WRIST INVOLVEMENT IN HANSEN'S DISEASE

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We performed a neurological and radiological study of the wrists of 58 patients with Hansen's disease and 60 age-matched healthy control subjects. Significant differences ($p < 0.01$) were found between the groups in the carpal glenoid sector, the radial physeal widening index, the carpal ulnar distance, the carpal index and in distal radio-ulnar discrepancy.

Comparison of the results in three subgroups of leprosy patients with sensory impairment (group A-1), motor deficit (A-2) and no neurological impairment (A-3), showed significant differences ($p < 0.01$) between group A-1 and the other two. This suggests that in these patients the changes in the carpus and radiocarpal joint may be caused by neuropathic arthropathy of the wrist.

Our findings are of particular interest since there are few reports of neuropathic arthropathy in non-weight-bearing joints.

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Leprosy or Hansen's disease is less widespread than some years ago, but continues to give rise to bone and joint lesions which may ultimately become crippling.¹ There have been many reports of such lesions, most of which have exclusively addressed weight-bearing joints, with very few on the wrist.²⁻⁴ Our study was prompted by our

awareness that a number of patients with no motor impairment of the nerves of the hand had impaired wrist movement.

PATIENTS AND METHODS

We studied 116 wrists of 58 randomly-selected patients with Hansen's disease. There were 40 men and 18 women with a mean age of 47.5 years (38 to 67). Of these, 25 had lepromatous, 24 tuberculoid and 9 borderline lesions. The mean duration of the disease was 14.3 years (8 to 20). Patients with a history of wrist or carpal injury were excluded.

All had a full neurological examination. Sensory impairment was evaluated by measurement of two-point sensory discrimination in a digit; 4 mm or less was considered normal and greater than 4 mm abnormal.⁵ The degree of motor dysfunction was also assessed. The presence of an intrinsic minus finger, defined as hyperextension of the metacarpophalangeal joints and flexion of the proximal and distal interphalangeal joints of the ring or little finger, indicated motor impairment of the ulnar nerve. Thenar paralysis, with loss of opposition of the thumb to the ring finger, indicated motor loss in the median nerve.⁶

The patients were divided into three groups as follows: A-1 with sensory impairment only; A-2 with both sensory impairment and motor dysfunction; and A-3 with neither sensory nor motor loss.

A standard anteroposterior radiograph of both wrists was taken for each patient, and the following measurements were made in the neutral position:

- 1) The carpal glenoid sector which is the arc formed by the distal end of the radius and the ulna, articulating with the first row of carpal bones (Fig. 1, arc AC).
- 2) The radial physeal widening index which is the ratio of that proportion of the circumference representing the radius of the previous measurement, taking a point B where the secant passing through the sigmoid cavity of the radius intersects with the circumference (Fig. 1, arc AB/arc AC $\times$ 100).
- 3) The carpal index which is the ratio of the carpal height to the distance from the distal articular surface of the radius to the head of the third metacarpal (Fig. 1, ratio ab/ac).
- 4) The carpal ulnar distance which is the distance in millimetres from the prolongation of the ulnar axis to the

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Fig. 1

Diagram showing the measurements made on the radiographs.

Fig. 2

Measurement of the distal radio-ulnar discrepancy (ulnar variance).

axis of rotation of the carpus (Fig. 1, d-d').

5) The covered length of the lunate, which is the percentage of the os lunatum lying beneath the radius.

6) The distal radio-ulnar discrepancy which is the distance from the radius to the ulna in millimetres (Fig. 2).^{7,8}

The presence of changes such as joint deformity and bone cysts, which may be seen in neuropathic joints, was also noted.²

The same measurements were made on radiographs of the wrists of 60 age-matched control patients (group B) which had been taken during the investigation of other wrist or hand problems.

The measurements were made by an independent radiologist who did not know to which group the patients belonged. They were analysed and correlated using a statistical package (SPSSPC+; SPSS Inc, Chicago, Illinois). *P* values of <0.05 were considered significant.

