

Progressive Kyphosis Deformity with Facet Subluxation after Cervical Expansive Laminoplasty: A Case Report

Hiroshi Noguchi¹, Masao Koda¹, Toru Funayama¹, Hiroshi Takahashi¹, Kousei Miura¹,
Masashi Yamazaki¹

Learning Point of the Article:

Progressive kyphosis deformity can rarely lead to dislocation of the intervertebral joints, worsening myelopathy.

Abstract

Introduction: In Japan, laminoplasty is often chosen over anterior surgery for the treatment cervical spondylotic myelopathy because most patients are the elderly with multiple stenoses. Laminoplasty is associated with lower perioperative risk, and it can be executed by inexperienced surgeons with relative ease. However, it is also associated with progression of kyphosis, which can result in the deterioration of neck pain and recurrence of myelopathy. Herein, we present a case in which kyphosis deformity progressed post-laminoplasty, resulting in intervertebral joint dislocation and worsening myelopathy.

Case Presentation: A 70-year-old Japanese man who underwent laminoplasty 10 months ago, presented with worsening myelopathy symptoms that had recurred after previously persisting for several days. These symptoms were associated with restenosis of the spinal canal at the C4/5 level due to spondylolisthesis and facet dislocation. As a corrective surgery, we performed anterior-posterior surgery. His post-operative course was almost satisfactory, and post-operative magnetic resonance imaging showed an improvement in spinal cord compression.

Conclusion: Progressive kyphosis deformity can rarely lead to dislocation of the intervertebral joints, worsening myelopathy. Although the prevention of kyphotic deformity is still difficult, laminoplasty should be performed in patients with a high risk of post-operative kyphosis, such as in this case, considering the possibility of deterioration of myelopathy associated with kyphosis.

Keywords: Cervical spine, laminoplasty, kyphosis, facet dislocation.

Introduction

The treatment for cervical spondylotic myelopathy can be divided into two distinct methods: Anterior and posterior surgeries. Laminoplasty, a representative procedure of posterior cervical spine surgery, is characterized by simultaneous multiple-level decompression and is widely performed in patients with spinal cord compression due to multiple intervertebral stenoses [1]. In Japan, laminoplasty is often chosen over anterior surgery [2] because most patients are the elderly with multiple stenoses. Moreover, the perioperative risk of laminoplasty is low, and it can be easily performed by relatively inexperienced surgeons. One of

the well-known post-operative complications of laminoplasty is the progression of kyphosis, which can result in the deterioration of neck pain and recurrence of myelopathy. In this study, we describe a rare case of kyphosis post-laminoplasty with facet dislocation and worsening myelopathy.

Case Report

History and examination

A 70-year-old Japanese man underwent cervical laminoplasty 10 months ago at another hospital for cervical spondylotic

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Dr. Hiroshi Noguchi



Dr. Masao Koda



Dr. Toru Funayama



Dr. Hiroshi Takahashi



Dr. Kousei Miura



Dr. Masashi Yamazaki

¹Department of Orthopaedic Surgery, Faculty of Medicine, University of Tsukuba, Ibaraki, Japan.

Address of Correspondence:

Dr. Hiroshi Noguchi,

Department of Orthopaedic Surgery, Faculty of Medicine, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8575, Japan.

E-mail: noguhiro0164@tsukuba-seikei.jp

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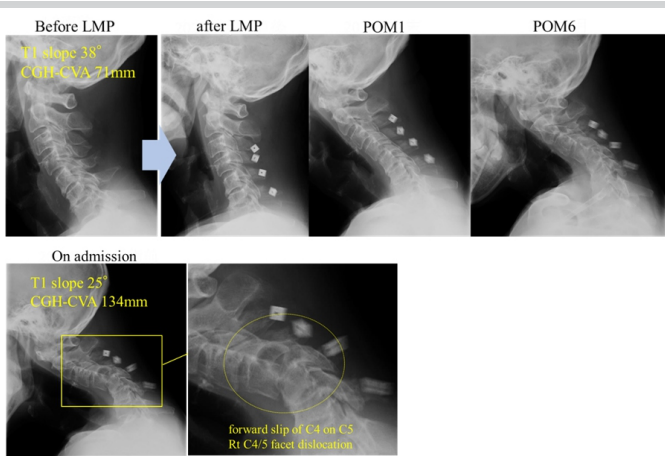


