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BONE MASS IN PRIMARY COXARTHROSIS

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The bone mineral content was measured by gamma absorptiometry at two levels on the forearms, proximally on the shafts and distally close to the wrist, in 53 cases of primary coxarthrosis. The bone mineral content at the distal measuring site, representing trabecular bone, was increased in coxarthrosis cases as compared with normal controls; the difference was significant only in women. At the proximal measuring site, representing cortical bone, there was no significant difference. The findings support the concept of impairment of the resilience of the juxta-articular trabecular bone as one factor contributing to the pathogenesis of arthrosis.

Key words: osteoarthritis; coxarthrosis; bone mineral

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Radin & Paul (1970) concluded from experimental loading studies on animal joints that only the periarticular soft tissues and the periarticular bone have significant force-attenuating properties and that therefore cartilage degeneration could be caused by alterations in the mechanical properties of the underlying bone. Once degenerative joint changes become clinically and roentgenologically apparent there are secondary changes in the periarticular bone. However, measurements of bone mass may be obtained from other parts of the body. Foss & Byers (1972) measured the cortices of the second metacarpal in patients with coxarthrosis and those with fracture of the upper end of the femur and found that coxarthrosis cases had higher values than the controls whereas fracture cases were below normal. Roh et al. (1973) found similar changes in the second metacarpal bone of coxarthrosis cases — the dimensions of the bones indicated an increased periosteal apposition rate with normal endosteal resorption rate, resembling the bone remodelling changes in acromegaly. Using a method of photon absorption measurement of bone mass Roh et al. (1974) found that not only the metacarpal bones but also the shaft and the distal end of the radius showed an increased bone mineral content in cases with coxarthrosis as compared with healthy controls. The difference was more pronounced in women than in men. On the other hand, Alhava et al. (1975) failed to demonstrate any deviation in the bone mineral content in the forearm of patients with coxarthrosis. The latter authors suggested that differences in results may be due to the selection of controls.

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MATERIALS AND METHODS

Coxarthrosis

Included in this study were altogether 53 cases of primary coxarthrosis, 20 men and 33 women, with

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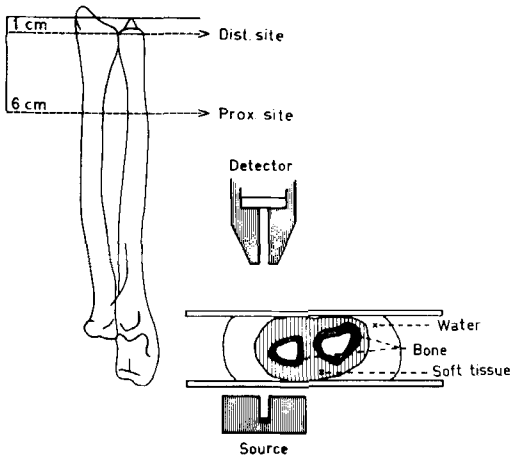

Figure 1. Schematic representation of the measuring device. The forearm is enclosed in a water-filled latex cuff and compressed between two parallel perspex slabs. A rectolinear scan is performed across the two forearm bones and the attenuation of the radiation from the radionuclide source used for calculation of the bone mineral content in the pathway of the beam. Measuring sites indicated on the left.

an age range of 43–85. They were all classified as primary since there were no signs and no history indicating rheumatoid arthritis, traumatic origin or pre-existing deformity. All the patients had such severe symptoms of coxarthrosis that they were scheduled for total hip replacement. In most instances the measurement was carried out when the patients were admitted for surgery.

Controls

The controls, 155 women and 140 men, were all drawn from previously collected normative data on the bone mineral content of the forearm (Westlin 1974). These subjects were hospital employees, randomly selected visitors to admitted patients and healthy men from a home for the elderly. Also, some orthopaedic patients from the outpatient department were included. These data have been analysed for homogeneity between the various groups sampled. Also, it has been established that individuals with clinical signs of reduced bone mass such as vertebral compression fracture, femoral neck fracture and fractures of the proximal humerus and the distal end of the forearm were not more often represented than in the base population. Using these data only those subjects who belonged to age groups corresponding to the coxarthrosis cases were selected for comparison, altogether 99 men and 115 women.

Bone mineral measurement

The bone mineral content (BMC) was measured at two levels on the forearm, 1 cm and 6 cm proximal to the tip of the ulnar styloid process (Figure 1). The measurements were obtained by gamma absorptiometry — a rectolinear scan across the radius and the ulna with a simultaneously moving radiation source (Americium–241) and detector (Figure 1) (Nauclér et al. 1974). The average thickness of bone mineral (g/cm^2) was calculated for the radius and the ulna together. The average of the left and the right forearms was used.

The BMC of control cases and coxarthrosis cases was compared by analysis of covariance with age as the covariant factor.

RESULTS

At the proximal measuring site, 6 cm from the ulnar styloid, representing mainly cortical bone, there was no difference between coxarthrosis cases and controls. At the distal measuring site, however, which includes also trabecular bone, the BMC was greater in coxarthrosis cases than in controls. This difference was significant only in women ($0.01 < P < 0.01$) (Figure 2). Patients walking with a stick did not deviate from other cases of coxarthrosis nor was there any difference between the arm holding the stick and the contralateral arm.

DISCUSSION

Roh et al. (1974) and Alhava et al. (1975) measured the BMC on the shafts of the radius and/or the ulna representing the cortical bone and at the distal end of the two bones representing trabecular bone. However, the latter measuring sites were located 2 or 3 cm from the tip of the ulnar styloid process. At these levels only 10–25 per cent of the bone is trabecular whereas at the measuring site used in the present study — 1 cm from the

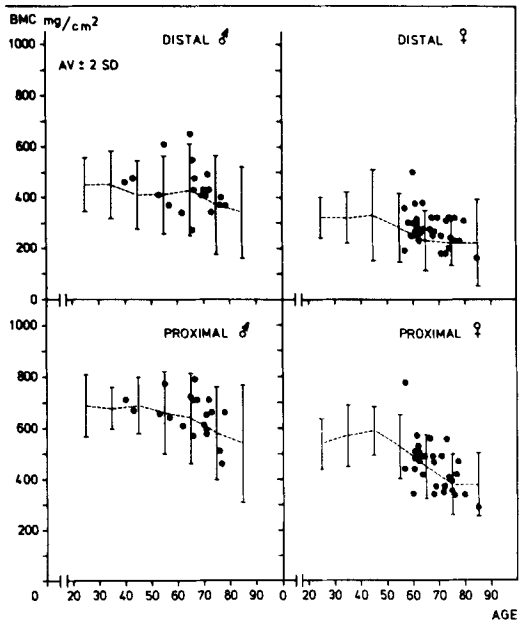

Figure 2. Bone mineral content at the two measuring sites as compared with normative data (interrupted line = average, vertical bars = 2 SD). Most values are within the normal range but, in the distal measuring site, women with coxarthrosis deviate significantly from the normative data.

ulna styloid tip — 50 per cent of the bone is trabecular (Schlenker 1976). Therefore, previous studies on the relationship between bone mass and arthrosis have dealt mostly with cortical bone whereas the interesting structure is probably the subchondral trabecular bone. Our coxarthrosis cases did not deviate from normal with respect to cortical bone; only the juxta-articular cancellous bone of the wrist deviated from normal and, when studied for both sexes separately, the deviation was significant only in women. Our data tend to support the hypothesis that the shock-absorbing capacity of the subchondral bone may be impaired in some individuals in whom the bone mineral mass is slightly higher as compared with the average for their age group. This may be one of several factors in the pathogenesis of coxarthrosis.

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