ANTERIOR DECOMPRESSION FOR MYELOPATHY RESULTING FROM OSSIFICATION OF THE POSTERIOR LONGITUDINAL LIGAMENT

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In this series, 15 patients with ossification of the posterior longitudinal ligament underwent anterior decompression to relieve moderate or severe myelopathy, which in 11 included urinary disturbance. The operation consisted of partial resection of the vertebrae, release of the ossified plaque from the surrounding tissue and the insertion of an iliac bone graft. The extent of ossification was confirmed by computerised tomography before and after operation. The plaque was completely detached and moved forward in half of the patients, but only partially moved in the remainder. Symptoms improved considerably. Urinary disturbance disappeared in all patients, but sensory disturbance was left in most. Two patients had prolonged symptoms which were not relieved despite the complete release of the ossified defect.

Ossification of the posterior longitudinal ligament is relatively common in Japan (Onji et al. 1967; Nagashima 1972; Ono et al. 1977; Tsuyama et al. 1981). The symptoms of this disease could be caused by compression of the spinal cord and the nerve root by the ossified plaque. They include numbness of the upper extremities, weakness of the lower limbs, disturbance of sensation throughout the body, limitation of the fine movement of the fingers, and urinary and bowel symptoms. These symptoms vary from moderate to severe, depending on the size of the ossified area within the spinal canal. The ossification plaque usually grows very slowly, so the patients are seldom aware of the symptoms until the process is well advanced.

Ossification is of four types: segmental, continuous, combined, or circumscribed. The site of ossification varies considerably; although it mainly occurs in the cervical region, in a few cases it occurs in the thoracic and lumbar regions. In the cervical region, plaques may be found at every level except C1, the most common place being between C3 and C6.

In the management of ossification of the posterior longitudinal ligament, conservative treatment is the first choice. A cervical collar, or continuous traction of the neck, is sometimes very effective for relieving the symptoms. For patients who cannot be managed conservatively, there is a choice of two operative procedures: posterior decompression or anterior decompression. The posterior decompression was developed by Kirita (1972). To avoid dangerous swelling of the dura, he used an air-tome to decorticate the entire lamina which covered the lesion so as to make it thin enough to be cut off with scissors. In this way the laminectomy could be carried out within a few moments. Anterior decompression consists of hemi-vertebrotomy of the vertebrae to which the plaque adheres, and then releasing or resecting the ossified ligament, followed by iliac bone grafting (Sakou and Tomimura 1976; Yamura et al. 1976). In this series, the latter procedure was performed.

MATERIAL AND METHOD

Between 1976 and 1980 anterior decompression was performed on 15 patients, three women and 12 men, whose ages ranged from 42 to 66 years. All 15 patients had weakness and numbness of the arms or legs and pain in the neck or arms; 11 had urinary or intestinal symptoms. Eleven could not walk when admitted to the University Hospital. Two patients had a history of trauma and their symptoms dated from that injury. Nine patients were operated on within one year from the onset of symptoms, a further four within two years, and two patients between two and three years from onset. The
Ossification of the posterior longitudinal ligament was confirmed with lateral tomography and computerised tomography. The ossification was classified as segmented in seven patients, continuous in three and combined in five. The length of the defect varied from one to five vertebrae but was most commonly two (four patients) or four vertebrae (five patients). The stenosis ratio of the spinal canal was calculated on the lateral tomogram (Fig. 1): it ranged from 38 to 65 per cent.

Operative technique. The patient is placed supine with the neck slightly rotated towards the right. The anterior cervical spine is approached using Cloward's procedure. A radiograph is taken to confirm which vertebrae are to be operated on and then, with a Cloward's drill, small holes are made at two or three disc levels. The spaces between these holes are resected with a bone rongeur and the remaining vertebral bone is shaved with the air-tome. An operative microscope is used for the rest of the operation. If the margin of the ossified area is not clear, it may be necessary to confirm it by radiography before detaching it carefully from the vertebral body. It is very difficult to shave the vertebral bone from the edge of the lesion which sometimes adheres tightly to the dura. Once detached, the plaque becomes movable and floats in the centre of the new cavity, like an island. The length of the vertebral resection depends on the size of the plaque. Usually it starts at one vertebra proximal to the block shown on the myelogram and finishes at one vertebra distal to the block. The width of vertebral resection is about 1.5 centimetres, but in some cases a wider resection will be needed to release the plaque. After the release a T-shaped piece of iliac bone is grafted onto the resected vertebral bodies (Figs 2 and 3).

Fig. 1
Diagram to illustrate the calculation of the stenosis ratio. In the sagittal plane the percentage of stenosis is
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\frac{O}{A} \times 100.
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Fig. 2
Anterior view. Figure 3—Lateral view.

Fig. 3
Schematic drawing of the anterior decompression. Figure 2

Fig. 4
Fig. 5
Fig. 6
Figure 4—The sagittal tomogram showing the area of ossification extending from the upper border of C3 to the upper border of C5. Figure 5—The CT scan at the level of C4 showing the ossification plaque very clearly. Figure 6—The CT scan after the operation.
After the operation, the patient is kept supine with the head immobilised in a neutral position for about four to six weeks. The patient is then permitted to walk with a rigid cervical brace, which is worn for about six months.

ILLUSTRATIVE CASE REPORT
A man aged 55 years presented to the Nagoya City University Hospital in June 1977 suffering from a disabling gait and urinary disturbance. In August 1976 he had begun to notice progressive weakness of all four limbs. On examination, cutaneous sensibility was impaired below the level of the fourth cervical dermatome, and more distally. All tendon reflexes were exaggerated and pathological reflexes were observed in both arms and legs. Plain radiographs showed ossification of the posterior longitudinal ligament at the level of C3 to C5; sagittal tomography clearly showed an appearance like a stick; and computerised tomography showed an oval outline to the ossified area (Figs 4 and 5). The stenosis ratio was 55 per cent in the sagittal plane. Myelograms showed complete blocks at the level of C3 from proximal puncture and at the level of C6 from distal puncture.

