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Case Report

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Management of Traumatic Cervical Spondyloptosis with an Unsealable Dura Tear: A Case Report

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Conflict of Interest
The authors have no financial conflicts of interest.

ABSTRACT

Cervical spondyloptosis is defined as dislocation of the spinal column, most often caused by trauma. Due to transection of the spinal cord, severe neurological deficits are common. Here, we reviewed the case of a young man who presented with mental stupor and complete tetraplegia below the level of C5. The patient's left shoulder was sucked into a machine and subjected to strong lateral bending and distraction. Computed tomography (CT) scan and magnetic resonance imaging revealed fracture dislocation and complete transection of the spinal cord at the C5–6 level. Three-dimensional CT scan showed coronal and sagittal spondyloptosis. He underwent open reduction with two surgeries performed via the anterior and posterior approaches: C5–6 anterior cervical discectomy and fusion and lateral mass screw fixation with allograft from C3 to C7. In addition, both ends of the huge dura defect were sutured. We report the clinical history, imaging findings, and surgical management of spondyloptosis with a complete transected spinal cord containing a considerable dura tear.

Keywords: Fracture dislocation; Spondylolisthesis; Trauma

INTRODUCTION

Spondyloptosis is complete fracture dislocation and subluxation in the coronal or sagittal plane defined as grade V spondylolisthesis.[3-6,15] It is very rare, but when it does occur, severe neurological deficits are common due to transection of the spinal cord.[9,10] It usually results from birth trauma, congenital anomalies, neoplastic disease and high-energy injury.[1,2,11,13] The main mechanism of trauma is hyperextension-compression.[3] There have been a few reports of treatment of cervical spondyloptosis, which involved conservative care, only posterior fusion or combined anterior and posterior fusion.[2,3,7,8,12,14,15] Surgical decompression, reconstruction and stabilization of spondyloptosis allow for early mobilization and rehabilitation. However, there is no record of the treatment of a huge dura tear with complete spinal cord transection in spondyloptosis.

In this case, we report the management of cervical traumatic spondyloptosis with an unsealable dura tear.

CASE REPORT

A 25-year-old man presented to the hospital after his shoulder was sucked into a machine and sustained high-energy loading in the sagittal and coronal planes. On arrival, the patient presented with mental stupor, motor grade 0 below the C5 level, and unstable vital signs. A cervical computed tomography (CT) scan showed coronal and sagittal C5 on C6 spondyloptosis (Spondylolisthesis Grade V) complete fracture dislocation of both facet joints (**FIGURE 1A & B**). Magnetic resonance imaging (MRI) revealed postero-lateral dislocation at C5 on C6 with transdiscal injury and high-grade cord injury (**FIGURE 1C**).

Due to instability of the patient's vital signs, which was caused by spinal shock and potential cerebral ischemia, we decided to apply Gardener-Wells tong traction and delay surgery. On the second day after application of traction, his left pupil suddenly became dilated and fixed due to left middle cerebral artery territory infarction and we performed an emergent decompressive craniectomy. CT angiography revealed multifocal severe left internal carotid artery stenosis due to dissection (**FIGURE 2A & B**). High-grade stenosis resulted in hemodynamic infarcts of the middle cerebral artery. However, the right internal carotid artery was intact. The left vertebral artery was occluded with an intact posterior circulation. The dominant vertebral artery was on the right side. After one week, we performed open reduction and anterior cervical discectomy and fusion (ACDF) at the C5–6 level. Intraoperatively, we noticed a huge dural defect and continuous leakage of cerebrospinal fluid (CSF). Furthermore, we noted that the spinal cord had been transected unevenly and the dura was torn apart. Dural suture or duroplasty could not be performed and would not have been effective regardless (**FIGURE 3A**). Due to intraoperative instability of the patient's vital signs, we performed only reduction and ACDF (**FIGURE 3B**), not dura closure and posterior fixation and fusion, and chose to delay the second operation. Two weeks later, a large amount of CSF collection was observed on cervical MRI (**FIGURE 4A & B**) and percutaneous catheter drainage insertion was performed (**FIGURE 4C**). The initial drainage amount of percutaneous catheter drainage was over 400 mL in CSF volume. Clamping was performed after draining 160 mL a day for 5 days, showing no decrease in volume. At one week after drainage

