

## Case Report



# Acute Quadriplegia after Lumbar Puncture in a Patient with Misdiagnosed Cervical Myelopathy

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### Conflict of Interest

The authors have no financial conflicts of interest.

## ABSTRACT

The incidence of quadriplegia following drainage of cerebrospinal fluid by lumbar puncture (LP) below a spinal occupying lesion is rare. We report a case of acute quadriplegia following LP for presumed normal pressure hydrocephalus (NPH) in a 66-year-old man. Acute cervical myelopathy with a herniated cervical disc was subsequently found on magnetic resonance imaging (MRI) at the C5–6 level. After posterior decompression and anterior cervical discectomy and fusion at the C5–6 level with a cervical plate, the patient's motor and sensory functions recovered. Clinicians should be aware that symptoms of NPH and cervical myelopathy may overlap, and that serious complications may occur when performing LP below a spinal lesion. As a safety measure, cervical spine MRI should be performed before LP.

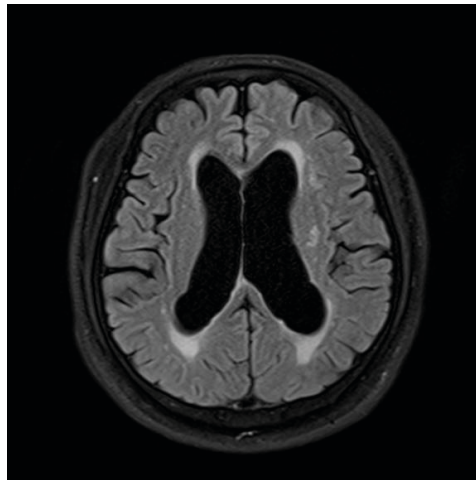
**Keywords:** Quadriplegia; Myelopathy; Lumbar puncture; Spinal cord injuries; Normal pressure hydrocephalus

## INTRODUCTION

Intracranial space-occupying lesions are well known as an important contraindication for lumbar puncture (LP).<sup>2,3)</sup> However, neurological deterioration after LP performed below a spinal space-occupying lesion is rarely recognized. Acute neurological worsening after LP has been reported in several spinal cord neoplasm cases.<sup>5)</sup> However, acute neurological worsening after LP in patients with cervical myelopathy with herniated discs has rarely been reported.<sup>2)</sup> Evaluation for spinal space-occupying lesions may be overlooked before LP is performed.<sup>14)</sup> In this case, symptoms of normal pressure hydrocephalus (NPH) and cervical myelopathy with herniated intervertebral disc overlapped,<sup>11)</sup> and acute neurologic deterioration occurred after LP drainage of cerebrospinal fluid (CSF) for the diagnosis of NPH.

## CASE REPORT

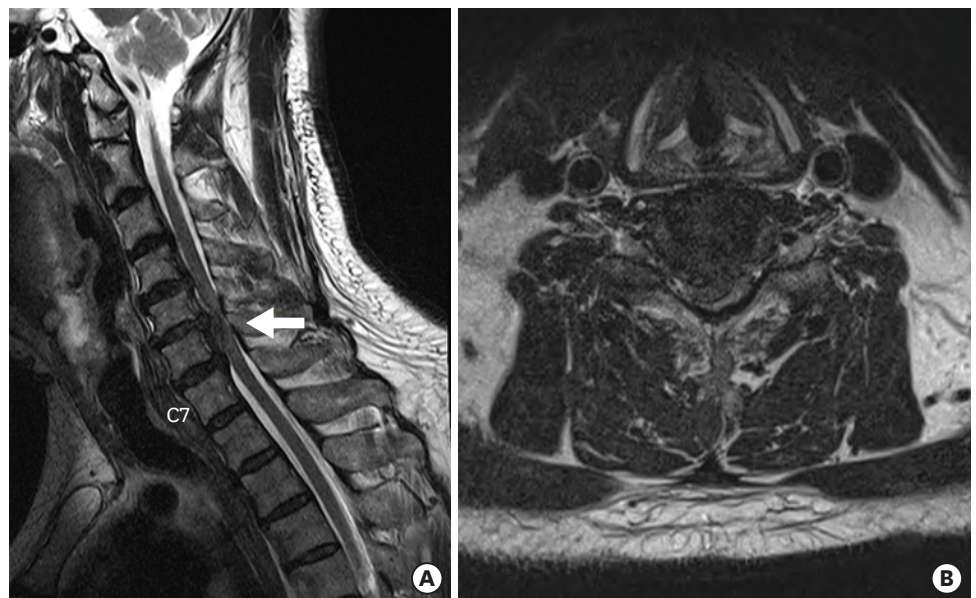
A 66-year-old man was admitted because of gait disturbance and weakness of both legs. The gait disturbance had gradually worsened for a month, and the patient was only able to walk slowly with cane assistance. General physical examination results were normal. On