RESULTS

Table I gives the measurements obtained for groups A and B. There were significant differences between them. In group A neurological examination showed impairment of digit two-point sensory discrimination in 42 patients, of whom 11 (26.19%) also showed motor dysfunction with abnormality restricted to the ulnar nerve in three (7.1%) and to the median and ulnar nerves in eight (19%). In this latter group only the left wrist was affected in two patients. The radial nerve was never affected nor the median nerve alone. In the remaining 16 patients neither sensory impairment nor motor dysfunction was observed.

Table II shows the radiological measurements in groups A-1, A-2 and A-3. A lateral radial boss (Fig. 3) was found in 28 wrists in group A (22 in A-1, 4 in A-2 and 2 in A-3) compared with four in group B; 30 bone cysts (Fig. 4) were observed in group A (20 in A-1, 7 in A-2 and 3 in A-3) compared with three in the control group. Comparison of the results for the different subgroups of patients with Hanson's disease (A-1, A-2 and A-3; Table II) showed significant differences between group A-1 and group A-3 for all measurements and for the presence of a lateral radial boss and bone cysts. Significant differences were also

Table I. Comparison of measurements (mean $\pm$ SD) and radiological findings in the patients with leprosy and in the control group

	Group A (n = 58)	Group B (n = 60)	p value
Carpal glenoid sector	70.84 $\pm$ 16.35	100.11 $\pm$ 13.68	<0.01
Radial physal widening index	81.74 $\pm$ 5.54	75.86 $\pm$ 5.69	<0.01
Carpal index	0.74 $\pm$ 0.45	0.53 $\pm$ 0.04	<0.01
Carpal ulnar distance	20.16 $\pm$ 3.25	17.54 $\pm$ 3.29	<0.01
Covered length of lunate	95.47 $\pm$ 3.71	82.57 $\pm$ 17.54	<0.01
Distal radio-ulnar discrepancy	2.26 $\pm$ 1.84	0.8 $\pm$ 1.37	<0.01
Bone cysts	30	3	<0.01
Lateral radial boss	28	4	<0.01

Table II. Comparison of radiological measurements (mean $\pm$ sd) for groups A-1, A-2 and A-3 (see text)

	Group A-1 (n = 31)	Group A-2 (n = 11)	Group A-3 (n = 16)	p value
Carpal glenoid sector	63.2 $\pm$ 12.74	67.6 $\pm$ 10.2	91.4 $\pm$ 9.95	A-1/A-2, >0.05NS A-1/A-3, <0.01 A-2/A-3, <0.01
Radial physeal widening index	84.5 $\pm$ 4.03	80.8 $\pm$ 5.21	75 $\pm$ 3.62	A-1/A-2, <0.01 A-1/A-3, <0.01 A-2/A-3, >0.05NS
Carpal index	0.76 $\pm$ 0.03	0.51 $\pm$ 0.04	0.53 $\pm$ 0.03	A-1/A-2, <0.01 A-1/A-3, <0.01 A-2/A-3, <0.01
Carpal ulnar distance	22.21 $\pm$ 1.98	18.7 $\pm$ 3.93	17.2 $\pm$ 1.95	A-1/A-2, <0.01 A-1/A-3, <0.01 A-2/A-3, >0.05NS
Covered length of lunate	98.5 $\pm$ 3.53	90.7 $\pm$ 15.61	90 $\pm$ 13.62	A-1/A-2, >0.05NS A-1/A-3, <0.01 A-2/A-3, <0.01
Distal radio-ulnar discrepancy	3.47 $\pm$ 1.5	1.64 $\pm$ 1.7	0.6 $\pm$ 0.61	A-1/A-2, <0.01 A-1/A-3, <0.01 A-2/A-3, >0.05NS
Bone cysts	20	7	3	A-1/A-2, >0.05NS A-1/A-3, <0.01 A-2/A-3, >0.05NS
Lateral radial boss	22	4	2	A-1/A-2, <0.01 A-1/A-3, <0.01 A-2/A-3, >0.05NS

Fig. 3

Radiograph showing widening of the distal radial epiphysis, with a lateral radial boss and a subchondral bone cyst.

