DESTRUCTIVE SPONDYLO-ARTHROPATHY DURING LONG-TERM HAEMODIALYSIS

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We reviewed 29 patients who had developed destructive arthropathy of the spine during long-term haemodialysis. Their mean age when haemodialysis began was 43.8 years; at diagnosis they had been dialysed for an average of 8.6 years. In 26 patients, the lesions were between C4 and C7; in six they were between L4 and S1, three having lesions in both regions. Sixteen patients had had previous surgery for carpal tunnel syndrome.

Spinal surgery was performed in nine patients with satisfactory results in only five. We demonstrated \( \beta-2 \) microglobulin amyloid deposits in the discs and surrounding ligaments in all biopsied cases. The natural history and management of this condition are not yet clear.

The most common orthopaedic problems in patients undergoing long-term haemodialysis are carpal tunnel syndrome and amyloid arthropathy presenting as chronic mono-articular or pauci-articular synovitis, which may lead to destructive arthritis and osteolytic lesions. Recent reports have ascribed these lesions to the deposition of \( \beta-2 \) microglobulin amyloid in the transverse carpal ligament and in juxta-articular bone (Fenves et al 1986; Bardin et al 1987).

The syndrome of destructive arthropathy of the spine has recently been reported; it is characterised by erosions of the discs and vertebrae and marked reduction of the disc space without significant osteophytes (Kuntz et al 1984). Biopsy specimens have shown various possible causative agents including hydroxyapatite or calcium pyrophosphate dihydrate crystals (Kuntz et al 1984; Kaplan et al 1987), but amyloid deposits now appear to be the most likely cause (Naidich et al 1988). It has been reported that, in severe cases, the spinal canal may be compromised, with resultant cord compression (Sebert et al 1986; Deramond et al 1987; Fiocchi et al 1989).

These patients may eventually need surgical decompression of the cord and spinal stabilisation.

We could find no previous studies with adequate length of follow-up of the results of the operative treatment of destructive spondylo-arthropathy in such patients. We have therefore reviewed 29 patients with this condition during long-term haemodialysis, and present the results of operative treatment in nine of them.

PATIENTS AND METHODS

We reviewed retrospectively the records of 83 patients undergoing haemodialysis who had been seen at the Department of Orthopaedic Surgery in Saiseikai Yahata Hospital from August 1985 to May 1990. All these patients had had clinical symptoms in the spine, varying from mild root pain to severe neuralgia. In 29 a radiological diagnosis of destructive spondylo-arthropathy had been made (Fig. 1) on the basis of severe narrowing of an intervertebral disc, erosions and irregularities of the adjacent vertebral plates, and the absence of significant osteophytes (Kuntz et al 1984). There were 12 men with a mean age at the time of diagnosis of 56.3 years (41 to 69) and 17 women with a mean age of 58.4 years (46 to 73). Haemodialysis had started at a mean age of 43.8 years (29 to 63). They had been on haemodialysis for a mean of 8.5 years. Non-contrast CT scans had been performed in nine patients and MRI in eight. Fifteen of the 29 patients had had radiographic examination of hands, wrists, shoulders, and hips.

Eighteen of the 29 patients had had mild to severe neuralgia which had not responded to conservative treatment, and after myelographic examination nine of
these had had operative treatment by the senior author (MN) during which specimens for pathological studies had been collected from the anterior and posterior longitudinal ligaments of the spine, the ligamentum flavum and the intervertebral discs. Paraffin-embedded sections had been stained with haematoxylin and eosin or Congo Red, and examined by conventional and polarised-light microscopy. Immunohistochemical studies had been performed on formalin-fixed paraffin sections using an avidin-biotin complex staining method (Hsu, Raine and Fanger 1981).

We assessed the results of operative treatment, placing them in one of four categories (Robinson et al 1962; White et al 1973): excellent relief of all pre-operative symptoms, with abnormal signs unchanged or improved; good, minimal persistence of pre-operative symptoms; fair, definite relief of some pre-operative symptoms while others remained unchanged (for ex-

Destructive spondylo-arthropathy at C5-C6 in a 58-year-old man after 17 years on haemodialysis. The lateral radiograph (a) shows disc destruction, and an axial CT scan (b) shows irregular destruction and defects in the vertebral body.

