

## Remote Cerebellar Hemorrhage after Spinal Surgery

Do Keun Kim, MD, Chong Oon Park, MD, PhD,  
Seung Hwan Yoon, MD, PhD and Dong Keun Hyun, MD, PhD

*Department of Neurosurgery, Inha University Hospital, School of Medicine, Inha University, Incheon, Korea*

This report details a case of a 56-year-old woman who presented with a herniated lumbar disc at L4-5 with congenital spondylolisthesis (grade II) and developed remote cerebellar hemorrhage following an iatrogenic acute reduction in cerebrospinal fluid (CSF) pressure during spinal interbody fusion. Possible mechanisms are discussed; however, pathological events leading to this complication are unclear. Intracranial hemorrhage (ICH) must be considered in patient presenting with unexplained neurological deterioration not attributable to the spinal surgery, especially when the dura has been opened followed by significant CSF loss. (J Kor Neurotraumatol Soc 2010;6:162-164)

**KEY WORDS:** Cerebellar hemorrhage · Spinal surgery · Cerebrospinal fluid.

### Introduction

Intracranial hemorrhage (ICH) after spinal surgery is extremely rare, but it is very serious clinical problem due to the location of the bleeding. Some authors suggest that remote cerebellar hemorrhage (RCH) occurs due to venous infarction, but the pathophysiology and etiology of this condition are unknown.<sup>5,12,13</sup> The widely assumed pathomechanism for this type of complication is a decrease in intracranial pressure due to loss of cerebrospinal fluid (CSF), which results in caudal shift of brain tissue, thus leading to traction and finally rupture of cortical blood vessel.<sup>2,13</sup> This type bleeding pattern includes blood in the sulci of one or both tentorial surface of cerebellum (zebra sign), ICH and ventricular hemorrhage.<sup>2</sup>

We report a case in which a postoperative RCH occurred after spinal surgery, and discuss possible causative factors. The related pathomechanism and the diagnostic imaging findings and literature are reviewed and discussed.

### Case Report

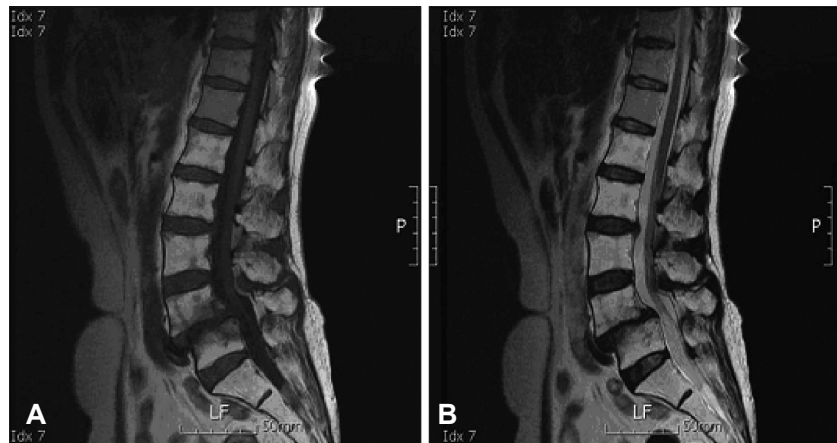
A 56-year-old woman presented with back pain and both leg pain. She had a history of radiotherapy and chemotherapy for cervix cancer 10 years ago. However, she had no other history of hypertension, trauma, coagulopathy. Magnetic resonance image (MRI) of lumbar spine showed the congenital spondylolisthesis (grade II) with disc herniation (Figure 1). During the operation of the spinal fusion under the prone position, the dura mater was breached accidentally, and gushed out approximately 80 mL of CSF before the dura closed water-tightly. After confirmed no CSF leakage, a Jackson-pratt drain was placed in the surgical bed and connected percutaneously to Hemovac suction under positive pressure. When the patient awoke from anesthesia, she was neurologically intact. In the first 24 hours after surgery, the drain drained 700 mL of blood with serosanguinous fluid. She had mild headache and it was resolved when drainage of the wound was discontinued and by lying flat under the suggestion of intracranial hypotension. Forty three hours after surgery, she complained nausea and vomiting. On neurological examination, she had no new focal neurological sign and improved the leg pain. We thought that such symptoms may be as a complication of the Fentanyl and Zofran<sup>TM</sup> for postoperative back pain and changed it with nonsteroidal anti-inflammatory drug. Two hours later, she became more disoriented and showed progressive dysarthria. Computed Tomography (CT) scan was done and it demonstrated compression of the fourth ventricle by a predominantly right-

