

Effects of Stabilization in Extension in Cervical Ossification of a Posterior Longitudinal Ligament: A Case Report

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Summary. A 74-year-old male with progressive myelopathy due to cervical ossification of the posterior longitudinal ligament (OPLL) was treated by laminoplasty from C3 to C7. One day after surgery, he complained of radiating pain and numbness from the neck to the radial side of the right hand when the head of the bed was raised 60 degrees with his head on a pillow. The symptoms, however, receded rapidly when the bed was returned to the horizontal position. Multi-segmental fusion in extension using a pedicle screw system was performed and the position-related symptoms ceased. We suspected that destabilization due to laminoplasty slightly increased the segmental motion, causing neurologic deterioration.

Key words—cervical OPLL, laminoplasty, postoperative upper arm palsy, spinal fusion in extension.

INTRODUCTION

In patients with cervical compression myelopathy, postoperative paralysis of the upper extremity is a rare but serious complication. Unilateral weakness of the deltoid and/or biceps brachii muscles with or without pain of the upper arm is a characteristic manifestation of the postoperative neurologic deterioration that can occur after decompression surgery, independent of the procedure used¹⁻⁹⁾. The etiology for this postoperative complication remains unclear, and effective preventive methods or additional treatments of choice have not been established.

The authors report a case of compression myelopathy due to ossification of the posterior longitudinal ligament (OPLL) with unilateral neurologic deterioration of the upper arm after laminoplasty that was successfully treated by stabilization with a pedicle screw system. We discuss a pathomechanism of the postoperative neurologic deterioration and the effectiveness of fusion in maximum extension as the treatment of choice for the complication.

CASE REPORT

A 74-year-old male experienced numbness of the upper and lower extremities for 10 months without a causative episode. Bilateral hand dexterity gradually deteriorated and there was difficulty in walking. There was no history of injury or significant physical activity, and the patient had been treated with medication for primary hypertension and diabetes mellitus for 20 years. On his clinical visit, he complained of numbness in all four extremities and in the trunk. He could not use chopsticks with dexterity. His gait was spastic and he needed a handrail to ascend and descend stairs. A slight muscular weakness of the extremities was detected without any vesicorectal disturbance. The patient demonstrated bilateral hyperreflexia and positive pathologic reflexes of the hands.

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Abbreviations—OPLL, ossification of posterior longitudinal ligament.

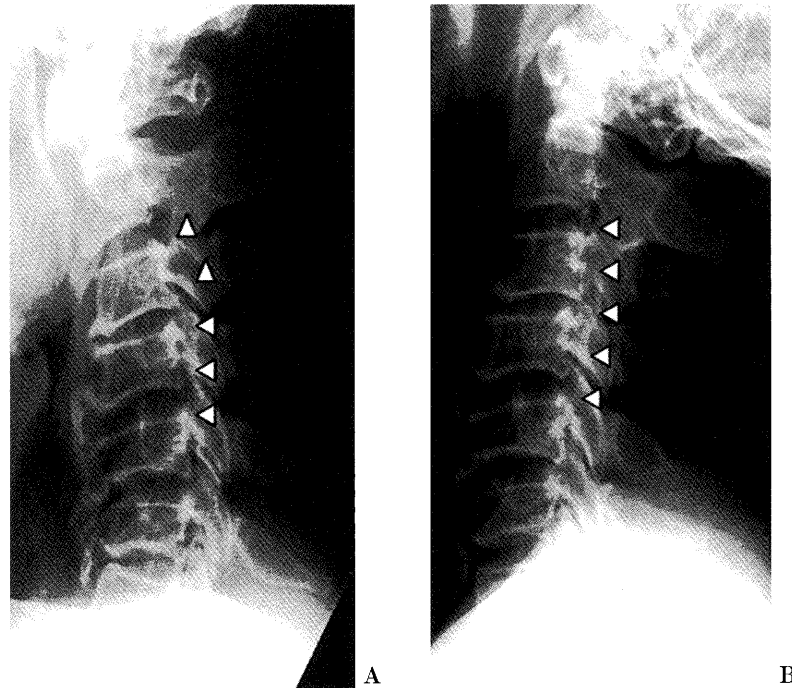


Fig. 1. Lateral X-rays showing OPLL (*arrow heads*) at the C3 to C7 levels with marked anterior osteophytes. Range of motion in flexion **A.** and extension **B.** X-rays are limited to 15° of kyphosis in flexion and 2° of kyphosis in extension between C2 and C5.

Examination

Lateral X-rays revealed OPLL at the C3 to C7 level with marked anterior osteophytes. Flexion-extension radiography revealed a diminished range of intervertebral motion with 15° of kyphosis in flexion and 2° of kyphosis in extension between C2 and C5 (Fig. 1). Magnetic resonance imaging of the cervical region demonstrated severe canal stenosis at the C3 to C5 level due to OPLL (Fig. 2).

