

## Case Report

## Delayed Occurrence of C3 Vertebra Anterior Subluxation Diagnosed after Surgery for Epidural Hematoma

### Abstract

A case of delayed occurrence of C3 vertebra anterior subluxation diagnosed 10 days after surgery for epidural hematoma is herein described. A 56-year-old man underwent surgery for right epidural hematoma. No spinal fracture was identified on the cervical–spinal computed tomography (CT) on arrival. The patient developed neck pain after the craniotomy, and cervical magnetic resonance imaging 5 days postoperatively revealed a disruption of the C3–C4 posterior ligament complex. The patient was conservatively treated with immobilization. Cervical CT 10 days postoperatively revealed C3 vertebra anterior subluxation. Posterior fixation surgery was performed 21 days after admission, and the postoperative course was uneventful. This case suggests that awareness of delayed occurrence of cervical dislocation after traumatic intracranial hemorrhage should be increased among neurosurgeons.

**Keywords:** *Delayed cervical subluxation, posterior fixation surgery, traumatic intracranial hemorrhage*

### Introduction

In Japan, there are many facilities in which patients with head trauma are treated predominately by neurosurgeons. When head trauma is accompanied by intracranial hemorrhage (ICH), patients with even mild symptoms are admitted directly to the department of neurosurgery because of the risk of delayed deterioration.<sup>[1]</sup> Therefore, neurosurgeons must be careful to avoid overlooking spinal injury in such patients. The incidence of delayed or missed diagnosis of spinal trauma has decreased in recent years, with developments in radiological diagnostic examination tools including computed tomography (CT) and magnetic resonance imaging (MRI).<sup>[2]</sup> Nevertheless, incomplete radiological studies and misinterpretation sometimes result in delayed or missed diagnosis. We recently experienced a patient in whom C3 vertebra anterior subluxation was diagnosed 10 days after craniotomy for the treatment of an epidural hematoma. We herein report this case to increase awareness of delayed occurrence of cervical dislocation after traumatic ICH among neurosurgeons.

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### Case Report

A 56-year-old man fell from a height of 2 m and was brought to our hospital. His consciousness level on arrival was depressed (Glasgow Coma Scale score of 10), and he exhibited left hemiparesis. Cranial CT revealed a right epidural hematoma and linear skull fracture [Figure 1a and b]. Scalp swelling was prominent in the right temporooccipital region, and the patient was believed to have hit his head in this region [Figure 1a, arrow]. No spinal fracture was identified on cervical–spinal CT [Figure 1c and d]. The patient was admitted for emergency craniotomy, and removal of hematoma was performed. The postoperative course was favorable, his consciousness level returned to alert, and his left hemiparesis was alleviated. Two days postoperatively, however, he began to complain of neck pain that was exacerbated in weight-bearing postures such as sitting or standing. The neck pain gradually worsened, and cervical MRI was performed 5 days postoperatively. No abnormal finding was detected on T1- or T2-weighted imaging [Figure 2a and b];

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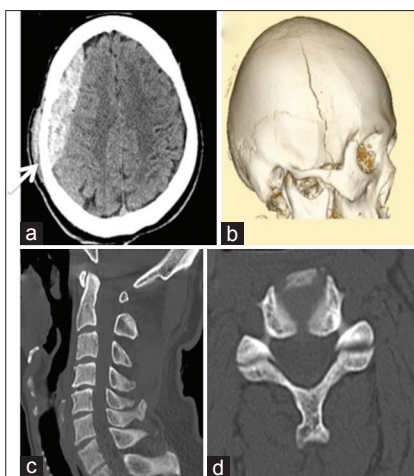
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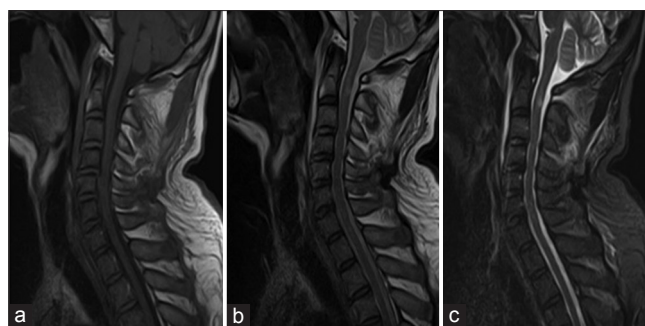
**Figure 1: Radiographic findings on arrival. (a)** Cranial computed tomography (axial view) showing a right epidural hematoma and prominent scalp swelling in the right temporooccipital region (arrow), (b) three-dimensional computed tomography showing a right linear skull fracture. No apparent spinal fracture was demonstrated on a (c) sagittal image of the cervical spine or (d) axial image at the level of C3–C4

however, high-signal intensity at the C4–C5 posterior ligament complex, including the inter- and supra-spinous ligaments, was demonstrated on T2 fat-suppression sagittal MRI [Figure 2c].

The patient was conservatively treated with immobilization in a rigid cervical collar and closely monitored neurologically and radiographically. Although neurological examination exhibited no muscle weakness and his sensory examination remained intact, cervical CT 10 days after surgery revealed C5 vertebra anterior subluxation [Figure 3a and b]. Posterior fixation surgery was performed 21 days after admission [Figure 3c and d]. The postoperative course was uneventful, and the patient's neck pain was alleviated. The patient was discharged 4 weeks after surgery with no neurological deficit.