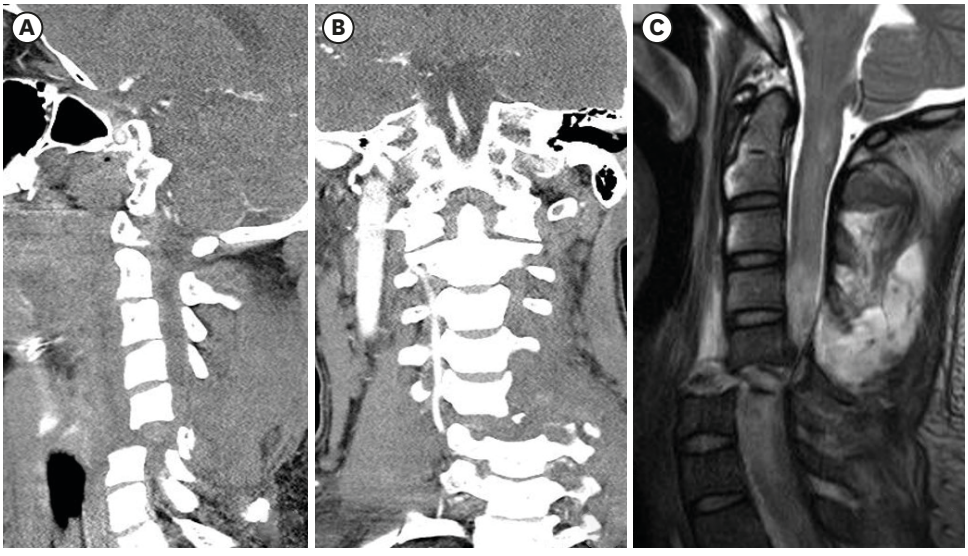

FIGURE 1. (A, B) CT showing cervical spondyloptosis at C5–6. (C) Sagittal T2-weighted MRI showing cord displacement and high signal intensity of the adjacent tissues.
CT: computed tomography, MRI: magnetic resonance imaging.

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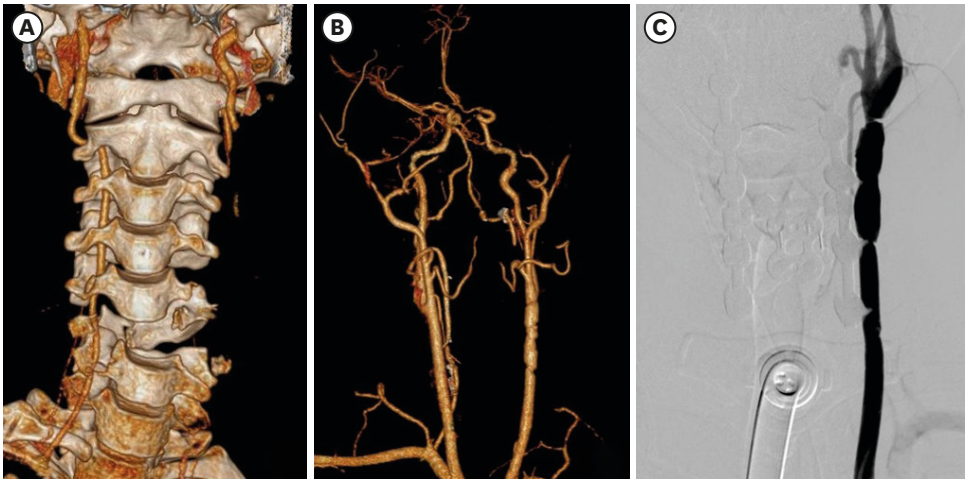

FIGURE 2. (A, B) CT angiography showing left middle cerebral artery occlusion, left vertebral artery occlusion, and left internal carotid artery dissecting injury. (C) Cerebral angiography showing severe left internal carotid artery stenosis due to dissecting injury.
CT: computed tomography.

