Periarticular bone mineral content in rheumatoid arthritis and arthrosis of the hip

Dual photon X-ray absorptiometry in 53 cases

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The bone mineral content (BMC) was determined by dual photon X-ray absorptiometry prior to hip replacement in 22 patients with rheumatoid arthritis and 31 with arthrosis. Compared with the arthrosis patients, the rheumatoids had approximately 20 percent lower bone mineral content in the proximal femur, the lumbar spine, and in the innominate bone superior to the acetabulum.

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Total hip replacement in rheumatoid arthritis (RA) is associated with an increased frequency of radiographic loosening of the acetabular component as compared to osteoarthrosis (OA) (Carlsson et al. 1986). Roentgen stereophotogrammetric studies have shown sockets among rheumatoids migrate at a larger rate, notably in the proximal direction (Snorrason et al. 1993, Önsten et al. 1993). Regarding the femoral component, however, there does not seem to be any difference between RA and OA (Carlsson and Gentz 1980).

We compared the bone mineral content of the proximal femur, and the innominate bone in patients with rheumatoid arthritis and arthrosis.

Patients and methods

Within 1 week prior to a total hip replacement procedure, 53 consecutive patients, 31 OA and 22 RA, had the bone mineral content (BMC) of their diseased hips assessed, using dual energy X-ray absorptiometry (DEXA). The diagnosis of RA was in all cases established by an experienced rheumatologist; 15/22 were seropositive; the mean duration of RA was 20 (6–47) years; most had major complaints and/or had undergone previous surgery in 5 (0–11) major joints; 9 had a history of steroid medication with a median duration of 5 (1–15) years; with 5 on steroid medication at the time of measurement.

There were 11 men and 20 women with OA, and 3 men and 19 women with RA. The mean patient age was 67 and 62 years in OA and RA, respectively. There was no difference in weight between the 2 groups. Among women, the arthrosis patients were older than the rheumatoids, whereas no difference in weight was registered (Table 1).

The BMC was measured with the patient in the supine position, using the Lunar DPX equipment. The hips were scanned from the level of the lesser trochanter to just underneath the iliac crest. The BMC (g/cm^2) in 3 different regions of the femur, i.e., the femoral neck, Ward's triangle and the trochanter (Figure 1), as well as the lumbar spine (L2–4), were automatically calculated by the algorithm. In addition, a further 2 regions of interest (ROI) were measured in the iliac bone; ROI 1 in the acetabular roof and ROI 2 in the spongious bone superior to the acetabular roof. ROI 1 was defined as a rectangular box in which the

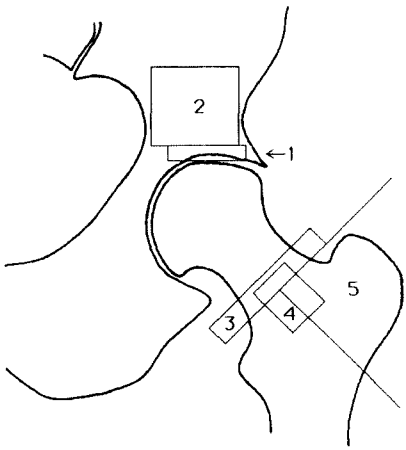

Figure 1. The measurement areas of the proximal femur and the iliac bone. 1 region of interest 1, 2 region of interest 2, 3 femoral neck, 4 Ward's triangle, and 5 trochanter.

Table 1. Demographic data and measurement results for the two populations. Mean *SD*

	All					Women				
	Arthrosis n 31		*P*-value	Rheumatoid arthritis n 22		Arthrosis n 20		*P*-value	Rheumatoid arthritis n 19	
Age	67	*9.7*	ns	62	*10.2*	70	*8.6*	0.008	62	*11*
Weight	75	*17.9*	ns	66	*19.1*	66	*12.1*	ns	64	*19.5*
Area ROI 1 (cm^2)	2.6	*0.7*	0.02	2.1	*0.4*	2.4	*0.7*	ns	2.1	*0.4*
Area ROI 2 (cm^2)	8.4	*3.3*	ns	7.1	*1.8*	7.0	*1.7*	ns	7.1	*1.8*
BMC										
Femoral neck	1.0	*0.2*	0.002	0.8	*0.2*	0.9	*0.2*	0.008	0.7	*0.2*
Ward's triangle	0.8	*0.2*	0.004	0.6	*0.2*	0.7	*0.2*	0.023	0.6	*0.2*
Trochanter	0.8	*0.2*	0.0002	0.6	*0.2*	0.7	*0.2*	0.002	0.5	*0.1*
Lumbar spine	1.2	*0.2*	0.0008	1.0	*0.2*	1.1	*0.2*	0.02	0.9	*0.2*
ROI 1	1.7	*0.4*	0.002	1.4	*0.4*	1.6	*0.3*	0.003	1.3	*0.3*
ROI 2	1.1	*0.3*	0.01	0.9	*0.3*	1.1	*0.3*	0.02	0.9	*0.2*

