

Alterations in appendicular skeletal mass in patients with rheumatoid, psoriatic, and osteoarthropathy

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SUMMARY Appendicular bone mass was measured in a series of 50 patients with non-steroid treated rheumatoid arthritis, 20 with polyarticular seronegative psoriatic arthritis, and 30 with osteoarthritis, and compared with that of 40 controls of similar age and sex. Distal forearm bone mineral content was reduced in patients with rheumatoid and psoriatic arthritis and increased in those with osteoarthritis. The increase in bone mass in patients with osteoarthritis was confined to those with isolated large joint disease and was not found in those with primary generalised osteoarthritis.

Key words: rheumatoid arthritis, psoriatic arthritis, osteoporosis, bone mass, photon absorptiometry, osteoarthritis.

Several cross-sectional studies have shown that patients with rheumatoid arthritis have lower bone mass at various skeletal sites than controls of similar age and sex.¹⁻⁶ The severity, skeletal distribution, clinical importance, and cause of this generalised bone loss, however, remain controversial.⁷ Many techniques are now available for the non-invasive measurement of bone mass. As changes in bone mass differ at various skeletal sites⁸ it is important that information is obtained about alterations in both the axial and appendicular skeleton in rheumatoid arthritis. The assessment of skeletal status in other polyarthropathies is also relevant to our understanding of the osteoporosis which accompanies rheumatoid arthritis. We have therefore measured appendicular skeletal mass in a series of patients with rheumatoid arthritis, polyarticular seronegative psoriatic arthritis, and osteoarthritis and compared them with controls selected from the same district population.

Patients and methods

Bone mass was measured in 50 outpatients (nine men, 41 women) with classical rheumatoid arthritis

who had never been treated with steroids, 20 patients (11 men, nine women) with seronegative polyarticular psoriatic arthritis, with or without distal interphalangeal joint involvement, and 30 patients (seven men, 23 women) with osteoarthritis, 19 of whom fulfilled the criteria of Kellgren and Lawrence for primary generalised osteoarthritis,⁹ and 11 of whom had osteoarthritis of the hip. The results were compared with those from 40 control subjects (20 men, 20 women), selected from relatives visiting acutely admitted orthopaedic inpatients. None of them suffered from diseases associated with osteoporosis or were receiving drugs known to influence calcium metabolism.

Distal forearm bone mineral content (BMC) was measured in the non-dominant forearm by ¹²⁵I single photon absorptiometry (Molsgard BMA 1100). The scanning was performed rectilinearly with the first pass at the site where the radius and ulna are 8 mm apart, and five subsequent passes proximal to this at 4 mm intervals. This region has been shown histologically to have a cortical to trabecular ratio of 4:1.¹⁰ Bone mineral content was calculated as the mean of the six scans and expressed in arbitrary units (mass/unit length). In two patients with severe arthritis of the non-dominant wrist and five patients who regularly held a stick in their non-dominant hand the contralateral forearm was measured. The precision of the measurement

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method was assessed by measuring four volunteers on five successive occasions over a period of one month and gave a coefficient of variation of 1.4%. The method was less reproducible in patients with rheumatoid arthritis (coefficient of variation 3.7%), perhaps because laxity of the triangular ligament accompanies the disease, leading to variable separation of the radius and ulna.

Clinical and laboratory measurements undertaken at the time of study included estimation of Ritchie articular index, joint count and Westergren erythrocyte sedimentation rate (ESR).

Comparability of BMC values was achieved by converting each result to a percentage of the normal mean value for a subject of that age and sex. The normal ranges for men and women in Southampton had been previously constructed from BMC measurements in 120 healthy women and 40 healthy men in six decade age groups from 25 to 84 years, using the method of Christiansen and Rodbro.¹¹ Statistical analysis was performed with the non-paired *t* test; the Mann-Whitney test was used for small samples.

Results

Table 1 shows the composition of the study groups

by age, sex, and menopausal status. The rheumatoid and psoriatic groups were similar in respect of disease duration, joint count, articular index, and ESR (Table 2). No significant differences in age at

Table 1 Age, sex distribution, and menopausal status of study subjects

	Control	RA	PsA	OA
Number of subjects	40	50	20	30
Sex (M:F)	20:20	9:41	11:9	7:23
Age (mean (SD))	63 (12)	62 (13)	54 (12)	63 (15)
Pre-/postmenopausal	3:17	12:29	4:5	3:20

RA=non-steroid treated classical rheumatoid arthritis; PsA=sero-negative polyarticular psoriatic arthritis; and OA=osteoarthritis.