## Discussion

Cervical spine dislocation is usually associated with disruption of the disc and posterior longitudinal ligament anterior to the cord, fracture of the posterior elements of the vertebra, and disruption of the surrounding ligaments.<sup>[3]</sup> Misdiagnosis of the cervical spine injury is less likely when an obvious bone wound is present. However, delayed instability and dislocation have been reported in cases, in which an obvious bone wound was not confirmed.<sup>[2,4-7]</sup> We have herein described the first reported case of delayed cervical subluxation diagnosed after surgery for traumatic ICH. The initial head CT of this patient demonstrated scalp swelling in the right temporooccipital region [Figure 1a, arrow]. Neurosurgeons must be aware of the site of head impact in patients with head trauma. When the occipital side of the head has been impacted as in our patient, distractive flexion cervical injuries should be considered even if the cervical CT findings are normal

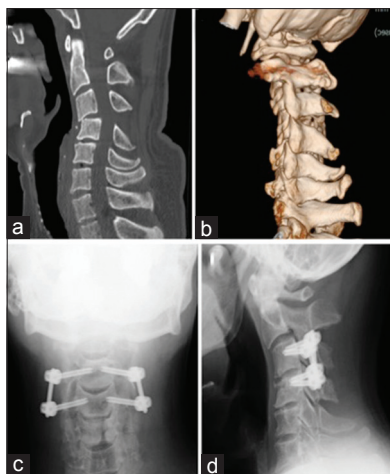


**Figure 2: Sagittal magnetic resonance images of the cervical spine** obtained 5 days after craniotomy. No abnormal findings were detected on (a) T1-weighted imaging or (b) T2-weighted imaging, (c) high-signal intensity was shown at the C3–C4 posterior structure on T2 fat-suppression sagittal magnetic resonance imaging, suggesting a posterior ligament complex injury

because such patients may develop posterior ligament complex injuries and consequently delayed subluxation.<sup>[2,3]</sup>

For acutely injured patients with a normal level of consciousness, we typically perform evaluation of bony structures by a three-view radiographic study as recommended by the American College of Surgeons Committee on Trauma guidelines.<sup>[8]</sup> Even in case radiographic findings are normal, soft cervical collar is used if patient complained of neck pain or midline tenderness and further examination including MRI or flexion and extension radiographs is considered. Patients with traumatic ICH usually treated by neurosurgeons present many obstacles to the use of this methodology. The initial radiographic studies are often inadequate because of the interference of concurrent therapies and positioning restrictions. In addition, the patient's condition precludes reliable assessments of pain or subtle neurological deficits. As a general rule in our hospital, cervical radiology or cervical spine CT is performed for patients with traumatic ICH. Suspicion of an injury of the posterior cervical ligament complex using only static radiographic studies, including cervical CT, may be insufficient to permit an exact diagnosis and determine proper management.<sup>[3,9]</sup> Importantly, MRI also has a high false positive rate in detecting cervical instability.<sup>[7]</sup> For patients with traumatic ICH in whom no obvious bone wound is detected on the initial spinal CT, flexion and extension radiographs should be carefully obtained to avoid neurological deterioration, especially when the patient begins to complain of cervical neck pain or when recovery of consciousness is not recognized.<sup>[9]</sup>

Surgical treatment of subluxation includes reduction with proper alignment of the vertebral bodies and then stabilization of the affected segment either by an anterior or posterior approach or by a combined approach involving both.<sup>[10,11]</sup> Facet joint subluxation with accompanying intervertebral disc herniation should be reduced after the herniated intervertebral discs have



**Figure 3:** (a) Sagittal image and (b) three-dimensional reconstruction of cervical computed tomography 10 days after surgery demonstrated C3 vertebra anterior subluxation, (c) anteroposterior and (d) lateral XP radiographs after posterior cervical fixation surgery

been removed through an anterior approach to prevent exacerbation of neurologic symptoms.<sup>[12]</sup> If satisfactory results are achieved with reduction after removal of the herniated discs through an anterior approach, then anterior fixation and fusion can be performed. However, most patients have fibrous fusion of facets, which may not be visible radiologically.<sup>[10-12]</sup> Disc hernia was not identified in the present case; therefore, we chose posterior fixation. Various techniques and instrumentation options are available with regard to posterior stabilization of the subaxial cervical spine.<sup>[13]</sup> Two methods have recently become more common: the lateral mass screw (LMS) technique and the cervical pedicle screw (CPS) technique.<sup>[13]</sup> Based on the available literature, the rates of perioperative neurological and late biomechanical complications, including pseudarthrosis, are similarly low for both the LMS and CPS techniques.<sup>[13]</sup> Statistically, vertebral artery injuries occur with a higher incidence when using the CPS technique; however, they are still extremely rare.<sup>[13,14]</sup> In the present case, we used the CPS technique because it can be four times stronger than the LMS technique and has been safely performed in our department in the past.<sup>[15,16]</sup> Delayed or missed diagnosis of the cervical spine injury occurs with an incidence of 5% to 20% according to the previous studies.<sup>[17]</sup> Prompt and accurate diagnosis of the cervical spine injury is important to prevent the catastrophic results that can be caused by undetected lesions. The possibility of delayed cervical dislocation should be considered in patients with traumatic ICH even if their cervical CT findings are normal on arrival.

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#### Conflicts of interest

There are no conflicts of interest.

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