Cervical Radiculomyelopathy due to Calcification of the Ligamentum Flavum

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The authors experience a rare case of the cervical radiculomyelopathy due to calcification of ligamentum flavum at the level of C4-6 and report it with review of the literature. A 60-year-old woman was admitted, complaining progressive quadripareisis, gait disturbance and neck pain. She had been treated with diabetes mellitus and hypertension for several years. On radiologic study, calcification of ligamentum flavum (CLF) at the C4-6 level was demonstrated on cervical spine CT and MR scan. Decompressive laminectomy of the C4-6 and removal of CLF were performed. During operation, thecal sac was severely compressed by hypertrophic ligamentum flavum and there were tight adhesion between calcified ligamentum flavum and dura. After the operation, her motor function and neck pain improved and she could walk with an assistant.

KEY WORDS: Ligamentum flavum · Calcification · Radiculomyelopathy.

Introduction

Hypertrophy and ossification of the ligamentum flavum (OLF) are relatively well-known disorders in the thoracic and lumbar vertebrae. Cervical myelopathy caused by calcification of the ligamentum flavum (CLF) is a rare disease, but most evident in Korean and Japanese. Although OLF usually is located in the lower half of the thoracic spine, CLF characteristically occurs in the cervical spines of older women. The authors experienced a case of the CLF at the level of C4-6 and report it with review of the literature.

Case Report

A 60-year-old woman was admitted, complaining progressive quadripareisis, gait disturbance and cervicalgia. She was 159cm in height, 61kg in weight and had been treated with diabetes mellitus and hypertension for several years. She had no previous history of trauma. About 1 month before admission, she first noticed motor weakness of both legs, voiding difficulty and clumsiness of both hands. General physical examination showed no abnormalities. A neurological examination at the time of admission revealed marked motor weakness of both legs and sensory changes. She could not walk and void. Plain x-ray films of the cervical spine showed a degenerative change and computerized tomography (CT) of the cervical spine demonstrated an oval mass of high density which projected into the spinal canal at C4/5 and C5/6(Fig. 1). Magnetic resonance imaging (MRI) of the cervical spine showed a hypertrophic ligamentum flavum, which produced marked stenosis of the cervical spinal canal and canal diameter was 4.5mm in maximal compression level. In addition, C4/5 and C5/6 disc herniations aggravated the stenosis. The ligamentum flavum was hypointense on T1- and T2-weighted sequences, suggesting that it was calcified or ossified lesion. T2-weighted magnetic resonance images revealed an intramedullary area of high-intensity sig-

Fig. 1. Axial computed tomography scan at C5-6 level shows an oval mass of high density projecting into the spinal canal and hypertrophic ligamentum flavum produced marked stenosis. The spinal cord is compressed severely.

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nal at the level of C4/5(Fig. 2). Decompressive laminectomy of the C4-6 and removal of CLF were performed with posterior approach. During operation, the thecal sac was severely compressed by hypertrophic ligamentum flavum and there were right adhesion between calcified ligamentum flavum and dura. This layer of ligamentum flavum was excised en bloc for the whole length of the laminectomy. Histological examination of a fragment of the surgical specimen revealed some foci of calcification, without mature bone formation, in a degenerative ligamentum(Fig. 3). After the operation, her motor function and neck pain improved and she could walk with an assistant. The postoperative radiologic findings revealed decompressive laminectomy of C4-6 and release of cord compression(Fig. 4).

Discussion

In 1960, the first case was reported about ossification of the ligamentum flavum(OLF) causing thoracic myelopathy by Yamaguchi, since then OLF are well known disorders of the thoracic and lumbar vertebrae. But, only a few reports are described patients with calcification of the ligamentum flavum (CLF). CLF, OLF and calcium pyrophosphate dihydrate crystal deposition disease(CPPD) of the ligamentum flavum are confused because of inadequate histological examination. In a recent study, Higashi found three patterns of calcium components in the deposits located in the ligamentum flavum. These calcium components were CPPD alone, apatite alone, and a double-layer structure with an outer CPPD and an inner apatite layer. And they suggested that the chondrocytes may have played a role in calcification in all types. The precise cause of CLF has not been established. Maybe aging, mechanical factor, endocrine abnormalities, the great mobility of the C3-C7 level have been postulated as predisposing factors.

