the population in general.

In our opinion, the proposal of the ISCD is the one that better allows us to approach the clinical problema of osteoporosis, especially when the women, as in the analyzed series, have a short postmenopausal period.

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