Operation and postoperative course

Because the patient was elderly and the X-rays did not demonstrate any abnormal flexion-extension motion, posterior extensive simultaneous multi-segment decompression¹⁰⁾ was performed from C3 to C7. The opened laminae were sutured to the paraspinal muscles. The patient felt relief from hand numbness following surgery while lying down. A day after surgery, he complained of radiating pain and numbness from the neck to the radial side of the right hand when the head of the bed was raised 60° with his head on a pillow. Weakness of the right hand and hyporeflexia of the right biceps and triceps tendons

became evident at the same time, suggesting deterioration of the myelopathy at the C5 to C7 level myelomere. The symptoms, however, receded rapidly when the bed was returned to the horizontal position. Grip power and deep tendon reflexes of biceps and triceps of the right upper extremity also recovered. On the second day after surgery, he demonstrated the same symptoms again when the head of the bed was raised. We suspected postoperative newly developed spinal cord compression by split laminae¹¹⁾ or epidural hematoma. Emergency myelography and subsequent computed tomography (CT) were performed. Although the anterior cord compression due to OPLL remained, the spinal cord was decompressed posteriorly through the opened laminae. There was no epidural hematoma or other lesions compressing the spinal cord (Fig. 3). Thus, we assumed that, because the OPLL remained, destabilization due to laminoplasty slightly increased the segmental motion, causing the neurologic deterioration.

We performed a second operation, a multi-segmental fusion from C3 to C5 using a pedicle screw system (NordOpedic AB, Länna, Sweden). We confirmed that the opened laminae, sutured to the paraspinal muscles, were stable. The laminae were



Fig. 2. T1-weighted image in magnetic resonance imaging demonstrating severe canal stenosis at the C3 to C5 levels due to OPLL.

removed for use as a posterolateral bone graft. The fusion area was instrumented in maximum extension with 3° of kyphosis between C3 and C5 on a lateral X-ray (Fig. 4). The day after the second surgery, the patient did not show any neurologic deterioration of the right upper arm, even when the head of the bed was raised 60°. CT myelogram following the second surgery revealed that the axial configuration of the spinal cord at the C3/4 to C4 level was further normalized (Fig. 5) compared with the preoperative CT myelogram (Fig. 3).

The patient did not complain of any pain in the right upper arm thereafter. Bilateral hand dexterity, use of chopsticks etc., gradually improved. The postoperative course was uneventful. X-ray demonstrated bony fusion at 3 years after surgery. His neurologic symptoms did not deteriorate during the follow-up period.

DISCUSSION

Postoperative neurologic deterioration after decom-



Fig. 3. Myelography and subsequent computed tomography (CT) after the first surgery. Although anterior cord compression due to OPLL remains, the spinal cord is decompressed posteriorly through split laminae. *Arrow heads* show the dorsal surface of the dural tube.

pression surgery for patients with cervical compression myelopathy is rare, but constantly reported¹⁻⁹, suggesting that there are some latent causes in the decompression surgery itself. Although several pathomechanisms of the postoperative neurologic complication have been postulated, convincing evidence has not been reported¹⁻⁹. It is therefore important to carefully examine each case with regard to neurologic deterioration after surgery and to assess the clinical details.

Characteristic features in the present case were as follows: 1) Neurologic deterioration of the unilateral upper arm after laminoplasty occurred when the head of the bed was raised 60 degrees, and the symptoms improved when the bed was returned to the horizontal position; 2) No compressive lesions of the spinal cord other than OPLL were observed during the postoperative radiologic examination; 3) Multi-segmental fusion with instrumentation at the OPLL level with the segments in extension eliminated the symptoms. In a biomechanical study, White et al. concluded that the cervical spine becomes unstable if all the anterior elements or posterior elements of a functional spinal unit destroyed¹²). In the present case, the cervical spine should have been stable because laminoplasty preserves the facet joints with all the anterior elements intact. We speculated that laminoplasty weakened the posterior elements and induced destabilization, although radiologically slight, contributing to increased segmental motion. The cervical intervertebral angle in the upright position is 8.1 degrees larger than in the supine posture,