**FIGURE 1.** Brain magnetic resonance imaging. T2-weighted axial image shows hydrocephalus.

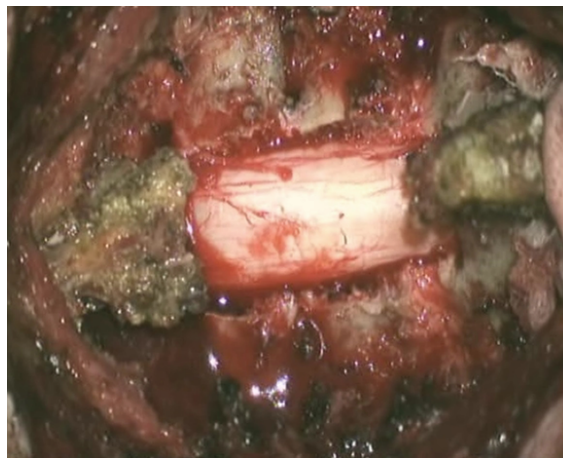
neurological examination, motor power of both upper and lower extremities was grade 4. Sensory examination was normal, and no pathologic reflex was found. At admission, magnetic resonance imaging (MRI) of the brain showed enlarged ventricles (**FIGURE 1**). CSF drainage by LP was planned to diagnose NPH.

LP was performed uneventfully at the L3–4 intervertebral space. Three hours after CSF drainage, the patient suddenly developed loss of sensation of both legs and weakness of both arms and legs. Five hours after LP, pain and temperature sensation was decreased below the T3 dermatome. Motor power was grade 1 for both hands and grade 0 for both legs. Anal tone was decreased. Cervical spine MRI showed a large herniated intervertebral disc at the C5–6 level and severe spinal cord compression with high signal intensity on T2-weighted images (**FIGURE 2**).

