

The Importance of Lamina Size Measurement and Proper Implants Selection before Laminoplasty : Two Case Reports

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Open door laminoplasty using plates is a safe and effective procedure for multi-level cord compression. To achieve stable laminar arch, various types of plate have been developed and used. Now, we introduce two rare complications related to the laminar shelf of plate.

In the first case, we used the wider laminar shelf plate because the elevated lamina did not fit well into the usual laminar shelf. During follow-up, cord compression due to laminar shelf was observed.

And in the second case, the laminar shelf of plate did not fit into the elevated lamina, so we inserted it with a little bit of force. But the patient's symptom was not improved. On CT image, the inner cortical bone of the lamina was fractured. To prevent these complications, surgeons need to consider the thickness of the lamina and the size of the laminar shelf before surgery.

Key Words: Bone plate, Laminoplasty, Postoperative complications, Spinal cord compression

Cervical laminoplasty is standard treatment for multi-level spinal canal stenosis caused by cervical spondylotic myelopathy (CSM), and ossification of the posterior longitudinal ligament (OPLL).^{1,2} Open-door laminoplasty was developed by Hirabayashi et al.² in 1977 is one of the most popular surgical methods that provides adequate decompression of the spinal cord over multiple segments and reconstructs the stable laminar arch with sufficient space for the spinal cord. Many techniques have been reported to fix

elevated lamina in open-door laminoplasty, such as traditional facet joint suturing, anchor screw fixation, ceramic spacer and plate fixation.³⁻⁶ Plate fixation method provides better clinical outcomes than other methods based on published articles.^{5,7} Various types of plate have been developed and used, such as plates with spacer, expandable plates, and plates with or without laminar shelf.

Unlike other plates, plates with laminar shelf allow for easy fixation to elevated lamina. And

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there is also the plate with wider laminar shelf to accommodate thick lamina comfortably. This design affords an initial resistance to displacement of either the plate or the lamina as the “mouth” of the plate accepts the cut edge of the lamina.⁸ Despite this advantage, the use of an inadequate plate due to ignorance of the patient’s lamina thickness can cause significant complications that may lead to cord compression. We introduce rare complications related to the plate for the first time.

CASE

CASE 1

A 56 years old man with no medical history visited with gait disturbance that started one month ago. Neurological examination revealed upper arm radiating pain that did not follow definite dermatome and upper motor neuron signs such as abnormal tandem gait, a positive sign of Hoff-

man, Babinski, and Lhermitte.

Ossification of the posterior longitudinal ligament (OPLL) from C4 to C7 with myelopathy was diagnosed on magnetic resonance imaging (MRI) and computer tomography (CT). So open-door laminoplasty using the plates was performed from C4 to C7. At surgery, we used a plate with wider laminar shelf, since the elevated spinal lamina did not enter the laminar shelf of the plate well.

During follow-up one year after surgery, the patient’s symptom had not improved so we conducted imaging evaluation. In MRI and CT, cord compression due to shelf of plate was observed (Fig. 1), so the plate was changed. Unfortunately, there was no obvious improvement in symptoms after revision surgery.

CASE 2

A 71 years old man with lung cancer was referred for gait disturbance and right leg weakness. On physical examination, motor grade of the right leg was grade 3 and upper motor neu-