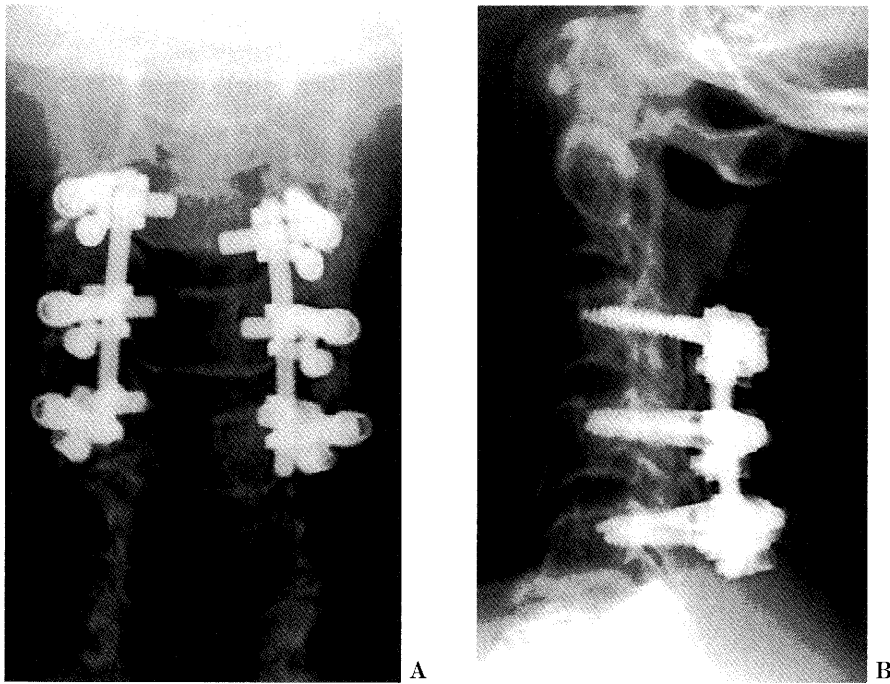


Fig. 4. X-rays after the second operation of multi-segmental fusion from C3 to C5 using a pedicle screw system with the neck in extension. Posteroanterior **A.** and lateral **B.** views.

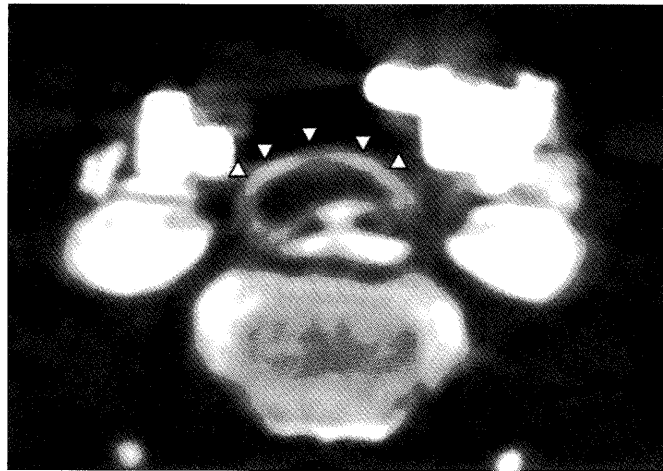


Fig. 5. CT myelogram at the C3/4 level following the second surgery, demonstrating further decompression of the spinal cord compared with the preoperative CT myelogram. *Arrow heads* show the dorsal surface of the dural tube.

and an axial load simulating the upright load narrows the cross-sectional area of the dural tube at C5/6³⁾. This position-related change of the cervical spine alignment might explain the deterioration of myelopathy in the present case. Furthermore, the

improvement of the neurologic deterioration after laminoplasty by stabilization in extension with instrumentation supports this hypothesis.

Although total removal of the OPLL lesion through the anterior approach is an ideal procedure for

decompression of the spinal cord, the procedure is sometimes unrealistic when the OPLL is the long, continuous type or the patient is compromised due to general complications. Therefore, posterior decompression surgery is usually performed rather than the anterior procedure for multilevel OPLL in the cervical spine. Posterior surgery including laminoplasty, however, has limited decompression effects in cases with lordosis under 10 degrees or kyphosis in the preoperative sagittal alignment, and with a preoperative maximal ossification thickness of more than 7 mm¹⁴⁾. This suggests the importance of achieving a lordotic alignment for improvement of the symptoms. On the other hand, there are reports of anterior interbody fusion without decompression as an effective treatment for cervical OPLL myelopathy, resulting in stable, long-lasting results¹⁵⁾. This suggests the importance of stabilization in this pathology. In the present case, posterolateral fusion with instrumentation using a pedicle screw system was effective in preventing deterioration of the myelopathy after laminoplasty (Fig. 4). Therefore, posterior decompression and fusion in extension using instrumentation can be an option for the treatment of cervical myelopathy due to a large multi-segmental OPLL.

In conclusion, the authors here report a case of cervical OPLL that presented with unilateral post-laminoplasty palsy of the upper arm and was successfully treated by multi-segmental fusion using a pedicle screw system, suggesting a slight destabilization after laminoplasty with a large OPLL. Hypolordotic alignment apparently contributes to neurologic deterioration.

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