Figure 1: History of kyphosis post-laminoplasty in the current case. (Upper row; before admission lower row; on admission). Before laminoplasty, his cervical alignment was lordotic but not kyphotic. The kyphotic changes occurred early in the post-operative period and gradually progressed.

myelopathy. Postoperatively, his hand numbness had been improving; however, his cervical alignment became kyphotic (Fig. 1). Ten months after surgery, he experienced sudden onset of severe neck pain and numbness and muscle weakness in both upper limbs, following which he visited his previous doctor, who detected facet dislocation with progressive kyphotic deformity post-laminoplasty. The patient was referred to our department for further evaluation and treatment. He had a history of diabetes mellitus and alcoholic liver cirrhosis with no evidence of neuromuscular disease.

On admission, he was unable to stand or sit because of severe neck pain and complained of severe numbness and weakness in both upper limbs. The patient showed distal dominant upper limb muscle weakness (manual muscle testing level of 3–4/5). Decreased sensation was observed in both palms, and bladder-rectal function was slightly diminished. The patellar and Achilles tendon reflexes were enhanced in both sides, and the



Figure 3: The radiography image after anterior-posterior surgery. We performed an anterior-posterior surgery as a corrective surgery. First, there is a close reduction in the facet dislocation. Second, anterior cervical discectomy and fusion were found at the C4/5 level. Third, posterior cervical fusion by C3-6 lateral mass screw was found without removing a spacer for laminoplasty. The various radiological parameters were as follows: C2-7 angle of 2.5° (C4/5 angle of 3°), T1 slope of 30°, and center of gravity of the head sagittal vertical axis of 80 mm.

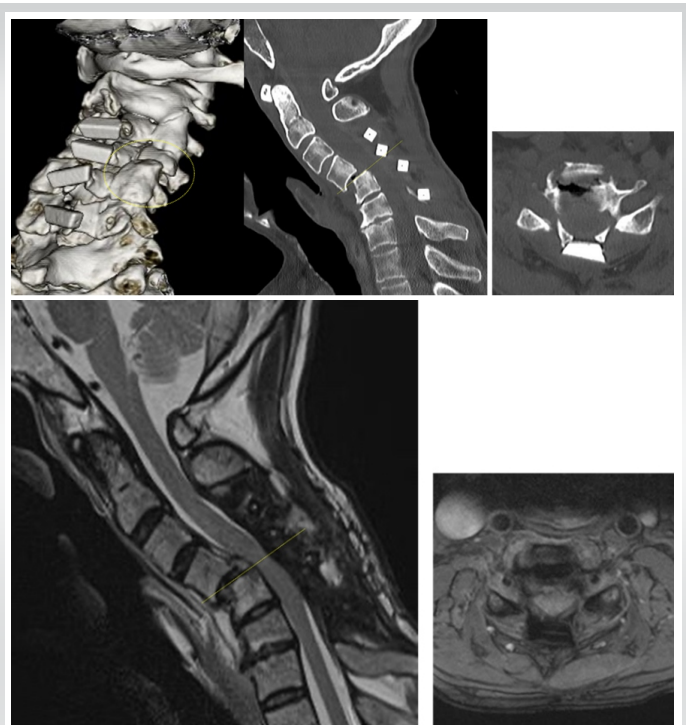


Figure 2: Computed tomography and magnetic resonance image on admission. (a) The sagittal, axial, and three-dimensional reconstructed computed tomography images revealed right C4/5 facet dislocation. (b) Restenosis of the enlarged spinal canal at the C4/5 level was observed on magnetic resonance T2-weighted images.

patient exhibited a spastic gait. The Japanese Orthopedic Association (JOA) score for cervical myelopathy was 7.5 points out of 17 (full marks).