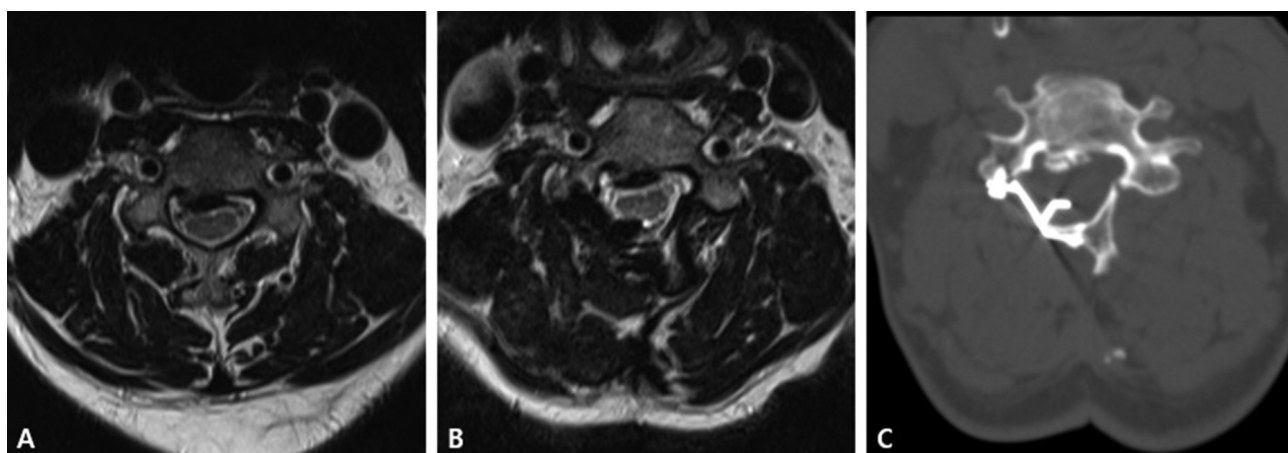


Fig. 1. (A) Spinal cord compression due to OPLL on the pre-operative magnetic resonance image. (B) Spinal cord compression and subtle signal intensity change of spinal cord were identified on the magnetic resonance image. (C) The wide lamina shelf of plate protruded into the epidural space on computed tomography image.

ron signs were revealed. On MRI, segmental OPLL from C2 to C5 with myelopathy was diagnosed and laminoplasty was performed. The shelf of the plate did not fit into the elevated spinal lamina, so we inserted it with a little bit of force. After surgery, there was no improvement in the patient's symptoms. So we conducted imaging evaluation. On CT, we identified that the inner cortical bone of the lamina was fractured, and spinal cord was compressed by the fractured fragment (Fig. 2). Reoperation for fractured inner cortical bone removal and plate reposition was performed. Two weeks after surgery, the patient's right lower leg motor grade was restored to grade 4.

DISCUSSION

Among various methods of laminoplasty, unilateral open-door laminoplasty, introduced by Hirabayashi et al., has been considered easy and safe procedure because of its indirect decompression

of the spinal cord and it provides sufficient space for the spinal cord to drift away from a osteophyte, OPLL or herniated disc.⁹

There are various methods for unilateral open-door laminoplasty. Suture system is always present with potential risk of closure of the open lamina due to lack of rigid fixation.^{3,10} There are also spacer systems such as bone struts, hydroxyapatite, and glass ceramic to prevent closure of lamina.^{4,6} However, spacers are not rigidly fixed, and risk of spacer dislocation exists. This dislocation may cause door reclosure as well as injury of the spinal cord or nerve root.¹¹ In recent years, titanium plate fixation system has been developed in open-door laminoplasty. Compared to suture and spacer fixation, the plate system provides more rigid support and preservation of an enlarged spinal canal.⁹

Among many plate fixation systems, plate with laminar shelf is the most commonly used. That plate has two special parts of design. First, a laminar shelf of plate allows for easy fixation to the cut edge of the lamina. And there is plate with

