CONCISE REPORT

Usefulness of bone densitometry in postmenopausal women with clinically diagnosed vertebral fractures

J M Nolla, C Gómez-Vaquero, J Fiter, D Roig Vilaseca, L Mateo, A Rozadilla, M Romera, J Valverde, D Roig Escofet

Ann Rheum Dis 2002;61:73–75

Objective: To analyse whether bone mineral density (BMD) assessment is required in postmenopausal women presenting with low trauma vertebral fracture.

Methods: Women with vertebral fracture diagnosed over a 10 year period were recruited from our database. The following were excluded: (a) patients with high energy trauma; (b) patients with malignancies; (c) patients with a metabolic bone disease other than osteoporosis. All postmenopausal women were included in whom BMD had been evaluated at both the lumbar spine and femoral neck by dual energy x ray absorptiometry during the six months after the diagnosis. Patients with a potential cause of osteoporosis other than age and menopause were not considered. A total of 215 patients were identified.

Results: The mean (SD) age of the patients was 65.9 (6.9) years. BMD at the lumbar spine was 0.725 (0.128) g/cm² and the T score was -2.94 (1.22); BMD at the femoral neck was 0.598 (0.095) g/cm² and the T score was -2.22 (0.89). The BMD of the patients was significantly lower than that of the general population at both the lumbar spine and femoral neck. When the lowest value of the two analysed zones was considered, six patients (3%) showed a normal BMD, 51 (23.5%) osteopenia, and 158 (73.5%) osteoporosis. The prevalence of osteoporosis at the femoral neck increased with age; it was 25% in patients under 60, 35% in patients aged 60–70, and 60% in patients over 70.

Conclusion: These results indicate that bone densitometry is not required in postmenopausal women with clinically diagnosed vertebral fractures if it is performed only to confirm the existence of a low BMD.

A strong relation exists between bone mineral density (BMD) measured by dual energy x ray absorptiometry (DXA) and the risk of fracture.¹ Fracture risk increases with decreasing BMD, so that there is no exact cut off point to characterise absolutely a person who will fracture from one who will not.²

The consensus definition³ of osteoporosis captures the notion that low BMD is an important component of the risk of fracture. Furthermore, the operative definition⁴ is based on BMD status; in 1994, an expert panel of the World Health Organisation (WHO) recommended thresholds of BMD in women to define osteopenia and osteoporosis.

It is clear that the relation between fracture risk and bone density is best described as a gradient rather than a threshold. However, WHO thresholds are useful in clinical practice to give information on prognosis. Moreover, although risk factors independent of bone mass should also be considered,² BMD status is the main factor in the decision on intervention, and WHO thresholds are used as cut off points.^{5,6}

Unfortunately, the generalised use of DXA is limited because it is expensive and time consuming, it is not portable, and it is available only in specialised clinics. It is therefore only feasible to use it to investigate patients at high risk of osteoporosis. Thus, a previous fragility fracture is a classic indication for bone densitometry,⁷ which is supported by the more recent guidelines.⁸ However, it has also been suggested that, when low trauma vertebral fracture is diagnosed, patients can receive specific treatment for osteoporosis without measurement of BMD.⁹

We studied a group of postmenopausal women with clinically diagnosed vertebral fracture, seen in a rheumatology department over 10 years, in order to evaluate the incidence of osteopenia and osteoporosis according to WHO criteria. Our aim was to analyse whether BMD assessment is required in women with low trauma vertebral fracture.

PATIENTS AND METHODS

The study was performed at the rheumatology department of the Ciutat Sanitària i Università de Bellvitge, a 1000 bed teaching hospital in Barcelona, Spain. The department has a 14 bed unit for admissions and four outpatient clinics, one in the hospital and the other three in affiliated primary care health centres. In our area, patients with suspected osteoporotic fracture are usually referred to staff members of the rheumatology department for specialist opinion. The department has an established protocol for the evaluation of patients with vertebral fractures.

Women with vertebral fracture diagnosed between January 1990 and December 1999 were recruited from our database. Only patients who consulted for back pain were included; asymptomatic patients in whom diagnosis was established on the basis of radiological studies performed for other clinical problems were not considered. A 20% reduction in the height of the anterior, mid, or posterior vertebra was taken to indicate the presence of a fracture; radiographs were not examined by the same rheumatologist and were not digitised. We excluded patients with high energy trauma, malignancies, or metabolic bone disease other than osteoporosis. A total of 534 patients were identified. Mean age was 67.8 (8.6) years (range 30–91). The fracture was single in 272 (51%) cases and multiple in 262 (49%).