The lateral radiographs (a,b) show spondylo-arthritis at C5-C6 and spondylolisthesis of C6. MRI (c) shows narrowing and sharp bending of the spinal cord at C6-C7. The patient refused operative decompression and eventually died from pneumonia with complete paraplegia.
ample, relief of arm pain but persisting neck pain); and poor, unchanged or worse symptoms and signs.

Follow-up in the nine operated patients ranged from three months to five years two months, averaging two years and ten months.

RESULTS

The radiographic appearances resembled those of infective spondylitis, but there was no clinical or laboratory evidence of infection in any of the patients. In 26 of the 29 patients, the lesions were from C4-C7 in the cervical spine; six patients had involvement of more than one disc level. In three of these 26 patients, there was spondylolisthesis at the level just below the destroyed segment (Fig. 2). Lumbar spine lesions between L3 and S1 were seen in six patients (Fig. 3), three of them also having cervical lesions.

Axial CT scans showed irregular destruction of the adjacent vertebral plates, with radiolucent defects of variable size and no evidence of a prevertebral mass (see Fig. 1). MRI revealed disc narrowing at affected levels, with decreased T1-weighted signal intensity in the disc and adjacent vertebral end plates (Fig. 3b). There were no areas of high signal intensity on T2-weighted sequences which would have suggested the presence of infection or inflammation: the affected disc was of low signal intensity on all imaging sequences. In ten of the 15
patients who had had a radiographic survey, cystic bone lesions were found in the wrist, shoulder, or hip regions (Fig. 3c).

Sixteen of the 29 patients had had previous surgery for carpal tunnel syndrome, 13 with bilateral involvement. Four of these had had no benefit from decompression.

Of the 18 patients who had had myelograms, seven had a normal dural tube. There was a complete block at the involved segment in three patients (Fig. 4), with incomplete blocks at several segments, including the involved disc, in the other eight. Clinical myelopathy, radiculopathy or both was evident in nine of the 11 patients with myelographic filling defects, and all of these had had operative treatment (Table I).

The average time from starting haemodialysis to the onset of spinal symptoms was 12.3 years (7.0 to 19.3), and the average age at the time of surgery was 57.3 years (52 to 63). Three patients had had anterior cervical fusions, two decompressive laminaplasties and four simple lumbar laminectomies.

Biopsy specimens had been taken in seven patients; all showed amyloid deposits which reacted with anti-\( \beta \)-2 microglobulin antiserum (Fig. 5). No deposits reacted with antibodies to AA protein, pre-albumin, or immunoglobulins.

At an average follow-up of two years ten months, five of the nine operated patients had good clinical results, two had fair and two poor. There was a dural tear during lumbar laminectomy in one patient leading to meningitis and death 46 days after the operation. The other patient with a poor result continued to have severe neuralgia despite solid bony fusion.

### DISCUSSION

Distinction between destructive spondylo-arthropathy and infective spondylitis may be difficult: the characteristic findings of discovertebral changes on plain radiographs and CT scans are similar. MRI may be helpful. Rafto et al (1988) reported that the intervertebral disc had a low signal intensity in destructive spondyloarthritis on both T1- and T2-weighted images, in contrast to a high signal intensity on T2-weighted images in infective spondylitis. We had similar results, with low signal intensities on both T1- and T2-weighted images in destructive spondylo-arthritis.

