

Case Report



Delayed Unilateral Facet Interlocking After a Stable Superior Articular Process Fracture of the Cervical Spine: A Case Report

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Conflict of Interest

The authors have no financial conflicts of interest.

ABSTRACT

A 42-year-old man presented with neck pain after a fall from a tree. Spine computed tomography (CT) illustrated the right C5 superior articular process fracture without displacement. Magnetic resonance imaging (MRI) confirmed the fracture and injury of the posterior ligament complex. Initially he was managed conservatively with a neck brace as there were no signs of instability or vertebral body misalignment. However, three days after discharge, right shoulder weakness and numbness of the right upper arm became prominent. X-rays and CT showed anterior slippage of the C4 vertebral body and locked C4/5 facet – a fractured bony fragment of the C5 superior articular process was pushed forward by the locked inferior articular process of C4 and invaded the neural foramen. Anterior cervical discectomy and fusion (ACDF) was performed using allograft and plate/screws fixation. Although initial imaging showed no evidence of subluxation, surgeons should be aware of occult instability and the possibility of delayed dislocation associated with the unilateral cervical facet fracture.

Keywords: Facet joint; Spinal fractures; Cervical spine

INTRODUCTION

Unilateral cervical facet injuries comprise around 6% of all cervical spine injuries.²⁾ It has a spectrum from fracture, subluxation/dislocation to a combination of these.²⁾ Minimally or non-displaced superior articular process fracture represents about 35% of this type of injury and is mostly treated non-operatively.²⁾ However, when facet fracture is combined with facet joint dislocation, its outcome becomes worse than fracture-alone cases and usually, surgical treatment is recommended. While previous studies reported concomitant fracture-dislocation cases, delayed development of subluxation/dislocation after nondisplaced unilateral facet fracture has not been explained explicitly, including its epidemiology, timing for intervention, ideal follow-up interval, and consensus management. Because unilateral facet fracture-dislocation can lead to pain, deformity, or even catastrophic neurologic deficit, this issue needs to be addressed.⁷⁾ Here, we describe a rare case of stable unilateral cervical facet fracture aggravated by delayed dislocation and locking, treated with anterior cervical discectomy and fusion (ACDF).

Presentation

This research presented in the 62nd Annual Meeting of the Korean Neurosurgical Society.

CASE REPORT

A 42-year-old man, a lumberjack, presented to the emergency department with headache and neck pain after injury from a tree fall. He lost consciousness for about one minute at the moment of the accident. The patient's Glasgow Coma Scale score was 15. Pupillary light reflex was 3 mm prompt. He had a history of craniotomy for arteriovenous malformation (AVM) removal 5 years ago due to an AVM rupture at the left parietal area.

Cranial and cervical spine CT illustrated acute subdural hemorrhage in the right frontal with a maximum thickness of 9 mm and comminuted skull fracture involving bilateral parietal bone. Also, the right C5 superior articular process fracture without displacement was observed (**FIGURE 1**). Cervical magnetic resonance imaging (MRI) confirmed the fracture and injury of the posterior ligament complex (**FIGURE 2**). As the patient exhibited minimal neurologic deficit except for mild weakness of the right shoulder abduction and subsequent dynamic c-spine X-rays showed no signs of instability or vertebral body misalignment, conservative care with a neck brace was decided (**FIGURE 3**). He was discharged on post-injury day 8.

However, on the outpatient clinic follow up at three days after the discharge, the weakness of the right shoulder abduction (grade III+) and paresthesia of the right upper arm C5 dermatome became more prominent. X-rays and CT showed anterior slippage of the C4 vertebral body and locked C4/5 facet with ipsilateral facet fracture – a fractured bony fragment of the C5 superior articular process was pushed forward by the locked inferior articular process of C4 and invaded the neural foramen (**FIGURE 4**). Closed reduction was achieved through the extension of cervical spines by placing the (towel) roll underneath the neck. Pre-operative MRI confirmed the successful reduction and ACDF without reduction procedures was planned.

Usual Cloward type ACDF between C4 and C5 was performed with allograft and plate/screws fixation. Intra-operative findings show no annulus or ligament tear surrounding the C4-5 disc space. Immediate post-operative x-rays and CT showed good vertebral body alignment and reduction of displaced segment (**FIGURE 5**). Postoperatively, neurologic symptoms of weakness improved to IV+ and paresthesia was resolved.

