Traumatic C4-C5 Unilateral Facet Dislocation With Posterior Disc Herniation Above a Prior Anterior Fusion

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Abstract

We report the case of a unilateral cervical facet dislocation above the level of a prior non-instrumented cervical discectomy and fusion, resulting in incomplete neurologic injury. Pre-reduction imaging demonstrated a large posterior disk extrusion. This finding altered our management approach from closed reduction to urgent anterior cervical discectomy, open anterior reduction, and fusion. The patient had excellent neurologic recovery and outcome at 12 months postoperative follow-up.

A fused motion segment in the spine creates increased stress on neighboring segments when subjected to normal physiologic stresses,[1,2] which may contribute to adjacent level degeneration.[3] It follows biomechanically that supra-physiologic stresses, such as traumatic injury, would also be most concentrated at motion segments adjacent to previous fusions. We report an uncommon case of a unilateral cervical facet dislocation above the level of a prior non-instrumented fusion, resulting in an incomplete neurologic injury in conjunction with a large posterior disk extrusion. The patient provided written informed consent for print and electronic publication of the case report.

Case Report

A 55-year-old woman presented to the emergency department (ED) of our institution by ambulance following a motor vehicle accident in which she was the restrained driver of one of the vehicles. The surgical trauma team evaluated and stabilized the patient per institutional protocol. At presentation, she reported severe neck pain and numbness in both arms, the right extremity worse in severity than her left, though she was grossly able to move all 4 of her extremities. Her medical history revealed a prior C5-C6 disc herniation causing symptoms of myelopathy that was treated 10 years earlier with an uninstrumented C5-C6 anterior cervical discectomy and fusion.

Neurologic examination demonstrated an awake, alert patient with hyperreflexia in her bilateral biceps, a positive Hoffman's sign bilaterally, and 4/5 strength in her right deltoid. The patient stated that the Hoffman's sign had been present since her prior cervical disc herniation. Her neurologic examination was otherwise normal. The patient was placed in a rigid cervical collar and immediately underwent a computed tomography (CT) scan of her cervical spine, revealing a unilateral right C4-C5 facet dislocation (Figure 1). Her neurologic examination remained stable and unchanged while she was in the ED. A non-contrast magnetic resonance image (MRI) of her cervical spine was obtained prior to reduction. Results of the MRI are shown in Figure 2.

The MRI demonstrated significant posterior herniation of a large portion of the C4-C5 disc, which had migrated superiorly behind the body of the C4 vertebra. Due to the risk of acute cord compression with closed reduction, surgical decompression was recommended. We took the patient to the operating room urgently and performed a left-sided anterior approach to C4-C5 in order to remove the disc and decompress

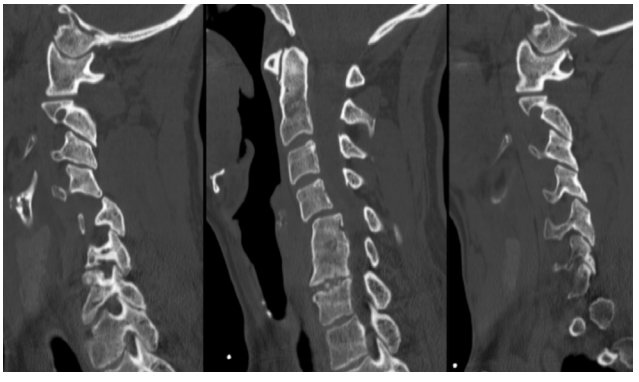

Figure 1. Sagittal reconstructions from the initial CT scan of the cervical spine demonstrating the right unilateral facet dislocation at the C4-C5 level. Note the "empty facet" sign.

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Am J Orthop. 2012;41(6):E85-E88.

Figure 2. Pre-reduction sagittal T2-weighted MRI of the C4-C5 posterior disc herniation with migration of disc material superiorly behind the C4 body.

the spinal canal through the disc space. Large fragments of disc were removed from behind the posterior body of C4 with the use of small curved curettes and pituitary rongeur. The posterior longitudinal ligament (PLL) was inspected and found to be intact. After discectomy was performed, Caspar pins placed in the C4 and C5 bodies were used to aid reduction while 13.6 kg of axial traction was progressively placed on the head using Gardner-Wells tongs. Reduction was assessed at each step with intra-operative fluoroscopy. With gentle distraction and posteriorly directed pressure on the superior Caspar pin, the dislocation reduced. This was confirmed with fluoroscopy (Figure 3). A sized allograft spacer was placed, traction was removed, and an inflatable IV pressure bag placed between the shoulder blades was inflated to increase cervical lordosis. An anterior plate was then applied to stabilize the C4-5 level. The wounds were closed and the patient was placed in a rigid cervical collar. Somatosensory evoked potentials were consistent and stable throughout the procedure.