Figure 4: Post-operative magnetic resonance, computed tomography, and radiography images, (a) Post-operative magnetic resonance images obtained 1 year after surgery showed attenuation of spinal cord compression. (b) Post-operative computed tomography images obtained 6 months after surgery revealed that interbody fusion at C4/5 was completed. Post-operative radiography in the neutral position revealed that the patient's cervical spine was S shaped and slightly tilted forward without loosening screws.

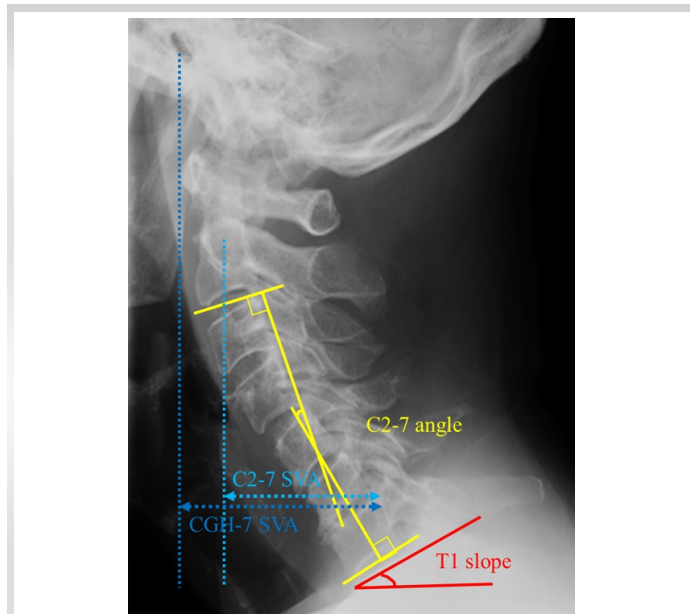


Figure 5: Radiological risk factors for kyphotic change after laminoplasty. Many researchers have reported radiological risk factors for kyphotic changes after laminoplasty. Typical radiological parameters that suggest high risk for kyphotic deformity are as follows: Low C2-7 angle, high T1 slope, and high C2-7 sagittal vertical axis.

Before the initial surgery, his cervical alignment was lordotic but not kyphotic. Kyphosis occurred early in the post-operative period and gradually progressed. On admission, we observed severe kyphosis with a forward slip of C4 on C5 with C4/5 facet dislocation (Fig. 1). The sagittal alignment parameters of the cervical spine were as follows: C2-7 angle, -52° ; T1 slope, 25° ; and center of gravity of the head (CGH)–C7 sagittal vertical axis (SVA), 134 mm. Computed tomography images revealed a C4/5 facet dislocation on the right side. Restenosis of the enlarged spinal canal at the C4/5 level was observed on magnetic resonance imaging (Fig. 2).

Surgery

The patient was diagnosed with cervical kyphotic change with restenosis of the spinal canal at the C4/5 level by spondylolisthesis and facet dislocation, and anterior-posterior surgery was selected. First, we attempted and successfully performed the close reduction of facet dislocation under anesthesia. Second, we performed anterior cervical discectomy fusion with an intervertebral cage (CeSPACE[®]XP Interbody System, B. Braun Aesculap, Germany) filled with artificial bone (Affinos, Kuraray, Japan) at the C4/5 level to improve cervical alignment. Subsequently, we performed posterior cervical fusion with C3-6 lateral mass screws (SYMPHONY OCT System, DePuy Synthes, USA). After surgery, his cervical spine was corrected for lordosis. Post-operative cervical sagittal parameters were as follows: C2-7 angle, 2.5° ; C4/5 angle, 3° ; T1 slope, 30° ; and CGH-SVA, 80 mm (Fig. 3).