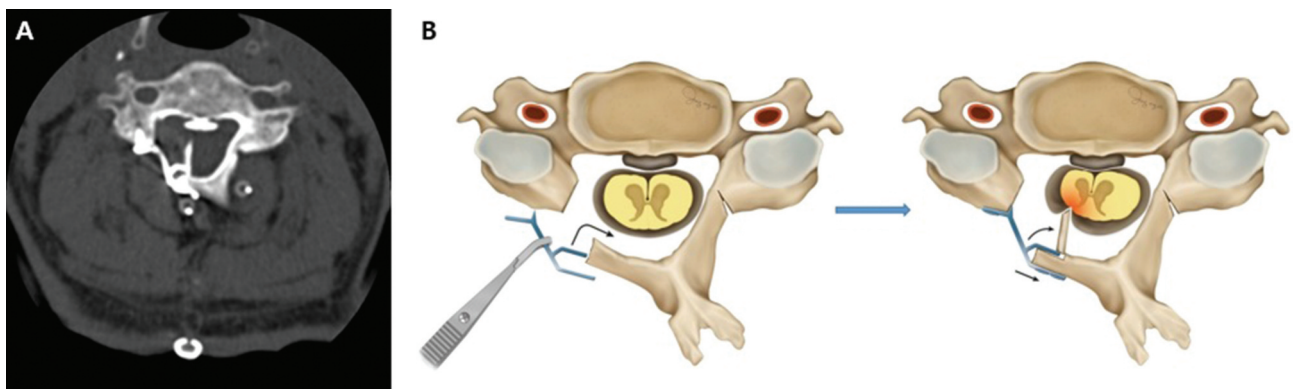


Fig. 2. (A) Inner cortical bone fracture with epidural space invasion was shown on the computed tomography. (B) An illustration cord compression caused by inner cortical bone fracture. Inner cortical bone fracture was caused by using a smaller laminar shelf plate than a laminar size.

wider laminar shelf to accommodate thick lamina comfortably. Second, kickstand design of plate allows it to be placed on the cut edge of the lateral mass stably (Fig. 3). So open door laminoplasty using the plate with laminar shelf has been a feasible method to resolve reclosure of the lamina and spacer dislocation issues.

Common reports on complications of laminoplasty have been wound infections, post-operative neck pain, post-operative kyphosis, hinge fracture and C5 nerve palsy. However, instrumentation-related complications have been rare.¹² Gabriel Liu et al.¹³ reported laminar screw back-out cases in laminoplasty, however, it did not associate with plate dislodgement or neurological complications. Chen et al.¹⁴ reported facet joint disturbance induced by mini-screws in plated cervical laminoplasty. This complication may not influence neurological recovery and spinal canal expansion. But in our cases, patients'

symptoms did not improve after surgery, and the patient with inner cortical bone fracture of lamina was observed to get worse.

Unilateral open-door laminoplasty is relatively easy to perform, but careful attention should be practiced to avoid complications such as ours, especially in the less experienced surgeons. It is advisable to check the thickness of lamina before surgery and consider the laminar shelf size of the plate to be used in advance. When using a plate with wide laminar shelf, it is necessary to consider if spinal cord compression will be caused by the shelf of the plate. And when the cut edge of the lamina does not fit naturally into the shelf of the plate, it is also necessary to consider the possibility of inner cortex fracture of the lamina. Additionally, patient's post-operative neurologic symptom get worse, it is important to evaluate the imaging test such as CT or MRI.

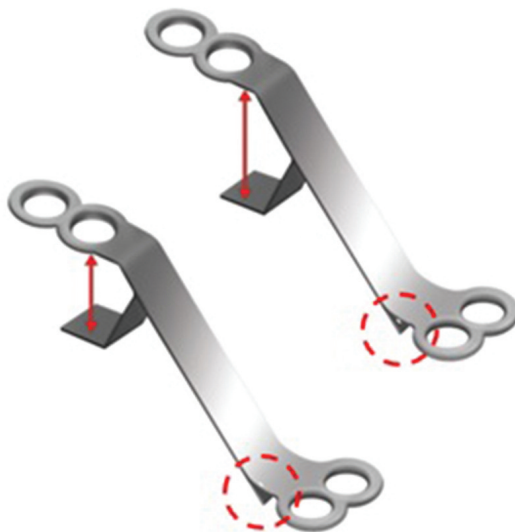


Fig. 3. An illustration of a plate with laminar shelf. It consists of two distinctive designs; lamina shelf (red arrow) and kickstand design (red dot circle) which allow stable positioning between the cut edge of the lamina and lateral mass.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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