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BONE MINERAL IN PATIENTS WITH OSTEOARTHROSIS OF THE HIP

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Foss & Byers (1972) showed that patients suffering from primary osteoarthrosis have a larger bone mass at the second metacarpal in comparison both with patients suffering from femoral neck fracture and also with the general population. Roh et al. (1973) postulated that the larger metacarpal bone mass of patients with osteoarthrosis of the hip was due to normal endosteal resorption and to increased periosteal apposition as compared with controls matched for age and sex. Using photon absorption, they also demonstrated that the mineral content of the forearms of osteoarthrotics was higher than that of controls (Roh et al. 1974). These observations justify the proposition that the aetiology of primary osteoarthrosis could be a general disturbance in bone mineral metabolism, for instance overproduction of growth hormone.

The purpose of the present investigation was to measure the bone mineral linear density (g/cm) and density (g/cm^3) of the forearm bones by the Am-241 gamma ray attenuation method, and to measure the cortical index and combined cortical thickness of the second metacarpals, all in patients with osteoarthrosis of the hip, and also to compare the results with measurements from a series of subjects with healthy bones.

MATERIAL AND METHODS

Eleven women and 18 men with primary osteoarthrosis of the hip, grades 3–4 according to Kellgren's classification (1963), were studied. The patients were otherwise healthy and they had no known diseases affecting the bone. The control material consisted of 124 persons with healthy bones (Alhava & Karjalainen 1973a). The mean ages, heights, and weights are presented in Table 1. The age range for female osteoarthrotics was 51–67 years and for males 38–71.

The bone mineral linear density (g/cm) and density (g/cm^3) were determined

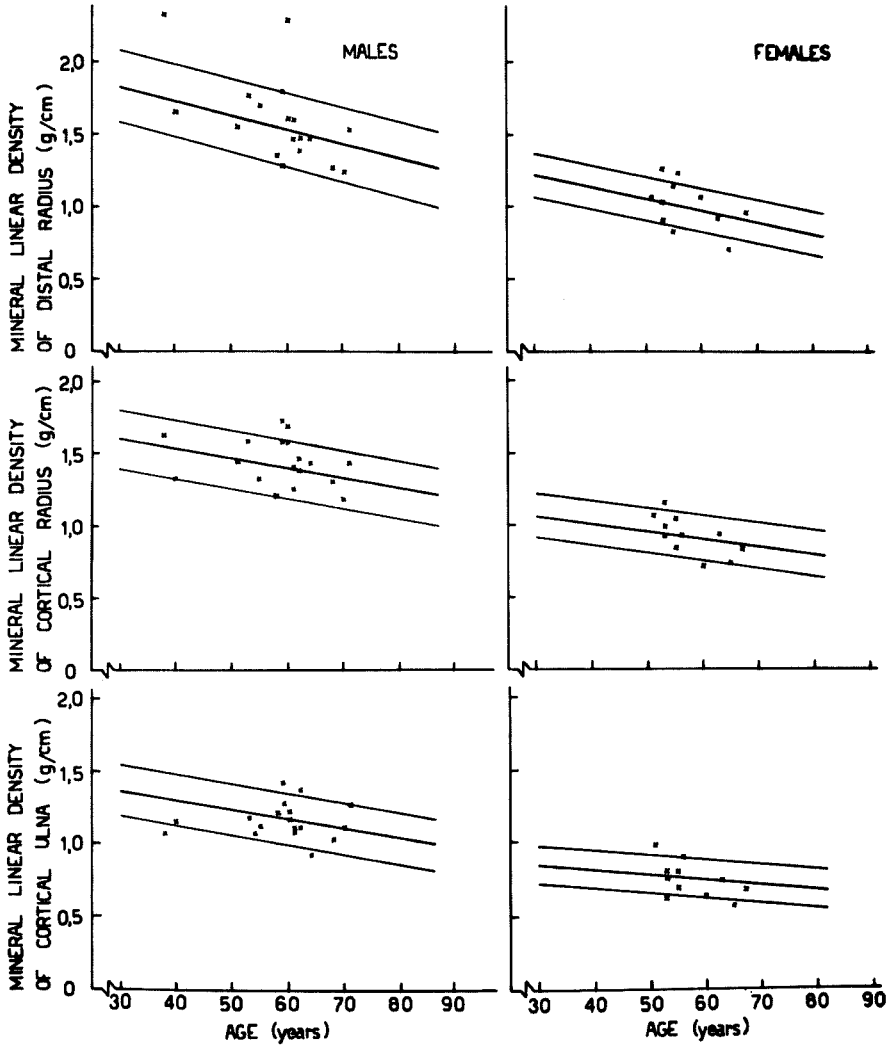

Figure 1 a.

from the left antebrachium, from the cortical and cancellous bone area, by the Am-241 gamma ray attenuation method (Cameron & Sorenson 1963, Karjalainen 1973). The cortical indexes and combined cortical thicknesses of the second metacarpals were measured with a caliper from postero-anterior radiographs (Barnett & Nordin 1960).