Patients (n = 103) with a potential cause of bone loss other than age and menopause were not considered. From the remainder (n = 431), we selected patients in whom a BMD assessment had been performed at both the lumbar spine and femoral neck, in our bone densitometry unit, during the six months after the diagnosis of vertebral fracture; 215 patients fulfilled the requirements and were included in the study.

Abbreviations: BMD, bone mineral density; DXA, dual energy x ray absorptiometry; MRPO, Multicentre Research Project on Osteoporosis; CI, confidence interval.

Table 1 Number (%) of patients (n=210) assigned to each WHO category using the lowest value of the two analysed regions

	50-59 (n=32)	60-69 (n=115)	70-79 (n=63)
Normal	2 (6)	3 (3)	0
Osteopenia	5 (16)	36 (31)	8 (13)
Osteoporosis	25 (78)	76 (66)	55 (87)

Classification by age (years) distribution. Patients under 50 (n=2) and over 80 (n=3) were not considered.

Table 2 Number (%) of patients (n=215) assigned to each WHO category from the bone mineral density status at the lumbar spine and femoral neck

	Lumbar spine	Femoral neck
Normal	12 (5)	18 (8)
Osteopenia	64 (30)	110 (51)
Osteoporosis	139 (65)	87 (41)

Patients included (n = 215) were younger (65.9 (6.9) years *v* 69.4 (9.2) years; *p*<0.01) than those not included (n = 216); the proportion of patients with multiple fractures was similar (41% *v* 50%).

BMD (g/cm²) was measured at the lumbar spine (L2-4) and femoral neck by DXA using a Hologic QDR1000 unit (Hologic Inc, Waltham, Massachusetts, USA). Calibration with a lumbar spine phantom was performed daily and with a femoral phantom weekly.

T score and Z score were established by comparison with data from the study of BMD at the lumbar spine and femoral neck in a Spanish population, performed by the Multicentre Research Project on Osteoporosis (MRPO).¹⁰ The aim of this study was to generate standard curves for BMD at both sites. The total sample size was 2442 subjects of both sexes aged 20-80 years, stratified according to survival rates, demographic distribution by local regions, and sex ratio in the Spanish population. BMD measurements were performed with a Hologic QDR device. The MRPO members considered that the results obtained were representative of BMD values in the Spanish population. As recommended by MRPO members, the age range from which normal values were derived for calculation of T scores was 20-44 years for the lumbar spine and 20-29 years for the femoral neck. We used the WHO thresholds⁴ to classify our patients into three diagnostic categories as follows: (a) normal, a BMD T score greater than -1 SD; (b) osteopenia, a T score between -1 and -2.5 SD; (c) osteoporosis, a T score below -2.5 SD.

Results are expressed as mean (SD). Confidence interval (CI) was used to assess the difference between the mean Z score at each site and that of the general population. For comparison between categorical variables, a χ^2 test was applied. Correlation between continuous variables was calculated by the Pearson test. Differences between groups were calculated by analysis of variance. *p*<0.05 was considered significant.

RESULTS

The mean age of the patients was 65.9 (6.9) years (range 45-83). A single fracture was found in 126 (59%) patients, and multiple fractures in the remainder. Patients with a single fracture were younger than those with multiple fractures. (65.1 (7.1) years *v* 67.1 (6.4) years; *p*<0.05).

The BMD at the lumbar spine was 0.725 (0.128) g/cm² and the T score was -2.94 (1.22). The BMD at the femoral neck was 0.598 (0.095) g/cm² and the T score was -2.22 (0.89).

Table 3 Number (%) of patients (n=210) assigned to each WHO category from the bone mineral density status at the lumbar spine and femoral neck

	50-59 (n=32)	60-69 (n=115)	70-79 (n=63)
Lumbar spine			
Normal	2 (6)	7 (6)	2 (3)
Osteopenia	6 (19)	41 (36)	15 (24)
Osteoporosis	24 (75)	67 (58)	46 (73)
Femoral neck			
Normal	4 (13)	11 (10)	1 (2)
Osteopenia	20 (62)	64 (55)	24 (38)
Osteoporosis	8 (25)	40 (35)	38 (60)

Classification by age (years) distribution. Patients under 50 (n=2) and over 80 (n=3) were not considered.