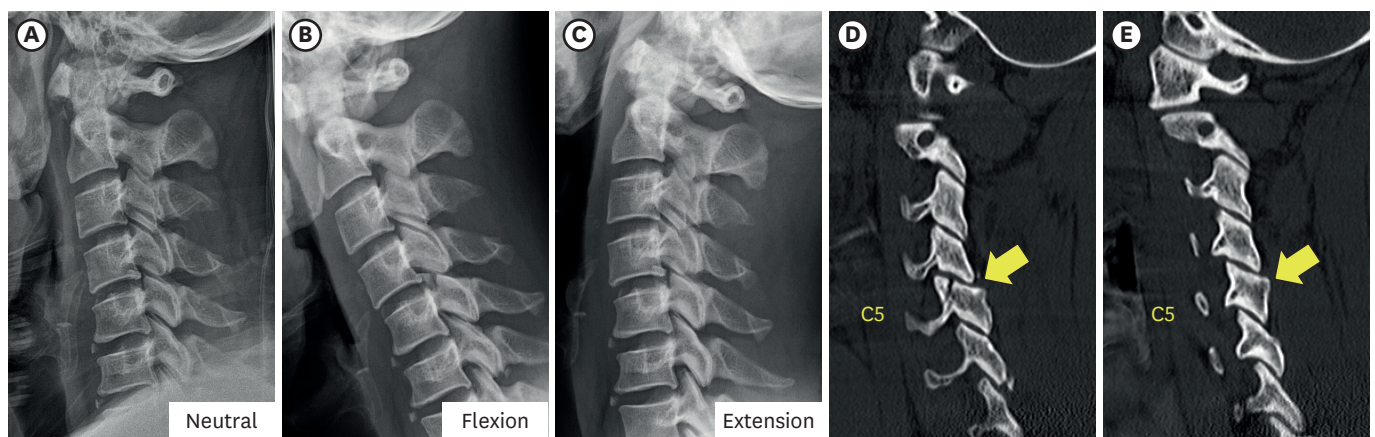


FIGURE 1. Initial presentation of the patient. Initial C-spine lateral X-ray (A), flexion (B), extension (C). Sagittal image of C-spine CT on injury day showed right C5 superior articular process fracture without displacement and dislocation (D). Contralateral, left facets were all intact (E). Yellow arrow: C5 vertebra.

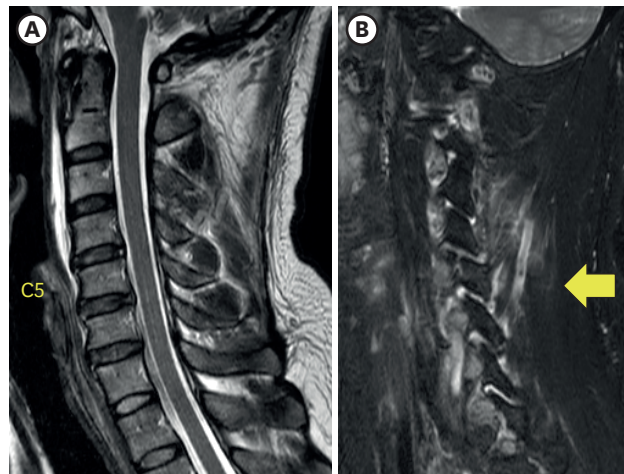


FIGURE 2. Associated injuries exhibited by magnetic resonance imaging. (A) Mid-sagittal section of cervical T2 magnetic resonance imaging showed no evidence of disc injury or herniation. Anterior and posterior longitudinal ligaments were not injured. (B) Fat saturated T2 sequence on post-trauma day 2 showed posterior ligament complex injury (yellow arrow).