In the statistical analysis of the results a comparison was made with a control material. The control values were taken at a point corresponding to the patient's age from the regression line for the left hand, calculated within the range of age distribution of the patients (Figure 1 a, b).

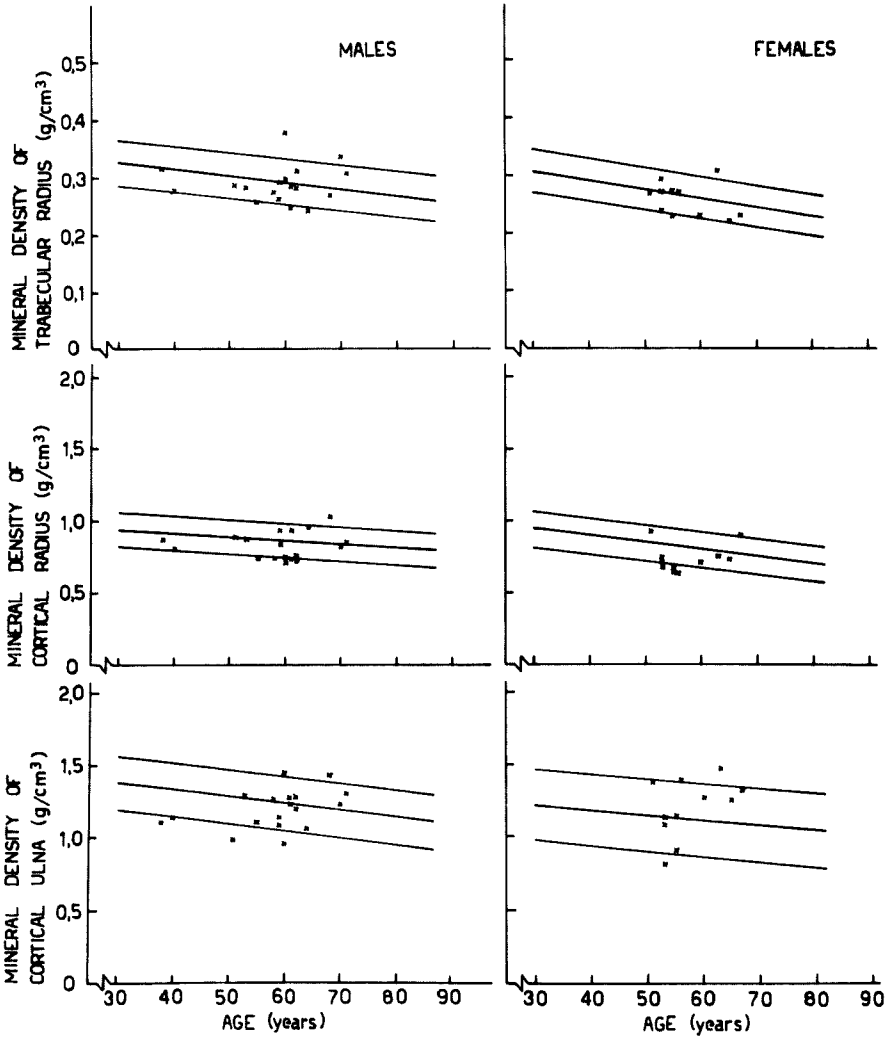

Figure 1 b.

Figure 1. Bone mineral a) linear density λ (g/cm) and b) density ϱ (g/cm³). The regression line with its 1 SD is plotted for the controls from the age of 30.

RESULTS

The bone mineral linear density (g/cm) of the patients did not differ in a statistically significant manner at any measuring point from that of the controls. The mineral density (g/cm³) of the cortical radius of the female patients was statistically significantly lower than that of the

controls ($P < 0.02$). There were no statistically significant differences at the other measuring points (Table 2).

Table 1. Age, height, and weight of patients and controls. The controls were selected from the healthy persons with corresponding age range to the patients. The t-test was used in the comparison.

	Sex	Patients		Controls		Significance		
		n	Mean±1SD	n	Mean±1SD	t	$P <$	
Age (years)	F	11	57±5	17	58±5	0.70	0.50	NS
Height (cm)	F	11	157±7	17	158±7	0.35	0.80	NS
Weight (kg)	F	11	65±8	17	69±11	1.09	0.30	NS
Age (years)	M	18	58±9	34	55±10	1.39	0.20	NS
Height (cm)	M	18	172±6	34	170±6	1.04	0.40	NS
Weight (kg)	M	18	77±13	34	74±13	0.93	0.40	NS

NS = not significant.