Upon awakening from general anesthesia, examination revealed full strength in the patient's upper and lower extremities bilaterally with less subjective numbness in her right arm. Her bilateral Hoffman's signs persisted.

Postoperative upright radiographs demonstrated maintenance of reduction and hardware placement. She was discharged from the hospital 3 days postoperatively and maintained full strength in all of her extremities at 1-month follow-up, with no evidence of myelopathy except her baseline Hoffman's reflex. At 10 months after her injury, she was involved in another motor vehicle accident. At the time of that injury, a CT scan of her cervical spine was taken as part of her trauma work-up, which demonstrated solid fusion (Figure 4A). On clinical examination at 13 months following her initial injury, the patient reported no axial neck pain, and an unchanged neurologic exam. X-rays demonstrated maintenance of the C4-5 reduction, fusion, and instrumentation (Figure 4B).

Discussion

Fusion of one or more cervical motion segments has been shown to lead to increased concentration of stresses and abnormal motion in neighboring segments.[1,4-7] While this has been hypothesized to contribute to adjacent segment degeneration after a spinal fusion, it has not been studied or demonstrated in the setting of spinal trauma.

The combination of traumatic cervical instability in the setting of a previous fusion is uncommon, with a reported incidence of 5.4%.[8] Only a handful of cases of trauma in the setting of prior spinal fusion have been reported in the literature. There have been 2 reports of C6-C7 bilateral facet dislocation in patients who underwent thoracolumbar fusions for idiopathic scoliosis,[4,9] as well as a single case report of a patient fused from T2-L1 who suffered a fracture dislocation of L2 on L3 after a motor vehicle collision.[10] Neyt and Weinstein[10]

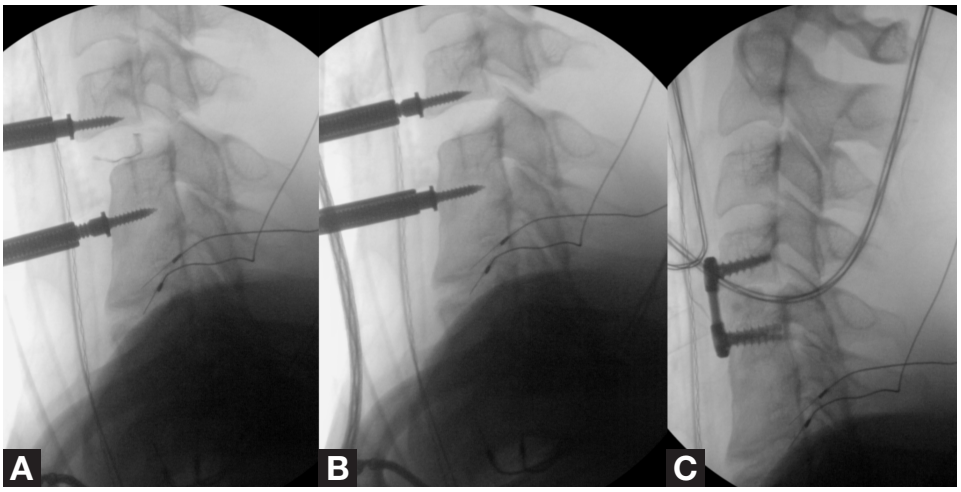

Figure 3. Sequential fluoroscopic images demonstrating open reduction with Caspar pin traction (A), followed by fusion with an allograft spacer (B), and anterior plate fixation (C).

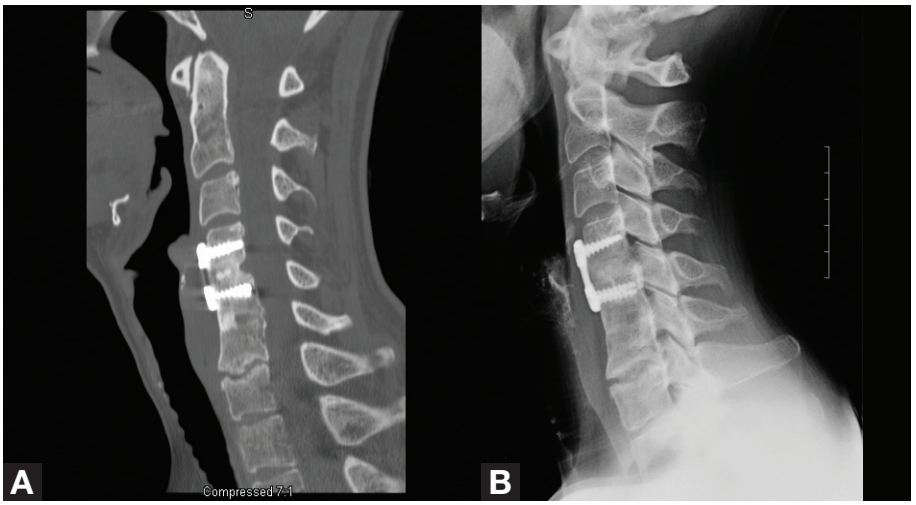

Figure 4. (A) A computed tomography scan obtained 10 months after the injury demonstrates bony fusion. (B) X-ray at 10 months post-surgery. The patient had neither neck or arm pain nor neurologic symptoms.

postulated that fusion of the thoracolumbar spine provided a rigid lever arm, concentrating the applied traumatic forces above and below the level of the fusion.

