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Effect of Radiographic Abnormalities on Rate of Bone Loss from the Spine

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Summary

When measured by dual-photon absorptiometry (DPA), the adjusted annual rate of change in bone mineral density (BMD) of the lumbar spine was 0.11±0.51 (SE)% in 44 healthy postmenopausal women with radiographic abnormalities in the scan field and −0.97±0.26% in 249 women with normal lateral lumbar radiographs (p=0.046). Rates of loss of BMD from the radius were similar in the 2 groups. Spurious rates of loss of spine BMD are likely to be found in subjects with calcification of the aorta, osteophytes or other abnormalities in the spine scan field. This should be kept in mind when serial spine scans are being considered in these subjects.

Introduction

DPA is widely used to measure spine BMD. Subjects with radiographic evidence of calcification of the aorta, osteoarthritis and other radioopaque abnormalities in the region of the scan field are found to have higher apparent mean BMD than do age-matched normals by some (1,2) but not other (3) investigators. This study was conducted to determine whether women with abnormalities in the spine scan field have altered rates of loss of BMD from the spine, when measured by DPA.

Materials and methods

The study population included 293 of 360 healthy postmenopausal women with low usual calcium intakes who were enrolled in a calcium supplement field trial. At enrollment, none had a compression fracture on lateral thoracic and lumbar radiographs, nor any illness or use of medications known to affect bone mass. In the trial, women were randomly assigned to a placebo or to 1 of 2 calcium treatment groups (each receiving 500 mg of elemental calcium daily as either calcium citrate malate or calcium carbonate). Women who were excluded from this study were those in whom years since menopause could not be estimated (i.e., those with partial hystorectomies), those who discontinued participation during the first treatment year, and those with incomplete scans. Written informed consent was obtained from each subject.

BMD measurements of the lumbar spine (L2-4) were made at enrollment and after 1 year of treatment with a model DP-3 dual-photon absorptiometer from Lunar Radiation Corp. (Madison, WI) and analyzed with software 08B. Measurements were corrected for inter- and intra-gadolinium and truncal-thickness-related drift with the use of an external standard, as described previously (4). BMD of the radius (1/3 distal site) was measured at baseline and 1 year with a model SP-2 single-photon absorptiometer from Lunar Radiation Corp.

The lateral lumbar spine radiographs obtained at enrollment were examined for the presence of abnormalities in the scan field of L2-4. Subjects were designated as normal or abnormal and the type of abnormality classified as calcification of the aorta, osteoarthritis (osteophytes), or other (e.g., calcified nodes).

Results

Of 293 women studied, 44 had spine radiographs with abnormalities in the L2-4 scan field. Of these, 31 (70%) had calcification of the aorta, 7 (16%) osteophytes, and 5 (11%) miscellaneous other abnormalities.

Apart from age, the clinical characteristics given in Table 1 were similar in the 2 groups of women. There was a significant increase in the frequency of radiographic abnormality with age (p=0.0005 by trend test, Table 2).

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Table 1. Clinical characteristics (mean ± SD)

	Radiograph	
	Abnormal	Normal
N	44	249
Age	61±5	58±5
Years since last menses	12.9±6.3	10.2±6.5
% Reference wt.	117±19	118±19.8
Initial BMD, g/cm^2		
Spine (L2-4)	1.103±0.159	1.080±0.139
Radius	0.596±0.079	0.611±0.077

Bone loss from the lumbar spine during the year following enrollment was determined and compared in women with normal and abnormal radiographs. The adjusted annual rate of loss of BMD from the spine was less in those with abnormal than in those with normal lumbar radiographs [0.11±0.51 (SE)% vs −0.97±0.26%, respectively, $p = 0.046$]. In contrast, adjusted rates of change at the radius in the abnormal and normal groups were similar (0.41±0.65% vs 0.39±0.36%, respectively, ns). The rates of loss of the two groups were adjusted for % reference weight, dietary calcium intake, treatment group (placebo vs 500 mg of supplemental calcium), and years since menopause by the least squares means procedure from SAS GLM (5). Because the relationship between change in BMD and years since menopause may not be linear, a model was fitted that treated each value of years since menopause as a separate category. Age, height and weight were not included in the model because they provided no predictive capability beyond that already contained in years since menopause and % reference weight.

Discussion

In agreement with Ross et al. (2), the prevalence of radiographic abnormalities in the DPA spine scan field increases with age. The prevalence of calcification of the aorta in our study (11%) is very similar to that reported previously (2). The lower prevalence of osteoarthritis in our group [2% vs 24% reported by Ross et al (2)] may reflect population differences or use of different radiographic criteria for defining osteophytes (neither we nor Ross report severity of osteoarthritis).

The adjusted rate of loss of BMD from the spine was lower in women with an abnormality on spine radiograph than in those with normal radiographs. In contrast, change in BMD at the radius was independent of lumbar spine radiograph status. We postulate that the true rates of loss from the spine in the 2 groups were similar and that the loss of BMD in the group with abnormal radiographs was offset by ongoing calcification of the aorta and osteophyte enlargement.

Table 2. Distribution of radiograph status by age

	Age, years		
Radiograph	40-49	50-59	60-71
Normal	13	129	107
Abnormal	0	13	31
Calc. aorta	0	11	20
Osteophytes	0	1	7
Other	0	1	4

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