Fig. 4

Subchondral bone cysts in the scaphoid and in the radial epiphysis.

recorded between group A-1 and group A-2 for all measurements except the covered length of the lunate, the carpal glenoid sector, and the presence of subchondral bone cysts. Between groups A-2 and A-3, significant differences were found only for the carpal glenoid sector, the carpal index and covered length of lunate.

DISCUSSION

Almost all studies on neurogenic arthropathy have been concerned with the leg since its joints bear considerable

loading and alterations in structure are more evident. Consequently, there are few published studies of Charcot joints in the arm and more particularly in the wrist.²⁻⁴ Non-weight-bearing joints may be affected in neurogenic arthropathies, but there is less degree of involvement. The wrist is subject to considerable mechanical stress, particularly in gripping, which may be sufficient to cause micro-injuries in a joint with impaired sensibility. The clinical and radiological changes may be less obvious than in the leg, but they are functionally significant and therefore of interest.

Fig. 5

Lengthening of the ulna relative to the radius, widening of the distal radial epiphysis and radial displacement of the carpus.

We have observed changes in the carpus and in the radiocarpal joint in patients with Hansen's disease. These were more marked in patients with only sensory impairment than in those who also had motor dysfunction. No changes were found in patients with normal sensibility.

Widening of the epiphysis and metaphysis of the distal radius, evident on the radiographs as a lateral radial boss, increased carpal index and relative shortening of the radius with respect to the ulna, are considered secondary to the pressure exerted by the carpus on the radius when gripping in a joint displaying impaired proprioceptive sensibility.⁹ This accounts for the differences observed between patients presenting with only sensory impairment and those with motor dysfunction, since the latter cannot close the fist normally. Moreover, in patients with impaired sensation the

grip is tightened more than normal to ensure that objects do not fall from the hand, leading to greater pressure on the carpus.¹⁰ These changes were not seen in patients with leprosy but without neurological impairment, suggesting that they are secondary to the sensory changes rather than due directly to the disease itself.

The decrease in the carpal glenoid sector and the increase in the radius-carpus distance and the covered length of the lunate, are secondary to the widening and collapse of the distal radius with consequent modification of the relative lengths of the radius and the ulna, leading to displacement of the entire carpus towards the radial side (Fig. 5). Carpal bone cysts may result from increased pressure on the carpal bones, as found in osteoarthritis,¹¹ and are thus more common in patients with sensory impairment. Indeed, in patients in whom motor dysfunction had affected only one hand, the radiological changes were much more evident in the wrist with sensory impairment only (Fig. 6).

We did not observe lunate collapse or scaphoid nonunion as has been previously described by Nagano et al.² This is probably because the patients in their series had had leprosy for a mean of 42.3 years, compared with the mean duration of 14.3 years in our patients. Thus, the greater duration of pressure on the carpus may have led to collapse of the lunate and more extensive involvement of other carpal bones.

We conclude that the radiocarpal joint may be affected by neurogenic arthropathy in patients in whom leprosy has led to sensory impairment. The clinical and radiological symptoms, however, may be less marked than in joints subjected to greater mechanical stress. We feel that our findings may be of interest in the prevention and treatment of neuroarthropathic disorders of the wrist; such changes are caused by mechanical overload due to clenching of the hand in patients with impaired sensibility. These patients may benefit from the use of adaptative aids fitted to com-

Fig. 6

Radiograph of both wrists of a patient with sensory impairment in the right hand and motor dysfunction in the left.

mon items of daily use, thus preventing complete closure of the hand and therefore overload on the surgery and wrist. Where wrist impairment already exists, surgery to shorten the ulna may be of value in restoring normal wrist anatomy as far as possible.

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