In terms of traumatic cervical instability adjacent to prior cervical fusion, Whitehill and colleagues[11] reported a single case of C4-C5 bilateral facet dislocation after a motor vehicle accident in a 21-year-old laborer who had undergone prior C5-C6 posterior fusion. The patient's fusion was extended after open reduction from a posterior approach; the patient was quadriparetic before and after surgery.

Aside from these case reports, Mac Millan and Stauffer[8] reviewed 15 cases of traumatic cervical instability in the setting of previous cervical fusion, whether from surgical fusion, degenerative ankylosis, or Klippel-Feil syndrome. The level of injury was within 2 levels of the fused segments in 14 of 15 patients, the authors noted. Patients with fusions at C4 and higher had a predisposition towards odontoid fractures. Of the 3 patients who were fused at C2-C3 and 1 patient fused at C3-C4, all sustained Type III odontoid fractures; 2 patients had associated fractures of the posterior arch of C1. The authors hypothesized that fusion of C2-C4 had eliminated significant flexion-extension, concentrating traumatic forces at the C1-C2 articulation. This same study also noted a specific fracture pattern in lower cervical spine fusions. In 9 trauma patients with fusions below C4, 7 suffered unilateral facet dislocations near the level of their fusion. The authors further hypothesized that the posterior ligamentous structures have less biomechanical strength in tension than the anterior structures.[8]

Thus, the bending and rotational forces in the cervical spine would lead to facet subluxation immediately adjacent to the fusion.[12,13] This was the observed pattern of injury in our patient, combined with the additional observation of a large posterior disc herniation at the level of injury.

Multiple studies using post-reduction MRI have shown that traumatic subluxations of the subaxial cervical spine is associated with disk herniations, with reported rates ranging widely from 9-77%.[14-18] Closed reduction of cervical facet dislocations has rarely been associated with neurological worsening, but several reports have indicated that the presence of disk herniation on pre-reduction imaging may be a cause for concern.[15,19-21] Eismont and colleagues[15] reported on 6 cases (out of 68 patients) of cervical facet subluxation with associated disc herniation. In 1 of the 6 cases, a posterior open reduction and fusion of bilateral facet dislocation resulted in catastrophic neurologic deterioration due to disc herniation. Although only 6 of 68 patients had a disc herniation in that series; the authors recommended that patients with partial neurologic injury in the setting of facet subluxation be evaluated by preoperative myelography or MRI. If disc herniation is diagnosed, the authors further recommended anterior decompression followed by reduction and fusion.

One caveat to this discussion is the debate over what defines a true disc herniation in the presence of cervical subluxation. In traumatic subluxation of the spine, the contours of the spinal canal are altered, and an apparent disc herniation may not substantially narrow the space available for the cord any more than restrictions conferred by the bony deformity. This phenomenon has been referred to as a "pseudodisc."[19-21] Other authors have pointed out that the contour of the ventral dura mater and PLL below the level of the dislocation is generally maintained. [21] Thus, a true disc herniation in the subluxated or dislocated spine is best defined as an extrusion of disc material posterior to the caudal vertebral body seen on sagittal imaging.[21] In either description, the disc herniation in this case meets criterion to be described as a true herniation or rupture.

For patients with true cervical disc herniations in the presence of traumatic subluxation, some authors have argued that closed reduction is still safe in an awake, alert patient.[22] In a series of 11 patients by Vaccaro and colleagues,[21] the incidence of disc herniation with facet subluxations was 18% pre-reduction and 56% post-reduction. Despite the presence of pre-reduction disc herniation in 2 patients, an awake, closed reduction did not result in neurologic worsening. Owing to the lack of clear and definitive clinical guidelines, many centers do not regularly obtain pre-reduction MRI scans in the setting of facet dislocations, and this issue remains controversial.

Conclusion

Currently, there is no clear evidence to determine whether traumatic dislocation of the spine adjacent to a prior fused cervical motion segment, which is an uncommon occurrence, is necessarily associated with a significant disc herniation. Furthermore, it is unclear whether the presence of a disc herniation at the level of traumatic dislocation makes an anterior decompression and reduction in lieu of an immediate closed reduction mandatory in the setting of an incomplete neurologic injury in an awake, alert, and cooperative patient. Based on the small but reported risk of catastrophic neurologic injury from such herniations, we recommended an urgent anterior discectomy, combined with open reduction and fusion in this patient's case, acknowledging that current evidence is insufficient to recommend against an attempt at closed reduction in the awake and alert patient.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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