AXIAL TRANSVERSE TOMOGRAPHY OF THE CERVICAL SPINE NARROWED BY OSSIFICATION OF THE POSTERIOR LONGITUDINAL LIGAMENT

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Ossification of the posterior longitudinal ligament in the cervical region is generally regarded as a rare disease, though a Japanese series of 185 cases has been reported. The main symptoms arise from a myelopathy, the degree of which varies from moderate to severe, due to stenosis of the spinal canal. In order to clarify the relationship between the severity of symptoms and the cross-sectional area of ossification, axial transverse tomography of the cervical spine has been carried out on twenty-six patients at intervals of 5 millimetres over the full extent of the ossification. In this way the cross-sectional areas of the ossified tissue and of the spinal canal were calculated. The former varied from a minimum of 0-8 to a maximum of 1-8 square centimetres. In cases of severe myelopathy the ossification was mainly at the fourth and fifth cervical levels and the stenosis ratio exceeded 30 per cent.

Ossification of the posterior longitudinal ligament leading to stenosis of the cervical spine and myelopathy has been recognised for a number of years, more frequently in Japan than in other countries. The disorder is not related in any way to ankylosing spondylitis. Transverse tomography is of considerable value in relating the severity of the symptoms to the amount of ossification.

**Clinical material**—Twenty-six patients with ossification of the posterior longitudinal ligament seen both in lateral radiographs and in sagittal tomographs were selected. Eight were women and eighteen men; their ages ranged from thirty-one to seventy-four years, the mean being fifty-one years. The common symptoms are listed in Table I.

The patients were classified as follows: Group 1, those able to walk without aid (ten); and Group 2, those able to walk only with crutches or quite unable to walk (sixteen).

**METHOD**

The transverse axial tomography was carried out with a Toshiba tomographic unit having a rotation angle of 200 degrees. The patient was placed supine on the special table, the neck was marked with lead wires at the upper and lower levels of ossification, and cuts were taken at intervals of 5 millimetres. The distances from tube to cervical spine and to cassette being fixed, the magnification was constant at 1:28. The cross-sectional areas of the spinal canal and of the ossified ligament were measured with a roller planimeter. Finally the various degrees of stenosis were calculated on a percentage basis (Fig. 1).

![Fig. 1](image-url)

To illustrate the calculation of the stenosis ratios.

In the sagittal plane the percentage of stenosis is \( \frac{O}{A} \times 100 \),

and in the transverse plane \( \frac{O}{S} \times 100 \).
RESULTS

The spinal canal was clearly demonstrated at the level of each vertebral body but not of course at each disc. The ossification was demonstrated to be over the posterior surface of the vertebral bodies or slightly separate from it (Fig. 2). When the case history was prolonged, the contour of the ossification was clear, but otherwise it was indistinct. The outline varied considerably, an oval shape being more common than a triangular one.

The transverse and antero-posterior diameters of the spinal canal were always widest at the level of C2 and narrowest between C3 and C5. In Group 2 the spinal canal was generally smaller than in Group 1 (Fig 3). In Group 2 the ossification areas were greatest at the level of C4–5 (Fig. 4). The transverse diameters seemed to be the same at all levels but the sagittal diameters were reduced at the level of C4 and C5 (Fig. 5).

The stenosis ratios of the spinal canal were calculated in both the sagittal and transverse planes. In all patients the sagittal ratios were greater than the transverse, especially in the upper cervical spine. In cases of severe myelopathy the ratios found in the transverse plane at the C4 and C5 levels were more than 30 per cent (Fig. 6).

A TYPICAL CASE REPORT

A man aged fifty-three came to the Nagoya City University Hospital in August 1972 suffering from a disabling gait and urinary disturbance. In June 1971 he had begun to notice progressive weakness of all four limbs. On examination, cutaneous sensibility was impaired below the level of the third cervical dermatome, and more so 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 C3–4; sagittal tomography clearly showed an appearance like a club (Fig. 7); and transverse tomography showed an oval outline of

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The sagittal tomograph and the transverse tomographs at four levels in a case of OPLL.
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FIG. 3
The average cross-sectional areas of the spinal canal in the two groups, as measured by roller-planimeter.

FIG. 4
The average cross-sectional areas of the ossification in the two groups as measured in the transverse plane.

FIG. 5
The average antero-posterior and transverse diameters of the cervical spine in each group.

FIG. 6
A record of the sagittal and axial stenosis ratios in both groups.

FIG. 7
Figure 7—The sagittal tomograph showing ossification extending from the upper border of C3 to the lower border of C4. Figure 8—The transverse tomograph at the level of C4 showing the degree of ossification very clearly.
Although the pathogenesis of the ossification is not completely understood, there have been many accounts of the symptoms and prognosis of the disorder. It is recognised by means of a plain lateral radiograph followed by a sagittal tomograph. The ossification may be local, or continuous or both (Yamaura et al. 1974). It usually covers one or two vertebral segments, but sometimes three or four. The rate of extension is usually slow; the spread is in both width and length. There is a relationship between the severity of the myelopathy and the thickness or level of ossification. Seki et al. (1974) reported that the myelopathy was severe when the stenosis ratio in the sagittal plane was more than 40 per cent, and moderate if less than 30 per cent. Terayama (1976) reported that the myelopathy was most severe when the ossification was confined to the lower cervical region, especially C4 and C5; on the other hand, if the ossification was continuous across some three or four vertebrae, the symptoms were comparatively mild. The prognosis of the untreated disorder is usually poor. Many patients eventually become paraplegic or tetraplegic, though the symptoms may stay moderate for a long period.

Transverse axial tomography has been used in recent years as a diagnostic method (Takahashi 1969). It is useful for clarifying the conditions in the axial plane (Harata 1970; Jacobson, Gargano and Rosomoff 1975). Sato, Sano, Kusakabe and Kobayashi (1971) have used the technique in the myelopathy of cervical spondylisis in order to localise compression of the spinal cord by an osteophyte. Some questions remain about this diagnostic method: it requires at least five exposures and sometimes the cut misses the most affected segment.

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REFERENCES