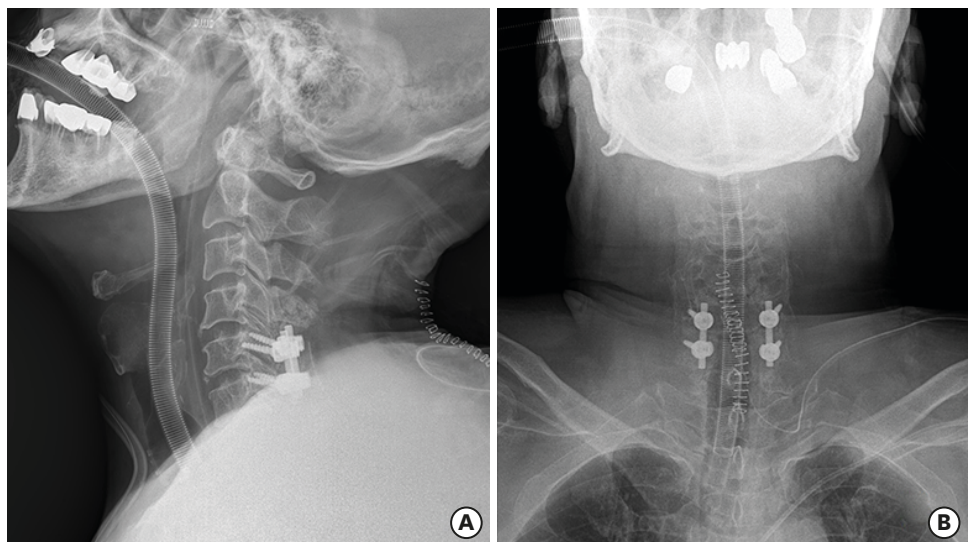


**FIGURE 2.** Preoperative cervical magnetic resonance imaging. T2-weighted sagittal (A) image shows compressed spinal cord with a high signal intensity change at C5–6 (white arrow). Axial image (B) shows a large ruptured disc herniation from center to right, compressing the spinal cord at C5–6.

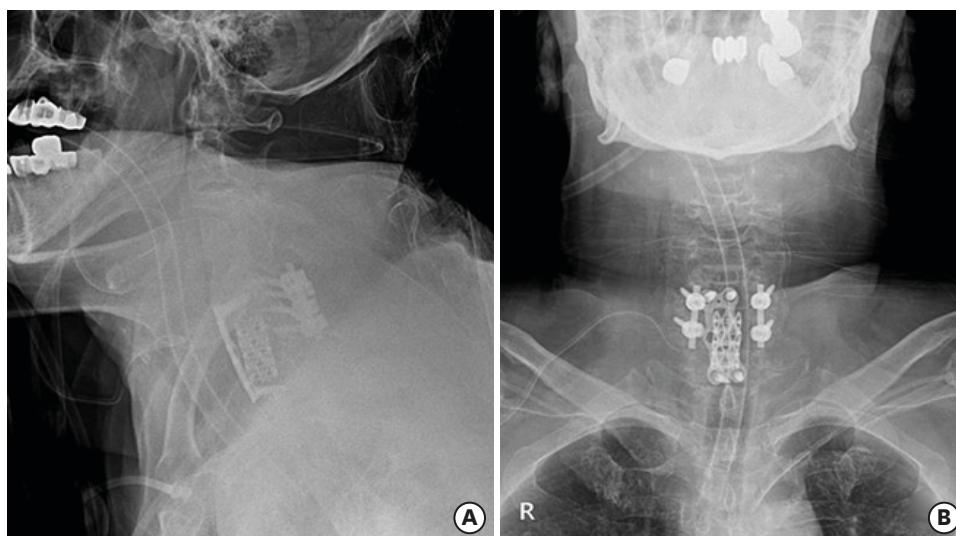
C5–6 spinal cord decompression was performed from the posterior approach for rapid decompression after a definite event. The thecal sac was swollen and thinned with an epidural hematoma (FIGURE 3). Lateral mass screw fixation and fusion were performed (FIGURE 4), followed by corpectomy of C6 and anterior cervical spinal fusion of C5–7 (FIGURE 5). The operative field showed sequestration of the ruptured intervertebral disc at C5–6 with an epidural hematoma (FIGURE 6). After surgery, the patient's motor grade recovered to grade 3 in both arms and legs, and hypoesthesia below the T3 dermatome recovered up to 70% compared to that before LP. The patient underwent rehabilitation therapy after discharge. The patient's motor power recovered to grade 4, and was able to walk with assistance.



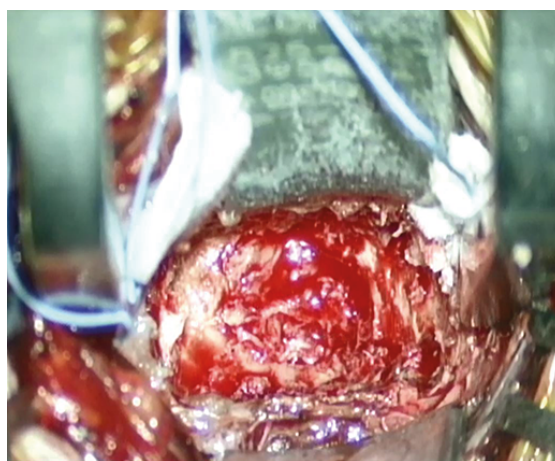
**FIGURE 3.** Intraoperative image of posterior decompression surgery. Image shows swelling of thecal sac with thinned dura.



