A Case of Recurrent Cervical Spondylolisthesis following Cervical Laminoplasty

Hiroshi Nomura, Yoshikazu Yanagisawa, Junichi Arima

ABSTRACT
We report a case of recurrent cervical spondylolisthesis following cervical laminoplasty. A 77-year-old woman with progressive quadriplegia due to cervical spondylotic myelopathy (CSM) without spondylolisthesis was treated with C3 to 5 French-door laminoplasty. At 15 months postoperatively, anterior slippage of the C4 vertebral body in flexion was prominent. At 20 months postoperatively, slippage had worsened, and C4 to 5 posterior fixation with a lateral mass screw and rod system was performed. At 20 months postoperatively, slippage had worsened, and C4 to 5 posterior fixation with a lateral mass screw and rod system was performed. In this case, atrophy of the cervical extensor muscles progressed in a time-dependent manner. Therefore, we suggest that progressive atrophy of the cervical extensor muscles might cause isolated neck extensor myopathy with flexible dropped head syndrome, leading to recurrent cervical spondylolisthesis.

Keywords: Dropped head syndrome, Isolated neck extensor myopathy, Laminoplasty, Spondylolisthesis.


INTRODUCTION
Cervical laminoplasty is a standard surgical treatment for cervical spondylotic myelopathy (CSM), especially in cases with multilevel spinal cord compression at the cervical spine. Major complications of laminoplasty include C5-root palsy, axial pain, and intraoperative blood loss. However, compared with cervical laminectomy, postoperative kyphosis and segmental instability after laminoplasty are rare, particularly in cases with normal cervical alignment and without prominent spinal instability preoperatively. Preservation of the nuchal ligament during surgery is a supportive technique to prevent postoperative kyphosis after laminoplasty.

To our knowledge, there has been no case of secondary cervical spondylolisthesis following laminoplasty. Here, we present what we believe is the first case of recurrent cervical spondylolisthesis after cervical laminoplasty.

CASE REPORT
A 77-year-old woman with a 2-week history of rapidly progressive quadriplegia, without any previous traumatic episode, and retarded micturition was admitted to our hospital. She had no history of rheumatoid arthritis; neurologic disorder, such as Parkinson's disease; or motor neuron disease. Neurologic examination revealed severe spastic gait, standing inability, and myelopathy hands, associated with hyperreflexia in bilateral upper and lower extremities, positive Hoffmann's reflex on bilateral fingers, and positive Babinski reflex on the right foot. In addition, she was unable to make and release a fist more than 11 times in 10 seconds. Her Japanese Orthopaedic Association score was 6.5 (highest possible score = 17). Radiography revealed developmental spinal canal stenosis without vertebral slippage of the cervical spine or kyphotic deformity in the sagittal plane in neutral (Fig. 1A). Magnetic resonance imaging demonstrated multilevel spinal cord compression from C3/4 to C5/6. Based on these findings, we diagnosed CSM causing progressive spastic paralysis.

C3 to 5 French-door laminoplasty was performed (Fig. 1B). During surgery, the nuchal ligament and...
cervical facet joints were gently preserved. Within 1 week postoperatively, her spastic paralysis remarkably improved, and she regained normal gait and coordinated finger movement sufficient to use chopsticks properly. At 3 months postoperatively, radiography revealed slight anterior slippage of the C4 vertebral body in the sagittal plane in flexion, but no slippage in neutral. At 15 months postoperatively, anterior slippage of the C4 vertebral body was noted in neutral and had worsened in flexion. At 20 months postoperatively, slippage of the C4 vertebral body had progressed, particularly in flexion (Figs 2A to C). Although no symptomatic abnormality was detected, atrophy of the cervical extensor muscles was observed.

At this time, C4 to 5 posterior fixation with a lateral mass screw and rod system (Mountaineer; DePuy Synthes Spine, Raynham, MA, USA) and synthetic bone grafting with beta-tricalcium phosphate (Superpore; PENTAX, Tokyo, Japan) were performed. At 6 months postoperatively, radiography demonstrated no slippage of the cervical spine in neutral, flexion, or extension (Figs 3A to C). However, at 8 months postoperatively, she complained of nuchal pain upon standing and numbness of the left hand in extension. Atrophy of the cervical extensor muscles had progressed, and her cervical posture in flexion resembled dropped head syndrome (DHS). Radiography revealed anterior slippage of the C5 vertebral body in neutral, and of the C3 and C5 vertebral bodies in flexion (Figs 4A to C).

At this time, occipitocervical–upper thoracic posterior fusion with a lateral mass/pedicle screw and rod system (Mountaineer) and iliac bone plus synthetic bone grafting with beta-tricalcium phosphate (Superpore) was performed. At 24 months postoperatively, there was a tendency of head dropping in neutral when the patient was unconscious despite no loosening of the spinal implants (Figs 5A and B). Axial computed tomography before laminoplasty and at 20, 28, and 41 months after laminoplasty clearly demonstrated progressive atrophy of the cervical extensor muscles in a time-dependent manner (Figs 6A to D). However, no degeneration of
A Case of Recurrent Cervical Spondylolisthesis following Cervical Laminoplasty


57

The cervical facet joints was observed at any time point (Figs 7A to C).

DISCUSSION

It is known that postoperative cervical kyphosis is less common after laminoplasty than after laminectomy due to preservation of the posterior supporting elements in the cervical spine and prevention of weakening of the structural support with laminoplasty. In fact, kyphosis after either laminectomy or laminoplasty is fixed and not flexible.6 In the current case, the patient’s cervical spine remained flexible after surgery, even after additional C4 to 5 fusion. Furthermore, no degeneration of the cervical facet joints was evident at any time point. Therefore, the pathologic mechanism of the recurrent cervical spondylolisthesis in the current case is unlikely similar to that of a typical case of postoperative kyphosis after laminoplasty.

Dropped head syndrome is characterized by severe kyphotic deformity of the cervicothoracic spine in sitting and standing positions due to severe neck extensor muscle weakness.6-8 Dropped head syndrome is classified as rigid or flexible, and flexible DHS is further classified into neurologic cause type or muscular cause type, which is defined as isolated neck extensor myopathy.6-8 In

Figs 4A to C: Lateral radiographs of the cervical spine in: (A) Neutral, (B) flexion, and (C) extension at 8 months after C4 to 5 posterior cervical fixation, demonstrating anterior slippage of the C3 and C5 vertebral bodies, particularly in flexion

Figs 5A and B: Anteroposterior: (A) Lateral and (B) radiographs of the cervical spine at 13 months after occipitocervical-upper thoracic posterior fusion, demonstrating no loosening of the spinal implants

Figs 6A to D: Axial computed tomography scans at the level of C4 to 5: (A) Before laminoplasty, (B) at 20 months, (C) at 28 months, and (D) 41 months after laminoplasty, demonstrating progressive atrophy of the cervical extensor muscles in a time-dependent manner.
terms of muscle atrophy after cervical posterior surgery, Fujimura and Nishi\(^9\) previously reported atrophy of the nuchal muscle after cervical laminoplasty, and that at 5 years postoperatively, the whole nuchal muscle was reduced to approximately 80\% of its preoperative size. However, there was a weak correlation between degree of atrophy and cervical curvature, which does not correspond to the current case. In the current case, the patient’s cervical extensor muscles were progressively reduced after laminoplasty in a time-dependent manner, and her cervical posture was similar to flexible DHS. Therefore, we suggest that rapidly progressive atrophy of the cervical extensor muscles, similar to the pathologic condition of isolated neck extensor myopathy, might cause flexible DHS, leading to recurrent cervical spondylolisthesis.

**REFERENCES**