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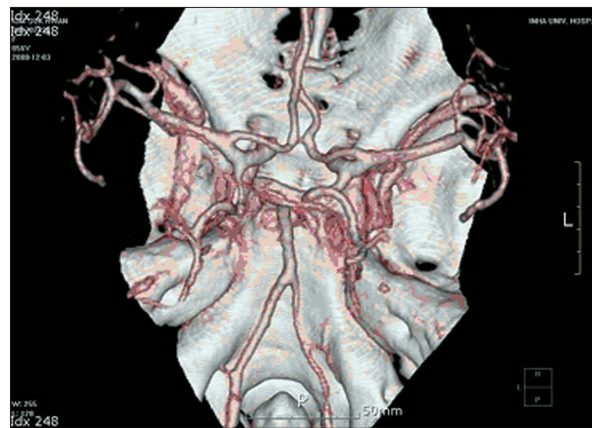
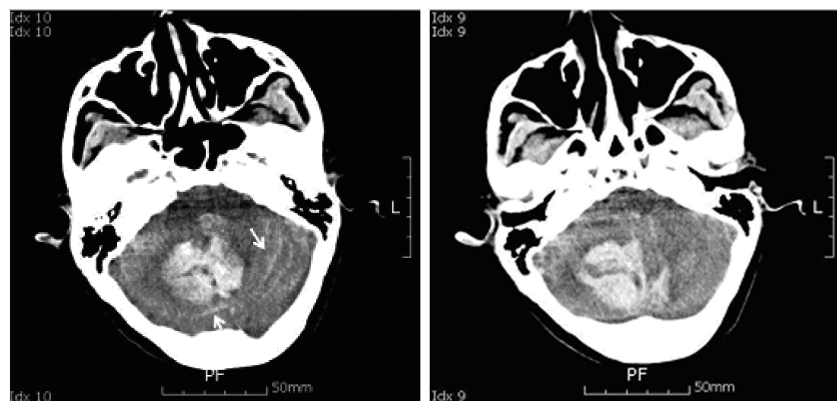
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**Address for correspondence:** Chong Oon Park, MD  
Department of Neurosurgery, Inha University Hospital, School of Medicine, Inha University, 7-206 Sinheung-dong 3-ga, Jung-gu, Incheon 400-711, Korea  
Tel: +82-32-890-2370, Fax: +82-32-890-3560  
E-mail: nspco@inha.ac.kr

**FIGURE 1.** Sagittal T1-weighted MR image (A) and T2-weighted MR image (B) show spondylolisthesis (grade II) with herniated disc at L4-5 level. Whole lumbar vertebral body shows the fat marrow change on T1- and T2-weighted MRI.



**FIGURE 2.** Axial CT scan obtained 45 hours after lumbar surgery, reveals large intracerebellar hemorrhage (central to right) with a streaky, curvilinear bleeding pattern in the cerebellar sulci (arrow).



**FIGURE 3.** CT angiography shows no specific abnormal vascular lesion.

sided ICH with edema, ventricular hemorrhage, and subarachnoid hemorrhage (SAH) with mass effect (Figure 2). Emergency operation was performed for removal of hematoma and posterior fossa decompression. Ventriculostomy was also performed. On the operation field, there were no specific arterial bleeding sources, but venous oozing between the cerebellar tentorium and upper portion of the cerebellum was noticed. Cerebellar hematoma was orga-

nized, which showed bleeding may be occurred from at least 1 day ago.

Postoperative coma therapy has been performed for 5 days. CT angiography was performed for detecting vascular lesions, which showed no specific findings (Figure 3). Followed brain MRI showed the fluid collection and low signal change at both hemisphere (right>left) with moderate hydrocephalus (hydrocephalic index=45%).<sup>10)</sup> Ventriculoperitoneal shunt was performed.

At 10 months after surgery, although she can't walk by herself, she can move by a wheelchair and communicate with us by a simple sentence.

## Discussion

RCH is an infrequent complication resulting from lumbar spinal procedures. The phenomenon was first described by Chaddock<sup>4)</sup> in 1981, after cervical laminectomy in which the dura was opened widely and the dentate ligaments were sectioned while the patient was in a sitting position. The author proposed that the gradient between the intravascular pressure and the CSF pressure might have increased in the sitting position followed by brain displace-

ment and vascular stretching, which would contribute to the development of hemorrhage. Some authors proposed that extensive CSF loss may cause down-ward displacement or "sag" of cerebellum and stretching of the superior vermian veins and their tributaries.<sup>1-3,7)</sup> Hemorrhage may occur as a consequence of venous tears caused by stretching or venous obstruction because of kinking of draining veins.<sup>1,7,13)</sup> Most recently, Thomas et al.<sup>12)</sup> reported a case in which supratentorial and infratentorial intraparenchymal hemorrhage developed after spinal surgery. There are various explanations of the pathogenesis of this complication; 1) an excessive loss of CSF because of intraoperative aspiration or drainage with infratentorial venous stretching and rupture secondary to upward cerebellar herniation, 2) pre-existing coagulopathies, 3) arterial systemic hypertension, 4) venous obstruction from extreme head rotation, 5) vascular anomalies, 6) anticoagulant therapy, 7) neoplastic angioma. But most authors mention excessive CSF loss as the most likely cause of RCH.<sup>1-9,11,12)</sup>

On our case, the dura was inadvertently opened on the operation and there was CSF leakage through a drainage catheter postoperatively. We thought this case supports the association between low CSF pressure and cerebellar hemorrhage remote from the operative site. With the abrupt loss of CSF that may occur during and immediately after spinal surgery, collateral venous drainage would not have time to develop. This may cause intracerebellar hemorrhage in patients with insufficient venous collaterals.

Brain CT scan showed the ICH in the upper vermis with SAH (atypical "zebra sign").<sup>2)</sup> On the operation field, there were no specific arterial bleeding source, but shown organized ICH with venous oozing between the cerebellar tentorium and upper portion of the cerebellum. We suspect that this RCH may be originated from venous system by the pressure gradient on the operation.

CT scanning is the neuroradiologic investigation with most practical value in patients with cerebellar hemorrhage, but may not be diagnostic in the case of early cerebellar infarction.

The treatment of acute cerebellar hemorrhage can be operative or conservative. This depends on the size of hematoma and patient's condition. Small amount of RCH can be managed medically, but a large amount of acute cerebellar hemorrhage with progressive brain stem dysfunction has a mortality that approaches 95% without sur-

gical decompression.<sup>1)</sup>

## Conclusion

In patient with persistent symptoms of headache and nausea after spinal surgery in which the dura has been opened, the diagnosis of intracranial hemorrhage should be considered. Such patient should undergo immediate neurological examination and CT investigation under the diagnosis of intracranial hemorrhage. Small amount of RCH can be managed medically, but monitored with serial imaging. A larger lesion with mass effect must be treated surgically.

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