Anterior decompression was carried out from C3 to C6. The CT scan then clearly demonstrated that the plaque had moved forward (Fig. 6). The stenosis ratio in the sagittal plane had been reduced to five per cent and the patient's symptoms rapidly improved.

RESULTS
Table I shows the area of operation and the results in the 15 patients. The most common area was C4 to C7 which was operated on in five patients. The length of resection was four vertebrae in seven patients, three vertebrae in six and two vertebrae in two. The forward movement of the plaque gave complete decompression in eight patients, but in seven patients it was not complete (Fig. 7).

Clinical results were excellent in one patient and good in eight, who only had minimal complaints. Muscle weakness improved in 13 patients; sensory disturbance remained in 12. Spastic gait remained in four patients, whose results were graded as fair: they were unable to work but able to walk without aid. Urinary disturbance was relieved in all cases. In two patients the results were evaluated as poor: one had a history of trauma and the other had suffered symptoms for three years before operation. In both these patients anterior decompression was relatively complete, but their symptoms became worse gradually after the operation. In all patients the stenosis ratio was calculated before and after the

Table I. Clinical details and operative results for the 15 patients

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Length of ossification plaque</th>
<th>Type of myelopathy</th>
<th>Urinary symptoms</th>
<th>Area of operation</th>
<th>Stenosis ratio (per cent)</th>
<th>Results</th>
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<tr>
<td>1</td>
<td>59</td>
<td>M</td>
<td>C2-C6</td>
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<td>+</td>
<td>C3-C5</td>
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<td>+</td>
<td>C5-C6</td>
<td>52</td>
<td>15 Fair</td>
</tr>
<tr>
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<td>M</td>
<td>C3-C5</td>
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<td>C3-C5</td>
<td>54</td>
<td>17 Good</td>
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<tr>
<td>4</td>
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<td>C5</td>
<td>Brown-Séquard</td>
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<tr>
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<td>Brown-Séquard</td>
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<td>48</td>
<td>18 Fair</td>
</tr>
<tr>
<td>6</td>
<td>53</td>
<td>M</td>
<td>C4-C5</td>
<td>Transverse</td>
<td>+</td>
<td>C4-C6</td>
<td>45</td>
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<tr>
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<td>Transverse</td>
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<td>C4-C7</td>
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<td>12 Fair</td>
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<tr>
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<td>F</td>
<td>C5</td>
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<td>C4-C5</td>
<td>46</td>
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<tr>
<td>9</td>
<td>55</td>
<td>M</td>
<td>C3-C5</td>
<td>Transverse</td>
<td>-</td>
<td>C3-C6</td>
<td>55</td>
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<tr>
<td>10</td>
<td>66</td>
<td>M</td>
<td>C4-C7</td>
<td>Transverse</td>
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<td>C4-C7</td>
<td>40</td>
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</tr>
<tr>
<td>11</td>
<td>55</td>
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<td>C6</td>
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<td>43</td>
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<td>59</td>
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<td>10 Good</td>
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operation: in eight it was reduced to under 15 per cent. Complications. Operative complications occurred in three patients. In one (Case 1) the upper two centimetres of the iliac graft became detached from the vertebræ as a result of slight body movement two days after the operation. At a further operation, carried out the next day, the corners of the resected vertebræ were reshaped to conform to the iliac bone. In another patient (Case 3) the shaving of the vertebræ went too deep, tearing the dura, and cerebrospinal fluid was seen in the operation field. After the operation, the patient’s right arm was paralysed. Three weeks after the operation, he could start to move his arm and three months later the neurological symptoms had disappeared except for a slight cutaneous disturbance in sensibility. In this case, resection of the vertebræ might have affected the spinal cord function. In the third patient (Case 9) severe laryngeal pain occurred one day after the operation, and continued for three weeks. It then lessened and finally disappeared two months after the operation. This symptom might have resulted from the length of the operation time, which in this case was six hours.

DISCUSSION

Ossification of the posterior longitudinal ligament in the cervical region gives rise to myelopathy and radiculopathy, symptoms varying considerably according to the amount of ossification that has occurred within the spinal canal. The stenosis ratio of the spinal canal has been accepted as an indicator of the severity of the disease: marked symptoms occur if the stenosis ratio exceeds 40 per cent in the sagittal plane or 30 per cent in the axial plane (Hanai, Adachi and Ogasawara 1977). Because of the slow progression of this disease, its management is difficult. Although conservative treatment is sometimes very effective, there are cases for which operative therapy is needed.

Posterior decompression laminectomy is used for the case which has a long area of ossification and a long defect on the myelogram. The laminectomy covers the length of at least four laminae and it may extend to six, and its width is sometimes extended to just inside the facet joint. This long and wide laminectomy could be a cause of spinal deformity, with neurological symptoms occurring several years after the operation.

The anterior decompression is used for the case that has a relatively short ossified area. Total resection of the plaque has been tried by some authors, who consider its removal to be vital. But in our clinic we only release it.

Although the decompression was incomplete in half of our patients, their symptoms were considerably reduced shortly after the operations, which seemed to demonstrate that partial decompression was useful. There is a limitation to this procedure, however. The upper border of vertebral resection is C3 and the lower border is C7. So, in the case of a large plaque at C2 or T1, anterior decompression would not be possible. The length of the vertebral resection and accompanying decompression is also limited by the maximal size of the iliac bone graft and is therefore restricted to four vertebræ.

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REFERENCES


