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Clinical Study

Static versus dynamic factors for the development of myelopathy in patients with cervical ossification of the posterior longitudinal ligament

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ABSTRACT

We studied 27 patients with cervical ossification of the posterior longitudinal ligament (OPLL) but no clinical symptoms of myelopathy. We investigated the occupation ratio of the spinal canal by OPLL with cervical radiographs, assessed the morphological types of OPLL, and measured the segmental range of motion (ROM) at the level of maximum cord compression on flexion and extension radiographs. Patients were classified as having continuous-type OPLL (17 patients), mixed-type OPLL (seven patients), or segmental-type OPLL (three patients). The segmental ROM was negatively correlated with the OPLL occupation ratio ($r = -0.49$, $p < 0.01$). No patient developed myelopathy during the study period. Three patients with massive OPLL did not develop myelopathy and the mobility of their cervical spine was highly restricted, suggesting that dynamic factors such as the segmental ROM preferentially contribute to the development of myelopathy in patients with cervical OPLL. Thus, by controlling the dynamic factors (hypermobility), we might be able to reduce neurological deterioration in patients with cervical OPLL.

1. Introduction

Ossification of the posterior longitudinal ligament (OPLL) of the cervical spine results in static compression of the spinal cord that causes myelopathy.[1–3] Both anterior and posterior surgical approaches have been performed for cervical myelopathy due to OPLL,[1,2,4,5] and several studies have shown that the anterior surgical approach results in a better surgical outcome when the occupation ratio by OPLL is large,[2,4] indicating that complete removal of the static compression factor is important in the treatment of myelopathy.

Dynamic factors, such as the mobility of the spinal column, are also important in the development of myelopathy when a considerable degree of the canal is occupied by OPLL.[6–8] However, the contribution of dynamic factors to the development of myelopathy in cervical OPLL patients has not been fully determined. In the present study, we radiographically and clinically evaluated patients who had cervical OPLL but no symptoms of myelopathy, and analyzed the contribution of static and dynamic factors to the development of myelopathy.

2. Materials and methods

From April 2000 through March 2007, 27 patients with cervical OPLL (11 men, 16 women, mean age at first diagnosis 63.3 years [range, 37–78 years]) in whom the space available for the spinal cord (SAC) (Fig. 1A) at the cervical spine was $\leqslant$ 12 mm visited our institute for initial consultation. When the patients were diagnosed with cervical OPLL, they had no clinical symptom of myelopathy. The mean follow-up period for all the patients was 59 months (range, 12–95 months).

Using cervical radiographs, we measured the occupation ratio of the spinal canal by OPLL [(thickness of OPLL/anteroposterior diameter of the bony spinal canal) $\times$ 100][8] (Fig. 1A). Morphologically, patients were classified as continuous, mixed, segmental, or localized OPLL types according to the criteria of the Japanese Investigation Committee on the Ossification of the Spinal Ligaments.[9] We also evaluated the segmental range of motion (ROM) at the maximum cord compression level based on flexion and extension radiographs[8] (Fig. 1B), and on T2-weighted MRI we examined the high signal change in the spinal cord. The patients' clinical course was assessed using the Japanese Orthopaedic Association (JOA) scoring system for cervical myelopathy.[8] On physical examination, we assessed the patients' deep tendon reflexes of the lower extremities and the Babinski reflex.

For statistical analysis we applied the Fisher's exact probability test and Pearson's correlation test. A $p < 0.05$ was considered sig-