**FIGURE 4.** Cervical spine radiography after posterior decompression surgery. Cervical lateral (A) and anteroposterior (B) radiographs show laminectomy and lateral mass screw fixation at C5–6.



**FIGURE 5.** Cervical spine radiography after anterior surgery. Cervical lateral swimmer's view (A) and anteroposterior (B) radiographs show fixed mesh cage after corpectomy at C6 and anterior plate fixation at C5–7.



**FIGURE 6.** Intraoperative view of anterior surgery. Image shows diffuse fragmentation of ruptured intervertebral disc with epidural hematoma behind body of C6 (removed).

## DISCUSSION

In this case, the patient presented with symptoms of NPH, but experienced acute quadriplegia after LP, which was determined to be the result of an underlying herniated disc with severe spinal compression. The risk of LP in the presence of increased intracranial pressure associated with mass lesions is relatively well recognized. However, the risk of complications in the presence of space-occupying lesions of the spinal cord is not well recognized.<sup>2,12</sup> Hollis et al.<sup>5</sup> reviewed 50 cases of spinal subarachnoid block after LP and reported that the incidence of neurological deterioration after LP below the level of spinal subarachnoid block was 14%.

There are several hypotheses regarding the mechanism of acute neurological deterioration after CSF drainage with spinal cord compression. Hollis et al.<sup>5</sup> explained that epidural venous engorgement was exacerbated by reduction of intrathecal pressure after CSF release. This



engorgement further compromises venous drainage from the spinal cord below the mass, resulting in cord swelling and increased compression.

Another mechanism was suggested by Doh et al.<sup>2)</sup> The presence of a spinal mass or any pathologic lesion that compresses the spinal cord or thecal sac may impair CSF flow. Above a pathologic lesion, CSF is produced and absorbed at normal rates that maintain pressure within a physiologic range. When the lesion completely blocks the CSF flow, the CSF space below the lesion becomes depressurized, creating a low-pressure compartment isolated from normal CSF space, which can be dangerous if LP is performed. Removing CSF by LP below the spinal subarachnoid block exacerbates pressure differences between the CSF spaces above and below the lesion, which can even cause herniation of parenchymal structures. This mechanism of action is also explained by Jooma et al.<sup>6)</sup> and Krishnan et al.<sup>8)</sup> with a term called “spinal coning.” Theoretically, CSF drainage should be performed only above the level of the lesion to prevent this pathological mechanism.<sup>10,11)</sup> However, CSF drainage at the upper spinal level above the lesion may cause serious complications.<sup>7)</sup>

Although key clusters of symptoms differ between cervical myelopathy and idiopathic NPH, both may show overlapping clinical presentations such as gait disturbance, particularly in the elderly.<sup>1,4,9,13)</sup> In this case, the 66-year-old patient had overlapping clinical findings of idiopathic NPH and cervical myelopathy, which led to the delayed diagnosis of cervical myelopathy. Naylor et al.<sup>11)</sup> reported the coincidence of idiopathic NPH and cervical myelopathy, suggesting that a screening MRI of the cervical spine should be considered in patients with suspected NPH.

## CONCLUSION

Gait disturbance and motor weakness of the lower extremities are commonly considered symptoms of NPH and cervical myelopathy in elderly patients. Performing LP below a spinal lesion causing a subarachnoid block can provoke dangerous complications. Clinicians must obtain a thorough history and perform neurologic examinations, and cervical spine MRI should be considered as a safety measure before performing LP.

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