Table 2 Indices of disease duration and disease activity (median and range) in patients with rheumatoid and psoriatic arthritis

	Rheumatoid arthritis	Psoriatic arthritis
Duration of disease (years)	8 (1-32)	7 (1-12)
Joint count (No)	8 (3-15)	9 (4-14)
Ritchie articular index	14 (2-32)	12 (1-25)
ESR (mm/h)	25 (3-70)	23 (2-65)

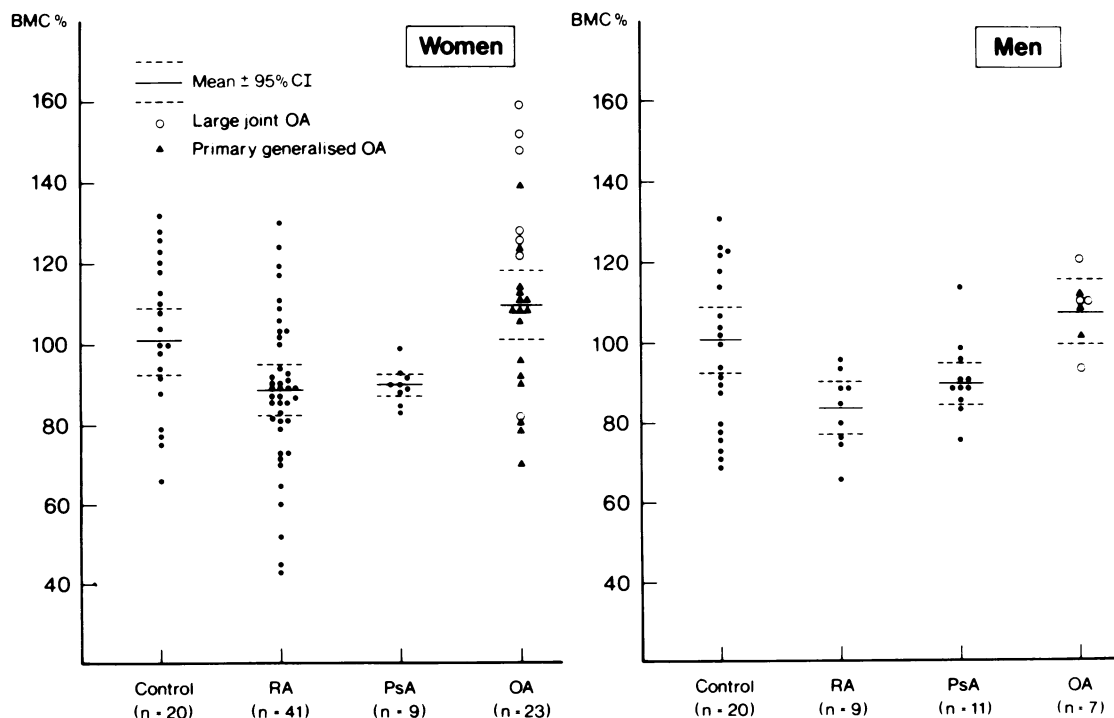


Fig. 1 Distal forearm bone mineral content (BMC) corrected for age and sex in patients with rheumatoid arthritis (RA), psoriatic arthritis (PsA), osteoarthritis (OA), and in controls.

menarche, parity, or age at menopause were found between women in the three disease groups.

Distal forearm BMC corrected for age and sex was significantly reduced ($p < 0.05$) in patients with rheumatoid arthritis and psoriatic arthritis (Fig. 1). Group mean values were reduced similarly in both men and women. BMC was raised ($p < 0.05$) in the patients with osteoarthritis. When the disease was categorised as primary generalised osteoarthritis or isolated large joint osteoarthritis the increase in bone mass was only found in the few patients with large joint disease (mean BMC % 122, SD 24), whereas those with primary generalised disease (mean BMC % 104, SD 16) did not differ significantly from the control group.