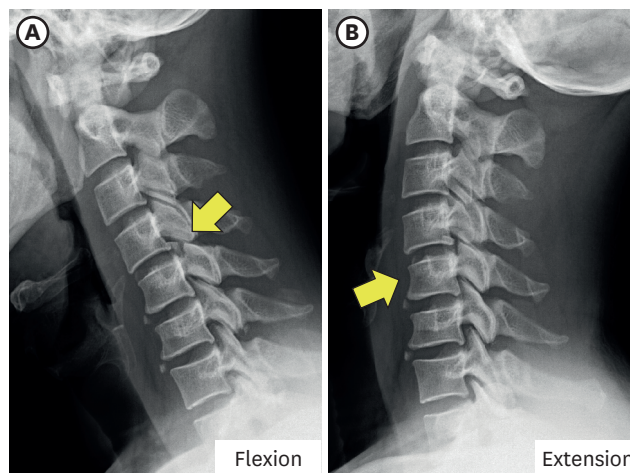


FIGURE 3. C-spine dynamic X-ray images before the discharge. Flexion (A) and extension (B) images showed no sign of dislocation or subluxation (yellow arrow: C5 vertebra).

Patient consent

The Institutional Review Board of Jeju National University Hospital waived patient consent for this case report submission.

DISCUSSION

Facet dislocation of the cervical spine due to facet fracture can be led to spinal cord injury that causes even paraplegia. It is, therefore, critical to manage this injury properly to prevent such neurologic complications. However, still, considerable controversy exists regarding the technique of reduction and fixation for facet dislocation.⁵⁾ While cervical facet fractures with concomitant facet dislocation or interlocking have been reported on a frequent base, “temporal change from non-displaced fracture to dislocation” like our case has rarely been described. This case brings up this often-missed point to address the issue of delayed dislocation.

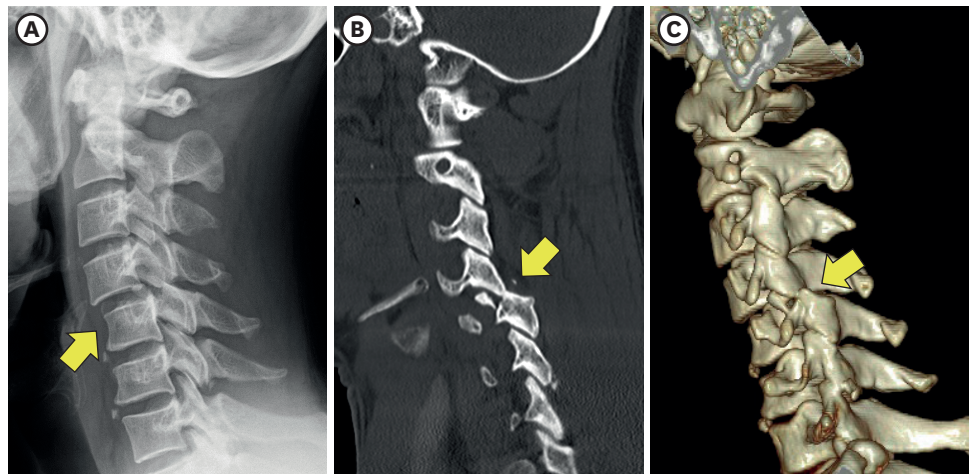


FIGURE 4. Facet fracture aggravated to facet interlocking. Cervical lateral X-ray (A), sagittal images (B) and 3D (C) of CT on 3 days after discharge showed anterior slippage of C4 body with unilateral facet interlocking and a bony fragment of C5 superior articular process was pushed forward by locked inferior articular process of C4 encroaching the neural foramen (yellow arrow: A) C5 vertebra B&C) locked facet of C45).

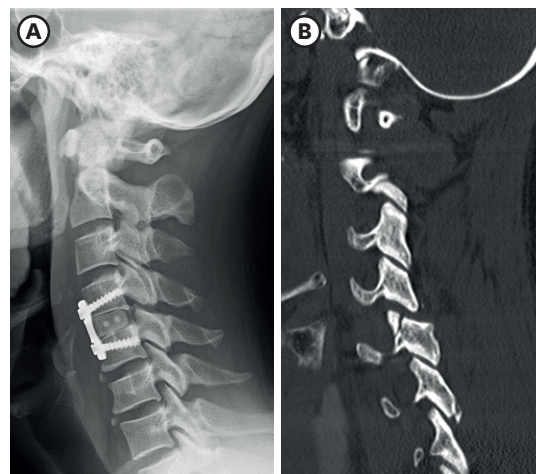


FIGURE 5. Post-op imaging. Post-op cervical lateral X-ray (A) and sagittal CT images (B) showed that vertebral bodies are in good alignment and the fracture fragment is in place.