Table 2. Bone mineral linear density λ (g/cm) and density ϱ (g/cm³) in osteoarthrotics and controls (1 = distal cancellous radius, 2 = cortical radius, and 3 = cortical ulna). t-test, paired comparison.

		n	Mean±1SD (patient)	Mean±1SD (control)	Significance		
					t	$P <$	
F	λ_1	11	1.01 ± 0.17	1.00 ± 0.04	0.31	0.80	NS
F	λ_2	11	0.92 ± 0.14	0.91 ± 0.03	0.35	0.80	NS
F	λ_3	11	0.74 ± 0.13	0.76 ± 0.02	−0.54	0.70	NS
M	λ_1	18	1.60 ± 0.30	1.52 ± 0.08	1.18	0.30	NS
M	λ_2	18	1.44 ± 0.16	1.38 ± 0.06	1.32	0.30	NS
M	λ_3	18	1.15 ± 0.12	1.21 ± 0.04	−2.00	0.10	NS
F	ϱ_1	11	0.258 ± 0.030	0.265 ± 0.009	0.88	0.30	NS
F	ϱ_2	11	0.73 ± 0.09	0.83 ± 0.03	−3.11	0.02	
F	ϱ_3	11	1.20 ± 0.21	1.13 ± 0.02	1.06	0.40	NS
M	ϱ_1	18	0.286 ± 0.032	0.283 ± 0.014	0.38	0.80	NS
M	ϱ_2	18	0.83 ± 0.09	0.88 ± 0.02	−1.88	0.10	NS
M	ϱ_3	18	1.19 ± 0.14	1.24 ± 0.04	−1.31	0.30	NS

NS = not significant.

There were no differences between the patients and controls as regards the cortical index and the combined cortical thicknesses of the second metacarpals.

DISCUSSION

The osteoarthrotics of our series had either been operated on shortly before for their hips or the decision to perform the operation had been made before they were selected for our study. The operated patients were mobilized immediately after the surgery and had no serious complications. The criteria for exclusion of known diseases affecting the bone mineral content were (Vaughan 1970): persons who had taken hormones and who had or had had an endocrinological disease, rheumatoid arthritis, malignant tumours, sarcoidosis, chronic nephropathy or renal calculi, malabsorption, osteomalacia, hemiparesis or other paresis, asthma or epilepsy; persons who had undergone intestinal surgery apart from appendectomy were also excluded. In addition, long-term users of psychopharmaceutical drugs and diuretics were also ruled out. The criteria were same for the osteoarthrotics and controls and the selection was made by the same person. The observers who made the measurements were the same for both series. The mean age, heights, and weights of the osteoarthrotics did not differ statistically from those of the controls of the same age range.

The gamma ray attenuation method for measuring osteoporosis has proved to be the most accurate and reliable one (Shimmins et al. 1972) and is suitable for screening studies (Alhava 1974). Foss & Byers (1972) in measuring the mineral mass of the second metacarpals stated that osteoarthrosis is associated with above average "bone density" and that osteoporosis and osteoarthrosis do not normally occur together. They also found that patients with hip fractures had a lower "mineral density" than controls. They presented only one case of osteoarthrosis in a series of 140 hip fractures. Alhava (1974) in his consecutive series of 104 hip fracture patients found five cases with concomitant arthrosis of the hip. Using the Am-241 gamma ray attenuation method Alhava & Karjalainen (1973b) also found that the mineral density of the distal radius was statistically significantly lower in patients with fractured hips than in control series. Roh et al. (1973) confirmed the observation of Foss & Byers that osteoarthrosis of the hip is associated with above average cortical bone mass at the second metacarpal bone. They proposed that this may be due to some kind of over-activity of growth hormone.

We found that the bone mineral linear density (g/cm) and density (g/cm^3) of the forearm bones were almost the same in osteoarthrotics and controls, with the exception of the female cortical radius where the

density was lower than in controls, perhaps by chance. Moreover, the cortical indexes and combined cortical thicknesses of the second metacarpals of these two groups did not differ in either sex.

Our results contradict the findings of Foss & Byers (1972) and Roh et al. (1973, 1974). One explanation for this may be the different compositions of the control series in the various studies. Our control series had healthier bones than the general population, because all known bone-affecting diseases and drugs were used as criteria for exclusion. We assume that the controls of Foss & Byers represented the general population, but those of Roh et al., including ambulant psychiatric patients and patients with tuberculosis, were osteoporotic (Engh et al. 1968, Nilsson 1970). Moreover, racial and geographical factors may influence the bone mineral content (Chalmers & Ho 1970, Alhava & Puittinen 1973).

Several investigations show that changes in the peripheral bones are similar to those in axial bones (Smith & Frame 1965, Nordin et al. 1970, Siegelman 1970). A longitudinal study is needed to determine the correlations between bone mineral densities and osteoarthrosis, and the possible effects of physical activity, over-activity of growth hormone etc. on these two factors.

SUMMARY

A series of 29 patients with primary osteoarthrosis of the hip were studied to evaluate their bone mineral status. A comparison was made with a series of persons with healthy bones. The bone mineral content of the osteoarthrotics, as measured either by gamma ray attenuation in the forearm bones, or as cortical indexes, or obtained from the combined cortical thicknesses of the second metacarpals from the radiographs, was not higher than in the control series. These findings do not support the concept that patients with osteoarthrosis tend to have a higher "mineral density" than healthy people.

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