

Effect of spinal osteophytosis on bone mineral density measurements in vertebral osteoporosis

T Masud, S Langley, P Wiltshire, D V Doyle, T D Spector

Department of Rheumatology, St Thomas's Hospital, London SE1 7EH

T Masud, research fellow and honorary lecturer
T D Spector, consultant rheumatologist

Department of Rheumatology, Whipps Cross Hospital, London E11 1NR

S Langley, research nurse
P Wiltshire, scan technician
D V Doyle, consultant physician and rheumatologist

Correspondence to: Dr Masud.

BMJ 1993;307:172-3

Bone mineral density measurements are used increasingly to assess the future risk of fracture and to monitor the response to treatment. The lumbar region, which is usually used for these measurements (L1-L4), is the most reproducible. It is also commonly affected by degenerative spinal disease, including osteophytosis, the prevalence of which increases dramatically with age.¹ Other small studies on whether lumbar bone mineral density measurements are affected by osteophytes have been contradictory.^{2,4} We have investigated to what extent varying degrees of spinal osteophytosis can affect bone mineral density measurements in the common clinical setting of women presenting with vertebral fractures.

Subjects, methods, and results

Ninety three postmenopausal women (aged 46-93) who presented to the osteoporosis clinic with at least one vertebral fracture were studied. We defined vertebral fracture as a 20% or greater reduction in vertebral height in lateral spine radiographs. Dual x ray absorptiometry (quantitative digital radiography 1000/whole body; QDR 1000/W) was used to measure lumbar spine bone density (L1-L4) and femoral neck bone density. The lateral spine radiographs were graded independently for the severity of osteophytosis by the method of Orwoll *et al* (OA0=none, OA1=mild, OA2=moderate, OA3=severe).² The presence or absence of vascular calcification in the aorta was also noted. The groups were compared by analysis of covariance (SAS software).

The mean lumbar spine bone density measurements adjusted for age and weight in all three groups with osteophytosis (OA1-OA3) were significantly higher than in the group with no osteophytosis (OA0; $p < 0.001$) (table). The most severe osteophytosis group (OA3) had an adjusted mean lumbar spine bone density 32.1% higher (95% confidence interval 23.5 to 40.7), and densities in the OA1 and OA2 groups were increased by smaller amounts—21.1% (13.0 to 29.2) and 20.2% (12.7 to 27.7) respectively. Overall the presence of even mild osteophytosis produced on average a 24.0% (17.7 to 30.3) increase in lumbar spine bone density.

The adjusted mean femoral neck bone density was higher in the osteophytosis groups (OA1-OA3) compared with the no osteophytosis group (OA0). However, the increases, ranging from a non-

significant 1.8% (95% confidence interval -3.6 to 7.2) in the OA1 group to 11.1% (5.3 to 16.9) in the OA3 group, were smaller than those seen in the lumbar spine. When the osteophyte groups were combined (OA1+OA2+OA3) the resulting adjusted mean femoral neck bone density was 8.2% higher (4.1 to 12.3) than in the no osteophytosis (OA0) group ($p=0.021$).

The relative contribution of osteophytes to the variance in lumbar spine bone density was assessed by multiple regression. Osteophytes had the greatest effect on bone density, explaining 27% of the variance (r^2), whereas adding age and weight to the model explained only a further 13%, producing a total r^2 of 0.40.

Forty subjects (43%) had evidence of vascular calcification. The mean lumbar spine bone density measurements adjusted for age and osteophytosis grade for the vascular calcification and no calcification groups were 0.772 g/cm² and 0.812 g/cm² respectively. There was no significant difference in adjusted mean lumbar spine bone density between the two groups ($p=0.24$).

Comment

These data show that in postmenopausal women with fractures even mild osteophytosis can lead to falsely increased lumbar spine bone mineral density measurements. As osteophytosis is common in older women the presence of osteophytes is likely to cause problems in interpreting lumbar spine bone density results. Although cross sectional, our data also suggest caution in interpreting changes in lumbar spine bone density in prospective studies or trials unless changes in osteophytes are also noted.