Table 4 Number (%) of patients (n=210) assigned to each threshold considered at the lumbar spine and femoral neck

	50-59 (n=32)	60-69 (n=115)	70-79 (n=63)
Lumbar spine			
T<-1	30 (94)	108 (94)	61 (97)
T<-1.5	27 (84)	101 (88)	60 (95)
T<-2	27 (84)	90 (78)	56 (88)
T<-2.5	24 (75)	67 (58)	46 (73)
T<-3	19 (59)	51 (44)	39 (62)
Femoral neck			
T<-1	28 (87)	104 (90)	62 (98)
T<-1.5	21 (67)	89 (77)	60 (95)
T<-2	11 (34)	68 (59)	54 (85)
T<-2.5	8 (25)	40 (35)	38 (60)
T<-3	2 (6)	20 (17)	18 (29)

Classification by age (years) distribution. Patients under 50 (n=2) and over 80 (n=3) were not considered.

The BMD of the patients was significantly lower than that of the general population at both sites; the Z score at the lumbar spine was -0.91 (1.00) (95% CI -1.04 to -0.78) and that at the femoral neck was -0.84 (0.89) (95% CI -0.96 to -0.72).

BMD was related to age of the patients at both the lumbar spine (*r*=-0.15; *p*<0.05) and femoral neck (*r*=-0.35; *p*<0.01). The correlation coefficient between BMD at the lumbar spine and femoral neck was 0.48 (*p*<0.001).

When the lowest value of the two analysed zones was considered, six patients (3%) had a normal BMD, 51 (23.5%) had osteopenia, and 158 (73.5%) had osteoporosis; table 1 shows the percentage of patients assigned to each WHO category when the patients were classified according to several age ranges.

Sixty eight (31.5%) patients had combined osteoporosis at the lumbar spine and femoral neck. Almost half (49%) of the patients with osteoporosis at the lumbar spine also had osteoporosis at the femoral neck.

Table 2 shows the percentage of patients assigned to each WHO category from the BMD status at the lumbar spine and femoral neck. Table 3 shows the same data when the patients were classified according to several age ranges. Table 4 shows data obtained when different T score thresholds were applied.

When patients were classified according to the number of vertebral fractures (single *v* multiple), no differences were found in the BMD at the lumbar spine (0.731 (0.126) g/cm² *v* 0.716 (0.131) g/cm²) or femoral neck (0.607 (0.098) g/cm² *v* 0.584 (0.088) g/cm²), nor in the T score at the lumbar spine (-2.87 (1.19) *v* -3.03 (1.26)) or femoral neck (-2.13 (0.092) *v* -2.34 (0.083)). Finally, we found no differences in WHO diagnostic categories (tables 5 and 6).

Table 5 Number (%) of patients (n=215) assigned to each WHO category using the lowest value of the two analysed regions

	Single (n=126)	Multiple (n=89)
Normal	5 (4)	1 (1)
Osteopenia	31 (25)	20 (23)
Osteoporosis	90 (71)	68 (76)

Patients are classified on the basis of the number of vertebral fractures.

Table 6 Number (%) of patients (n=215) assigned to each WHO category from the bone mineral density status at the lumbar spine and femoral neck

	Single (n=126)	Multiple (n=89)
Lumbar spine		
Normal	8 (6)	4 (5)
Osteopenia	38 (30)	26 (29)
Osteoporosis	80 (64)	59 (66)
Femoral neck		
Normal	12 (10)	6 (7)
Osteopenia	66 (52)	44 (49)
Osteoporosis	48 (38)	39 (44)

Patients are classified on the basis of the number of vertebral fractures.

DISCUSSION

We have studied the BMD status in a large series of Spanish postmenopausal women suffering from vertebral fracture. Patients with malignancies, metabolic bone disease other than osteoporosis, or high energy trauma were excluded. Moreover, patients with a potential cause for bone loss other than age and menopause were not considered in order to homogenise the series.

The study was performed in a clinical setting and should be interpreted in the light of several considerations. Although we asked patients about the existence of a high energy trauma, it is possible that a unmemorable episode may have been overlooked; nonetheless, we are confident that the effect of this possibility on the overall series is extremely low.

We included only symptomatic patients. However, there was no attempt to differentiate between recent and chronic back pain.

Radiographs were not digitised when we measured the reduction in vertebral height; moreover, they were evaluated by several clinicians and we have not analysed the degree of agreement between the examiners.

Finally, we have not systematically indicated a BMD assessment in our patients. Only half of the patients fulfilled the requirements for the study. Patients included in the study were younger than those not included, probably reflecting a trend to avoid the performance of bone densitometry in older women.

Despite these criticisms, the results may help to clarify the value of bone densitometry assessment in patients with vertebral fracture.