Both carpal tunnel syndrome and amyloid arthropathy have been reported to be frequent in haemodialysis patients and to increase with the duration of dialysis (Bardin et al 1987; Hardouin et al 1987; Naito, Ogata and Goya 1987). The role of \( \beta \)-2 microglobulin is recognised in these complications (Gejyo et al 1986). Our own and other studies have shown amyloid deposits within the disc and peridiscal ligaments, suggesting that

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**Table I. Details of nine patients on haemodialysis for chronic glomerulonephritis who had operations for destructive spondylo-arthropathy**

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Duration of haemodialysis (yr m)</th>
<th>Amyloid arthropathy</th>
<th>Carpal tunnel syndrome</th>
<th>Age at onset of symptoms (yr m)</th>
<th>Age at operation (yr m)</th>
<th>Operation</th>
<th>Follow-up (yr m)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>10 1</td>
<td>Yes</td>
<td>Bilateral</td>
<td>55 8</td>
<td>56 9</td>
<td>Laminectomy (L4-L5)</td>
<td>5 2</td>
<td>Fair</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>8 6</td>
<td>Yes</td>
<td>None</td>
<td>63 1</td>
<td>63 7</td>
<td>Anterior fusion (C3-C5)</td>
<td>4 2</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>7 9</td>
<td>No</td>
<td>Right</td>
<td>60 5</td>
<td>61 4</td>
<td>Laminectomy (L4-L5)</td>
<td>2</td>
<td>Died</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>7 0</td>
<td>No</td>
<td>None</td>
<td>52 0</td>
<td>52 1</td>
<td>Laminaplasty (C3-C7)</td>
<td>3 6</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>16 2</td>
<td>Yes</td>
<td>Bilateral</td>
<td>53 11</td>
<td>54 6</td>
<td>Anterior fusion (C4-C6)</td>
<td>2 9</td>
<td>Good</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>13 4</td>
<td>Yes</td>
<td>Bilateral</td>
<td>50 4</td>
<td>53 5</td>
<td>Anterior fusion (C5-C6)</td>
<td>2 6</td>
<td>Poor</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>13 4</td>
<td>Yes</td>
<td>Bilateral</td>
<td>58 6</td>
<td>59 3</td>
<td>Laminectomy (L4-L5)</td>
<td>1 11</td>
<td>Fair</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>19 3</td>
<td>Yes</td>
<td>Bilateral</td>
<td>51 8</td>
<td>53 11</td>
<td>Laminaplasty (C2-C7)</td>
<td>1 3</td>
<td>Good</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>15 4</td>
<td>Yes</td>
<td>Bilateral</td>
<td>60 0</td>
<td>60 6</td>
<td>Laminectomy (L3-L5)</td>
<td>1 1</td>
<td>Good</td>
</tr>
</tbody>
</table>
the pathogenesis of destructive spondylo-arthritis is similar (Sebert et al 1986; Deramond et al 1987), while Blumberg and Bürgi (1987) have shown a positive correlation between levels of β-2 microglobulin and the duration of dialysis. Such amyloid deposits in the vertebral body and disc may damage structural integrity and lead to erosive destruction of the spinal segment. Mechanical factors also seem to be important, since the most mobile segments of both the cervical and lumbar spine are predominantly affected (Kuntz et al 1984; Deramond et al 1987; Naidich et al 1988; Rafto et al 1988; Fiocchi et al 1989). It appears that physiological movement cannot be tolerated at the damaged levels.

It is suggested that proximal compression may lessen the resistance of a nerve to additional, more distal compression (Upton and McComas 1973). Hurst, Weissberg and Carroll (1985) reported that this 'double-crush' syndrome predisposed to bilateral carpal tunnel syndrome. In our series, four of 13 patients (31%) with spondylo-arthritis had derived no benefit from carpal tunnel release for bilateral symptoms. These results are poor compared with those of our earlier study, in which only two of 45 (4%) haemodialysis patients failed to benefit from operation for isolated carpal tunnel syndrome (Naito et al 1987). Both Hurst et al (1985) and Osterman (1988) have described less satisfactory results in patients with both carpal tunnel syndrome and cervical disorder than in carpal tunnel syndrome with no cervical involvement.

As yet, there is little knowledge of the natural history of this recently recognised complication, and no effective plan for its treatment. Attempts to ameliorate clinical symptoms and reconstruct the spine have been only partly successful. In our series, followed up for under three years, we had no excellent results, and good results in only five of the nine operated patients. One patient died from an operative complication and another continued to have severe pain.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