As in cervical spondylosis, spinal stenosis is considered important as a predisposing factor for the manifestation of symptoms. Nagashima, Sato and Tsuru measured the sagittal diameter of the spinal canal in Japanese patients and found the values to be smaller than those in white patients. Although the symptoms differ, the initial symptoms of patients include 1. clumsiness of the hands, and pain radiating into the arms or all four extremities; 2. restriction of neck movement; 3. weakness of the arms and legs.

And radiographic characteristics were as follows in CLF. Plain radiography showed evidence of abnormal shadows of calcification on the posterior wall of the spinal canal and CT scans disclosed round or oval masses of high density projecting from the posterolateral side into the spinal canal. MRI demonstrated spinal cord compression from the posterolateral aspect. The cord was compressed not only by the calcified mass but also by hypertrophied ligamentum flavum.

Although ossification of the ligamentum flavum is a well established finding, ossification and calcification may occasionally
Table 1. Characteristics of calcification and ossification of the ligamentum flavum.^

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>CLF</th>
<th>OLF</th>
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<tbody>
<tr>
<td>Location</td>
<td>Cervical</td>
<td>Lower thoracic</td>
</tr>
<tr>
<td>Age of presentation</td>
<td>7th decade</td>
<td>Younger than with presentation of CLF</td>
</tr>
<tr>
<td>Sex</td>
<td>Almost exclusively women</td>
<td>No sex prevalence</td>
</tr>
<tr>
<td>Axial CT</td>
<td>Nodular or diffuse calcification</td>
<td>Nodular or V-shape ossification</td>
</tr>
<tr>
<td>MRI</td>
<td>Hypointense on T1− and T2−weighted images</td>
<td>Hypointense on T1− and T2−weighted images at intervertebral level</td>
</tr>
<tr>
<td>Histology</td>
<td>Granules of calcification</td>
<td>Mature bones</td>
</tr>
<tr>
<td>Other possible findings</td>
<td>–</td>
<td>Ossification of posterior longitudinal ligament</td>
</tr>
</tbody>
</table>

<CLF: calcification of the ligamentum flavum; OLF: ossification of the ligamentum flavum. CT: computed tomography. MRI: magnetic resonance image.> (Table 1).

Most patients underwent laminectomy by posterior approach, which possibly leads to loss of stability. Osteosclerotic expansive laminectomy, either by unilateral opening or by midline sagittal splitting, is a choice without significant loss of stability. In most cases, rapid recovery after operation is expected, because the posterior origin of the compression and therefore sparing of the anterior spinal circulation has been suggested as the explanation.^

As stated in other reports, computed tomography and MRI are the optimal diagnostic methods, providing both an adequate evaluation of the cord compression and an exact definition of the extent of the disease. Regarding intramedullary high-intensity areas, some authors have reported that they reflect edema and gliosis and they are associated with a poor prognosis. The postoperative course in our patient was satisfactory, with good recovery in spite of the existence of an intramedullary high-intensity signal on the preoperative MRI scan. Nakamura and Fujimura suggested that the existence of high-intensity signal in patients with OLF who have no history of trauma may be due to reversible cord changes and this signal is not necessarily associated with a poor prognosis.

Conclusion

Reports of CLF-induced cervical myelopathy are rare and mainly discovered in Korea and Japan. Although symptomatic cervical CLF usually affects women older than 60 years of age, assuming that it is a progressive disease that starts early in life and becomes symptomatic later in life when spinal stenosis occurs, MRI and CT provide adequate diagnosis and allow proper surgical planning for decompression. Surgical decompressions was recommended as early as possible to avoid permanent deficits and to obtain improvement of the patient’s symptoms.

References


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