As expected, the BMD of the patients was significantly lower than that of the general population. Correlation between age and BMD was more pronounced at the femoral neck than the lumbar spine, probably reflecting the impact of the presence of osteophytes or fractures. Correlation between

spine and femoral BMD was only moderate. Measurements of the skeleton at one site correlate with measurements made at other skeletal sites, correlation coefficients ranging from 0.5 to 0.8; the correlations are closer in the young healthy population than in patients with significant bone loss.¹¹ Thus, the correlation obtained between spine and femoral BMD in this study was clearly less close than that observed in a recent study¹² performed in postmenopausal women without vertebral fractures and with a lower mean age.

The percentage of patients with normal BMD was very low. Three quarters of patients showed signs of osteoporosis at the lumbar spine and/or femoral neck; furthermore, almost 90% of patients aged 70–79 had osteoporosis at the lumbar spine and femoral neck combined.

On the other hand, the incidence of osteoporosis at the femoral neck increased with age in the different groups, probably in accord with the pattern of bone loss in postmenopausal women; in patients under 60 it was 25% and in patients over 70 it was 60%.

The results obtained support the proposal that bone densitometry in postmenopausal women with a fragility vertebral fracture is not required if it is performed only to confirm the existence of a low BMD.

Authors' affiliations

J M Nolla, C Gómez-Vaquero, J Fiter, D Roig Vilaseca, L Mateo, A Rozadilla, M Romera, J Valverde, D Roig Escofet, Department of Rheumatology, Ciutat Sanitària I Università de Bellvitge, Feixa Llarga s/n. 08907 L'Hospitalet de Llobregat, Barcelona, Spain

Correspondence to: Dr Nolla; 28634apj@comb.es

Accepted 4 July 2001

REFERENCES

- 1 Marshall D, Johnell O, Wedel H. Meta-analysis of how well measures of bone mineral density predict occurrence of osteoporotic fractures. *BMJ* 1996;312:1254–9.
- 2 Kanis JA, Glüer CC for the Committee of Scientific Advisors, International Osteoporosis Foundation. An update on the diagnosis and assessment of osteoporosis with densitometry. *Osteoporos Int* 2000;11:192–202.
- 3 Peck WA, Burckhardt P, Christiansen C, Fleish HA, Genant HK, Gennari C, et al. Consensus development conference: diagnosis, prophylaxis and treatment of osteoporosis. *Am J Med* 1993;94:646–50.
- 4 World Health Organisation. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. *WHO technical report series* 843. Geneva: WHO, 1994.
- 5 American College of Rheumatology task force on osteoporosis. Recommendations for the prevention and treatment of glucocorticoid-induced osteoporosis. *Arthritis Rheum* 1996;39:1791–801.
- 6 Meunier PJ, Delmas PD, Eastell R, McClung MR, Papapoulos S, Rizzoli R, et al. Diagnosis and management of osteoporosis in postmenopausal women. Clinical guidelines. *Clinical Ther* 1999;21:1025–44.
- 7 Johnston CC Jr, Slemenda CW, Melton LJ. Clinical use of bone densitometry. *N Engl J Med* 1991;324:1105–9.
- 8 Genant HK, Cooper C, Poor G, Reid I, Ehrlich G, Kanis J, et al. Interim report and recommendations of the World Health Organization task-force for osteoporosis. *Osteoporos Int* 1999;10:259–264.
- 9 Delmas PD. Do we need to change WHO definition of osteoporosis? *Osteoporos Int* 2000;11:189–91.
- 10 Diaz Curiel M, Carrasco de la Peña JL, Honorato Pérez J, Pérez Cano R, Rapado A, Ruiz Martínez I on behalf of the Multicentre Research Project on Osteoporosis. Study of bone mineral density in lumbar spine and femoral neck in a Spanish population. *Osteoporos Int* 1997;7:59–64.
- 11 Sahota O, Pearson D, Cawte SW, San P, Hosking DJ. Site-specific variation in the classification of osteoporosis and the diagnostic reclassification using the lowest individual lumbar vertebral T-score compared with the L1–L4 mean, in early postmenopausal women. *Osteoporos Int* 2000;11:852–7.
- 12 Fiter J, Nolla JM, Gómez-Vaquero C, Martínez-Aguilá D, Valverde J, Roig-Escofet D. A comparative study of computed digital absorptiometry and conventional dual energy x-ray absorptiometry in postmenopausal women. *Osteoporos Int* 2001;12:565–9.