Our results suggest that spinal osteophytosis does not affect femoral neck bone density to the same extent as lumbar spine bone density. Although in elderly people neck scans are often considered more difficult owing to poor positioning and poor patient mobility, these data imply that in the presence of spinal osteophytosis the femoral neck is a more reliable site for estimating bone mineral density. Our finding of a small (8.2%) increase in femoral neck bone density in women with spinal osteophytosis is consistent with the hypothesis of an inverse relation between osteoarthritis and osteoporosis.⁵

In conclusion our study shows that in postmenopausal women with fractures the common finding of mild spinal osteophytosis can lead to misleadingly high lumbar spine bone density readings and may mask the degree of underlying spinal osteoporosis. Our data suggest that, in older patients with vertebral fracture, unless the spine looks clear of osteophytes radiologically the femoral neck should be used to assess bone mineral density.

We thank the staff and patients at Chingford Hospital and St Bartholomew's Hospital for their help and the city branch of the National Osteoporosis Society for financial support. We

Description of lumbar spine bone density and femoral neck bone density in subjects with vertebral fracture by osteophyte status

Osteophyte status	Mean age (years) (SE)	Mean weight (kg) (SE)	Mean lumbar spine bone density (g/cm ²) (SE)	Adjusted mean lumbar spine bone density* (g/cm ²) (SE)	% Difference in lumbar spine bone density* from OA0 (95% confidence interval)	Mean femoral spine bone density (g/cm ²) (SE)	Adjusted mean femoral neck bone density* (g/cm ²) (SE)	% Difference in femoral neck bone density* from OA0 (95% confidence interval)
OA0 (n=34)	66.6 (1.6)	58.2 (2.1)	0.638 (0.020)	0.634 (0.025)		0.559 (0.018)	0.560 (0.017)	
OA1 (n=18)	64.7 (2.5)	60.1 (2.8)	0.819 (0.040)	0.804 (0.033)	21.1 (13.0 to 29.2)	0.589 (0.028)	0.570 (0.022)	1.8 (-3.6 to 7.2)
OA2 (n=25)	69.6 (1.9)	61.6 (2.1)	0.780 (0.027)	0.794 (0.029)	20.2 (12.7 to 27.7)	0.617 (0.023)	0.620 (0.019)	9.7 (4.7 to 14.7)
OA3 (n=16)	70.3 (2.1)	63.4 (3.8)	0.934 (0.057)	0.934 (0.036)	32.1 (23.5 to 40.7)	0.617 (0.035)	0.630 (0.024)	11.1 (5.3 to 16.9)
Combined group (OA1+OA2+OA3) (n=59)	68.2 (1.3)	61.6 (1.6)	0.833 (0.024)	0.834 (0.020)	24.0 (17.7 to 30.3)	0.608 (0.016)	0.610 (0.012)	8.2 (4.1 to 12.3)

*Adjusted for age and weight.

also thank Allan Hackshaw, Tuan Nguyen, and Deborah Hart for statistical support.

- 1 Lawrence JS. Disc degeneration: its frequency and relationship to symptoms. *Ann Rheum Dis* 1969;28:121-38.
- 2 Orwoll ES, Oviatt SK, Mann T. The impact of osteophytic and vascular calcifications on vertebral mineral density measurements in men. *J Clin Endocrinol Metab* 1990;70:1202-7.

- 3 Reid IR, Evans MC, Ames R, Wattie DJ. The influence of osteophytes and aortic calcification on spinal mineral density in postmenopausal women. *J Clin Endocrinol Metab* 1992;72:1372-4.
- 4 Dawson-Hughes B, Dallal GE. Effect of radiographic abnormalities on rate of bone loss from the spine. *Calcif Tissue Int* 1990;46:280-1.
- 5 Dequeker J. The relationship between osteoporosis and osteoarthritis. *Clin Rheum Dis* 1985;11:271-95.

(Accepted 13 May 1993)