Post-operative course

The patient was kept intubated on the day of surgery and extubated 3 days after surgery to treat the swelling of the pharynx caused by the combined anterior-posterior surgery. His hand numbness and skilled movements improved immediately after surgery, and he was able to walk using a walker 1 week after surgery. Three weeks after surgery, the patient was transferred to the previous doctor for rehabilitation. The JOA score for cervical myelopathy improved to 10.5 points out of 17 (recovery rate of the JOA score, 31.6%) a year after surgery. Post-operative magnetic resonance imaging showed the attenuation of spinal cord compression, and interbody fusion at C4/5 was satisfactory on computed tomography images obtained 6 months after surgery (Fig. 4). Post-operative radiography revealed that his cervical spine was S shaped and slightly tilted forward without screw loosening. Cervical sagittal parameters at 12 months after surgery were as follows: C2-7 angle, -5° ; T1 slope, 23° ; and CGH-SVA, 81 mm (Fig. 4). The progression of kyphosis was carefully observed.

Discussion

Facet dislocation due to kyphotic changes post laminoplasty, as in the present case, is very rare; therefore, we could not find similar reports, although post-operative cervical kyphosis after laminoplasty is a well-known post-operative complication. Post-operative kyphotic deformity can lead to unfavorable outcomes because kyphosis decreases posterior spinal cord shift, which is the main mechanism of spinal cord decompression by laminoplasty. The previous studies have revealed that post-operative kyphotic alignment changes are related to the deterioration of neurological symptoms [3, 4]. Thus, spinal surgeons should take preventive actions against post-operative kyphotic deformities to maintain favorable long-term results.

A precise understanding of the etiology of laminoplasty kyphosis is mandatory to predict and prevent its recurrence. According to the previous reports, post-laminoplasty kyphosis is associated with multiple factors as outlined below: (1) Invasion to the posterior extensor muscles. Preservation of the cervical extensor muscles, which play an important role in maintaining cervical lordosis, is important for preventing post-laminoplasty kyphosis [5]. In particular, the preservation of the semispinalis muscle attached to the C2 spinous process is a key to preventing kyphosis. (2) Poor pre-operative cervical sagittal alignment. Lower C2-7 angle, higher T1 slope, and higher C2-7 SVA are reported as possible risk factors for post-operative kyphosis [6, 7] (Fig. 5). Sakai et al. [8] and Sharma et al. [9] reported that the radiological risk factors for kyphotic change post-laminoplasty are CGH-SVA >42 mm and T1 slope $>29.5^\circ$.

(3) Pre-operative local instability (e. g., anterior slip).

In the present case, the pre-operative sagittal alignment parameters were as follows: C2-7 angle, 13.2°; T1 slope, 38°; and CGH-SVA, 71 mm. Pre-operative cervical spine lateral radiography in the flexion position showed a mild anterior slip at C4. Moreover, surgical records from a former hospital indicated that the C2 semispinalis had been invaded. Therefore, the present case fulfilled all possible risk criteria for post-laminoplasty kyphosis mentioned above.

The treatment strategy for patients with cervical spondylotic myelopathy at risk of post-laminoplasty kyphosis is controversial. In the present case, we chose anterior-posterior surgery as a salvage procedure because it could deal with any deformity. The C4/5 slipped vertebrae were successfully reduced by anterior cervical discectomy and the unstable posterior elements, including dislocated facet joints, were supported by posterior fixation. Based on the surgeon's preference, the patient's general condition, and the patient's previous history, one of the following surgical techniques should be selected: Anterior, posterior, or combined [10, 11, 12].

Conclusion

Progressive kyphosis deformity can rarely lead to dislocation of the intervertebral joints, worsening myelopathy. When performing posterior surgery in a patient with a high risk of post-operative kyphotic deformity, the patient must be informed of the possibility that additional surgery may be required due to the deterioration of myelopathy associated with cervical kyphosis.

Clinical Message

Progressive kyphosis deformity can rarely lead to dislocation of the intervertebral joints, worsening myelopathy. When performing posterior surgery in a patient with a high risk of post-operative kyphotic deformity, the patient must be informed of the possibility that additional surgery may be required due to the deterioration of myelopathy associated with cervical kyphosis. Even in the lordotic position, patients with a large SVA, T1 slope, and anterior slip should be recognized as a high risk of developing post-operative kyphosis.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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