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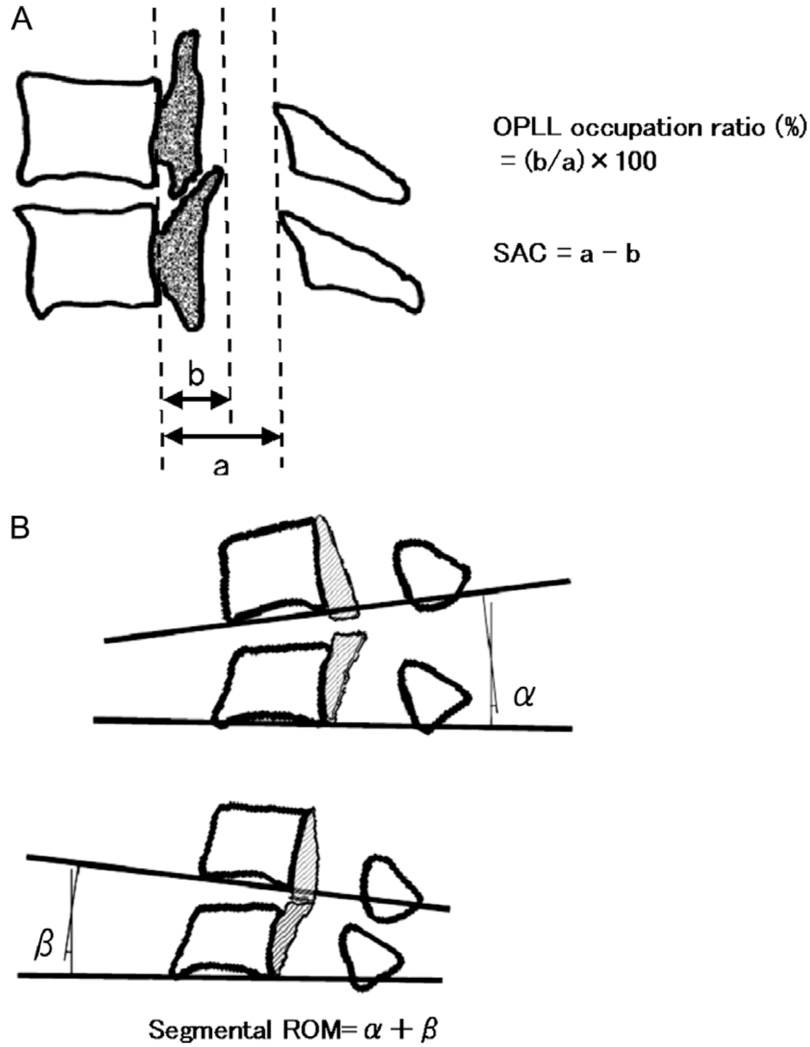

Fig. 1. Schematics showing the radiographic parameters assessed. (A) The ossification of the posterior longitudinal ligament (OPLL) occupation ratio and space available for the spinal cord (SAC) were measured from lateral cervical radiographs. (B) The segmental range of motion (ROM) at the maximum cord compression level was measured from flexion and extension radiographs.

Table 1
Radiographic findings for 27 patients with ossification of the posterior longitudinal ligament

	Type of OPLL[†]		
	Continuous	Mixed	Segmental
No. patients (n)	17[a]	7	3
SAC (mm)	7.6 ± 2.3 (3–12)	7.8 ± 1.0 (7–9)	9.4 ± 2.8 (7–12)
Occupation ratio (%)	42.5 ± 11.1 (25–64)	39.4 ± 7.6 (29–50)	27.7 ± 3.3 (25–31)
Segmental ROM (°)	2.4 ± 3.0 (0–9)	4.9 ± 2.9 (1–10)	9.7 ± 4.5 (5–14)

OPLL = ossification of the posterior longitudinal ligament, occupation ratio = occupation ratio of spinal canal by OPLL, ROM = range of motion (intervertebral disc mobility at the maximum cord compression level), SAC = space available for the spinal cord (see Fig. 1).
[†] Mean ± standard deviation (range).
[a] Statistically different from mixed-type OPLL and segmental-type OPLL ($p < 0.05$).

nificant. Data are presented as the mean ± standard deviation of the mean.

3. Results

3.1. Radiographic findings

Of the 27 patients analyzed, 17 (63%) were classified with the continuous type, 7 (26%) with the mixed type, and 3 (11%) with the segmental type of OPLL (Table 1), and the incidence of patients with continuous-type OPLL was significantly higher than that for the other types ($p < 0.05$).

The mean OPLL occupation ratio was 39.8% for all types. It was 42.5% in patients with continuous-type OPLL, 39.4% in patients with mixed-type OPLL, and 27.7% in patients with segmental-type OPLL (Table 1). The mean segmental ROM at the level of maximum cord compression was 3.8 degrees. It was 2.4 degrees in patients with continuous-type OPLL, 4.9 degrees in patients with