Previous studies suggested that nondisplaced or minimally displaced unilateral facet fractures without dislocation do not require surgery and non-operative treatments are enough. However, 21 to 80% of these fractures failed to be treated only with non-operative management.^{4,6,11} In a study by Spector and Vaccaro et al. on unilateral facet fractures managed without surgery, it was found that 5 of the 24 patients later needed surgery due to either a shift in the fracture position or the onset of radiculopathy. Additionally, out of 6 patients who initially had radicular symptoms, 4 experienced no relief from their symptoms by the end of the study.¹¹ This study suggested that if a fracture affects 40% or more of the total height of the intact lateral mass, or if the height impacted is at least 1 cm, there is a heightened likelihood that treatment without surgery will not succeed. AO spine fracture classification also adopted these criteria.¹³ Our case corresponded to a nonoperative case using this method – the height of the fractured fragment was 8.41 mm and it was involving 37.9% of the height of the intact lateral mass. However, delayed dislocation occurred. This criterion for surgery just considered the size of the fracture segment and might not be enough

to predict hidden instability. Other factors influencing the stability of the cervical spine such as accompanying disc/ligamentous injury should be counted for surgical decision-making for unilateral facet fracture to prevent possible hidden instability. Numerous researchers have utilized MRI to more accurately diagnose injuries to soft tissues, including associated disc or ligament tears, which are indicative of instability in the affected segment. Halliday et al suggested ligamentous injury on MRI as a determinant or predictor for the risk of delayed dislocation.³⁾ Yet, it was observed that the posterior longitudinal ligament was not uniformly affected in cases of unilateral facet dislocations.¹³⁾ Subaxial Injury Classification (SLIC) is another popular tool to assess the necessity for surgery based on morphology, neurology, and integrity of the disco-ligamentous complex (DLC).¹²⁾ According to SLIC, “undisplaced, or minimally displaced lateral mass and/or facet fractures are categorized as compression injuries unless visible translation is noted between vertebral levels on a lateral plain radiograph or reconstructed sagittal CT image or sagittal MRI.” The initial presentation of our case matched this description. MRI of this case showed no evidence of disc injury or herniation or disc space widening but hyperintense signal of posterior ligament complex on fat-suppressed T2 indicated indeterminate ligamentous injury.¹²⁾ Also, the patient’s symptoms matched a root injury. Therefore, SLIC score was 3 (compression=1, indeterminate DLC=1, root injury=1), and nonoperative treatment was rendered. In short, applying previously established guidelines failed to predict the delayed dislocation and hidden instability of the patient.

Other possible predicting factors might help clinicians from missing the delayed dislocation and timing for surgical intervention. First, “rotational” element of unilateral facet fracture may need attention, even though it does not meet the SLIC’s criteria for rotation, which is relative angulation of $\geq 11^\circ$. The facet joint, in conjunction with its capsular structure, is integral to the maintenance of sub-axial stability, limiting both rotational and linear translation during physiological movements to preserve adjacent neural structures.¹⁴⁾ It is posited that unilateral facet injuries precipitate a characteristic pattern of rotational instability, manifesting as the rotation of the compromised facet and lateral mass complex about the axis of the uninvolved contralateral facet.¹⁾ Second, the mobility of involved segments should be considered. The C4-5 or C5-6 segments show the largest intervertebral ranges of flexion and extension and as C4-5 segment contributes the greatest angular motion.^{8,9,15)} When these segments are affected in lower cervical spine (C3 through C7) injuries, closer attention is needed. Mobility is also affected by age – naturally the younger, the more mobile. However, even in cases of the aged spine, focal segmental instability can be found in the intervening hypermobile segments between separated spondylotic or ankylosed immobile segments.¹⁰⁾ Further studies are needed to elucidate hidden factors for delayed dislocation and devise tools to determine the timing for surgical intervention.

CONCLUSION

As this case illustrates, delayed dislocation may occur in the case of unilateral facet fractures of the cervical spine. Especially when it is associated with young age and hypermobile segment such as C4-5 like this case, a short-term follow-up and radiologic check-up might be helpful for early identification and intervention before irreversible neurologic deterioration.

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