height was set to incorporate no more than the subchondral bone in the acetabular roof, and the width was set to range from the lateral cortex of the innominate bone to a medial point where the subchondral bone turned into a distal direction. ROI 2 was defined by a square box occupying the distance in-between the pelvic ring medially and the lateral cortex of the innominate bone laterally. The size of the measurement areas in ROI 1 and ROI 2 are given in Table 1.

In 2 OA and 2 RA patients, spine BMC could not be measured since the patients after having measured hip BMC were unable to withstand a further supine position. In 1 OA patient, the measurement area did not include the femur. In order to explore a possible skewness in the distribution of the BMC in the rheumatoids, the quotients between the BMC of the different regions and the BMC of the lumbar spine were calculated.

Student's *t*-test, Mann-Whitney test and Pearson's correlation analysis were used.

Results

In all regions, the rheumatoids had less BMC than the arthrotics (Table 1). For both groups and with both sexes included, a correlation was found between the different regions of the proximal femur ($r \geq 0.86$, $P \leq 0.0001$), as well as between the femoral neck and L2–4 (r 0.80, P 0.0001). Except for the quotient trochanter/L2–4, the quotients between the different hip measurements and spine BMC did not differ between the 2 patient groups. Men weighed more, and had higher BMC in all measured regions. Since there was an uneven proportion of men in our 2 groups, further analysis refers to the women only.

No correlation was found between age and BMC in the different regions in either group, and thus, direct comparisons between the 2 patient groups were made despite the difference in age. The rheumatoids had 15–26 percent less BMC than the arthrotics in all measured regions. For the rheumatoid women there were correlations between weight and BMC values in all regions (r 0.51–0.77, P 0.03–0.0001), except for the femoral neck. No such correlation was found among the arthrotic women.

In the 9 rheumatoids who used or had previously used steroid medication, the BMC of ROI 1 and ROI 2 were 73 and 75 percent, respectively, of the non-steroid-treated rheumatoids (P 0.017 and P 0.1, respectively). Corresponding figures for the proximal femur were: neck 82 percent, P 0.04, Ward's triangle 79 percent, P 0.03, trochanter 83 percent, ns and for the spine 89 percent, ns.

Discussion

The coxarthrosis patients had, as expected, higher BMC values in all measured regions as compared with the rheumatoids. The deficit in the rheumatoids had a fairly even distribution between the regions. This finding does not support the view of a relative peri-acetabular osteopenia in the rheumatoid hip, as has earlier been proposed (Larsen et al. 1977).

In relation to bone mineral normative data from the same background population (Karlsson et al. 1993), the arthrotic women had a 2–17 percent increase in BMC, with peak relative increase in the femoral neck. By contrast, the rheumatoids had a 3–26 percent decrease, with the largest deficit in the trochanter. Previous studies have shown patients with coxarthrosis to have larger BMC values in the upper limb (Roh et

al. 1974, Carlsson et al. 1979), as well as in the spine and pelvis (Gotfredsen et al. 1990). There has not previously, to our knowledge, been any measurements of the bone mass in the hip region in rheumatoid arthritis.

Since socket fixation in total hip replacement is probably dependent on the strength of the surrounding trabecular bone, the bone mineral content of the periacetabular region might be important for implant anchorage. Further support for this view is the correlation between low body weight in rheumatoid arthritis and socket migration, as measured by roentgen stereophotogrammetry (Önsten et al. 1993). In the present study, there was a correlation between body weight and BMC in the rheumatoid patients, as opposed to the arthrotic patients, where no such correlation was found. The comparably decreased bone mineral density in the periarticular region in rheumatoids might be a reason for the socket anchorage to fail under load, and thus be one explanation for the increased frequency of socket loosening in rheumatoid arthritis.

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