Discussion

The results of this study suggest that distal forearm BMC is reduced in patients with rheumatoid and psoriatic arthritis and increased in some patients with osteoarthritis when compared with healthy controls chosen from the same population. Studies of overall skeletal status in rheumatoid arthritis, using neutron activation analysis to assess total body calcium, have confirmed that osteoporosis is a complication of the disease, even in patients who have not received corticosteroids.^{1,2} The relative contribution of the axial and appendicular skeleton and of cortical and trabecular bone to this osteoporosis remains unclear, however. Early investigations of the axial skeleton in rheumatoid arthritis using radiographic methods suggested an association with vertebral osteoporosis,³ and dual photon absorptiometric measurements of lumbar spine BMC show this to be substantially reduced, irrespective of corticosteroid treatment.¹² A more recent study, however, using quantitative computer tomography to assess vertebral bone density reported only a small reduction in the bone mass of non-steroid treated patients.¹³ The results of appendicular bone measurements in the disease are also discrepant. Studies using metacarpal morphometry and radiographic densitometry in the distal radius have shown no, or small, reductions in the bone mass of non-steroid treated patients when compared with controls of similar age and sex.^{4,5} In contrast, a single study using single photon absorptiometry to measure forearm BMC showed a significant reduction in bone mass associated with the disease.⁶ Our results support this finding with a mean reduction in appendicular BMC from normal levels of 10 to 15%.

Appendicular measurements, particularly those made in the hands of patients with rheumatoid arthritis, are likely to be influenced by the juxta-

articular osteoporosis which is an early feature of the disease, and is mediated by local mechanisms. The distal forearm site adopted for this study, however, is less likely to be so affected and has been shown to correlate well with total body bone mineral in both healthy subjects and patients with rheumatoid arthritis.^{14,15}

The aetiology of the generalised osteoporosis which accompanies rheumatoid arthritis remains unknown but may be related to several factors, including the disease process, chronic treatment with drugs that affect bone metabolism, progressive immobility, poor nutrition, and altered vitamin D metabolism.⁷ Data on skeletal metabolism in rheumatoid arthritis are conflicting,¹⁶⁻¹⁸ with some studies suggesting an alteration in bone turnover as a specific manifestation of the rheumatoid disease process. Our observation of a reduction in appendicular bone mass in a group of patients with polyarticular psoriatic arthritis of similar disease duration and activity to those of the rheumatoid group indicates that osteoporosis may be a feature of inflammatory joint disorders other than rheumatoid arthritis. Possible causes include immobility and the metabolic consequences of widespread inflammation.

Little information is available on the bone mass of patients with psoriatic arthritis. Juxta-articular osteoporosis is a well recognised radiological feature of the disease,¹⁹ but in the only published cross-sectional study total and appendicular bone mass (assessed by neutron activation analysis and metacarpal morphometry respectively) in 12 patients with psoriatic arthritis did not differ significantly from those of controls.²⁰ The patients studied suffered from less active disease than those in our series, however, and included some individuals with oligoarticular disease. Furthermore, the numbers investigated were small and different methods of assessing appendicular bone mass were used in the two studies.

The relation between osteoporosis and osteoarthritis remains to be clarified. Cases with vertebral crush or proximal femoral fractures have a significantly lower prevalence of osteoarthritis than expected.²¹ The results of studies of bone mass in patients with osteoarthritis have been conflicting, however. Two studies of the appendicular skeleton in primary osteoarthritis using metacarpal morphometry, single photon absorptiometry, and computed tomography have suggested greater bone mass in patients than in healthy controls of similar age.^{22,23} Similar studies of forearm BMC in osteoarthritis have failed to confirm this observation.^{24,25} They are supported by measurements of total body calcium and histomorphometric studies in patients

with primary generalised osteoarthritis.^{26, 27} Some of these discrepancies may relate to the use of varying diagnostic criteria for osteoarthritis. In our study no significant increase in bone mass was detectable in the patients with primary generalised osteoarthritis, the overall increase in the group with osteoarthritis arising almost entirely from the subgroup of patients with isolated large joint disease. These findings must be interpreted with caution for two reasons. Firstly, separation into two categories of osteoarthritis results in smaller numbers for comparison in each group. Secondly, the bone mass values in our study were not corrected for skeletal size. In a recent study an apparent increase in bone mass in a group of patients with osteoarthritis disappeared after allowance for weight and height.²⁸

In conclusion, our results suggest that appendicular bone mass measured by single photon absorptiometry in the distal forearm is reduced in non-steroid treated patients with rheumatoid arthritis. The finding that such bone loss is also a feature of polyarticular psoriatic arthritis lends support to the view that a substantial contribution to the generalised osteoporosis which accompanies rheumatoid arthritis is made by lifestyle factors, such as immobility, although a humoral factor which alters skeletal metabolism in inflammatory joint diseases remains a possibility. Appendicular bone mass in patients with osteoarthritis requires further study; our results suggest that patients with isolated large joint disease have a higher bone mass than expected for their age and sex while those with primary generalised osteoarthritis do not.

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