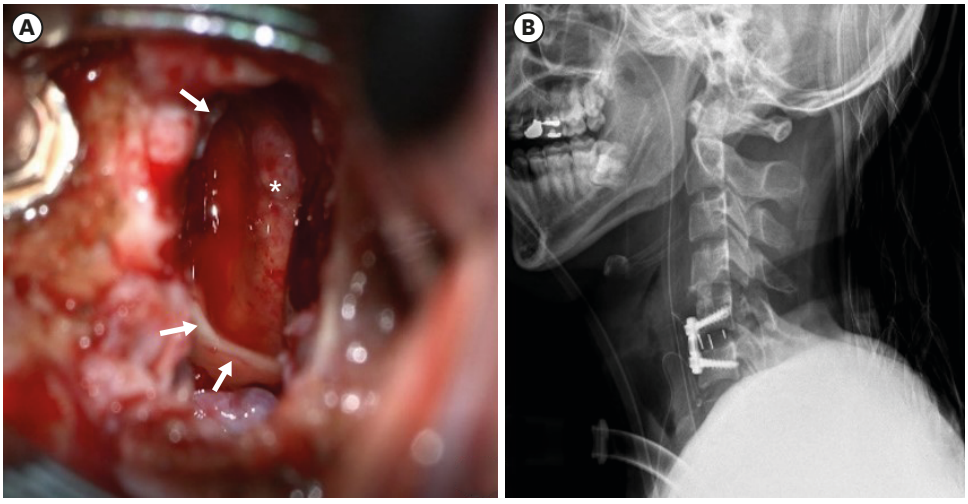

FIGURE 3. (A) Intraoperative photograph showing huge dura defect and leakage of CSF. (arrow: dura margin, asterisk: transected spinal cord) (B) Post-operative lateral plain radiograph of the cervical spine showing good realignment.

insertion, we decided to operate through a posterior approach to avoid ascending infection secondary to CSF leakage and to promote further stabilization. We opted to remove the spinal cord debris and suture the dura on both the cranial and caudal sides of the dural defect because repair of a huge dural opening is highly ineffective. The patient underwent total laminectomy at C4/C5, subtotal laminectomy at C6, and lateral mass screw fixation from C3 to C7. We also performed proximal and distal dura closure by suturing both ends of the dura (**FIGURE 5A & B**).

After the second cervical operation, the patient received intensive care for five days and was transferred, first to the general ward and then to a rehabilitation department, after an uneventful postoperative course. After the patient was stabilized, left internal carotid artery dissecting injury and severe stenosis were observed on cerebral angiography (**FIGURE 2C**). We added aspirin to prevent thromboembolism. Sixth months after posterior cervical surgery (**FIGURE 6A & B**), he remained quadriplegic below the C5 level. There was no change in internal carotid artery dissecting injury in the follow-up angiography (**FIGURE 6C**). Aspirin was taken as a prophylactic agent.

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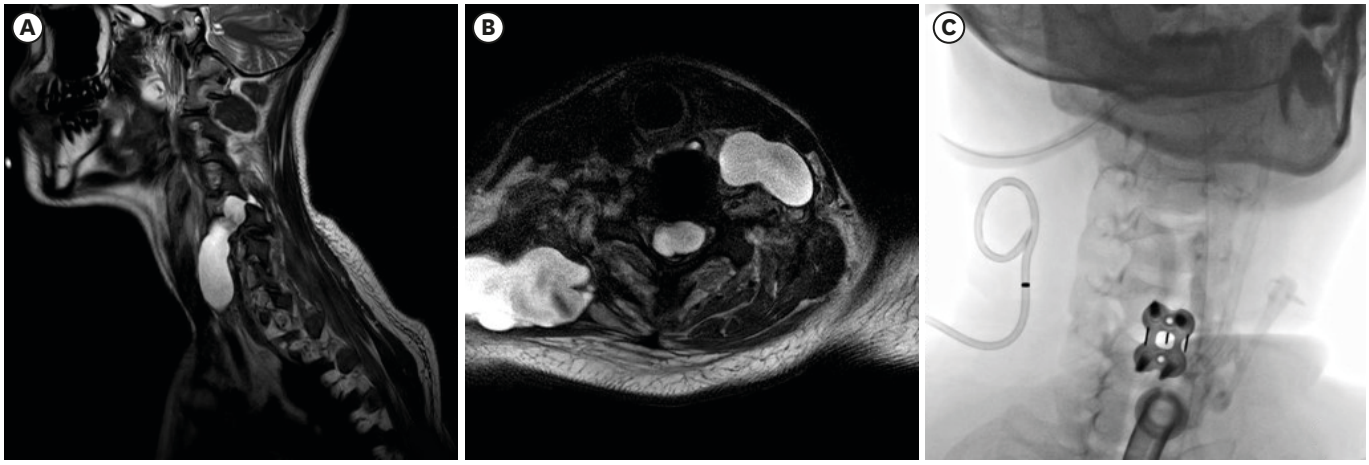

FIGURE 4. (A, B) Sagittal and axial T2-weighted MRI of the cervical spine showing CSF leakage after anterior cervical fusion. (C) Percutaneous catheter drainage insertion on the right posterior side.
MRI: magnetic resonance imaging, CSF: cerebrospinal fluid.

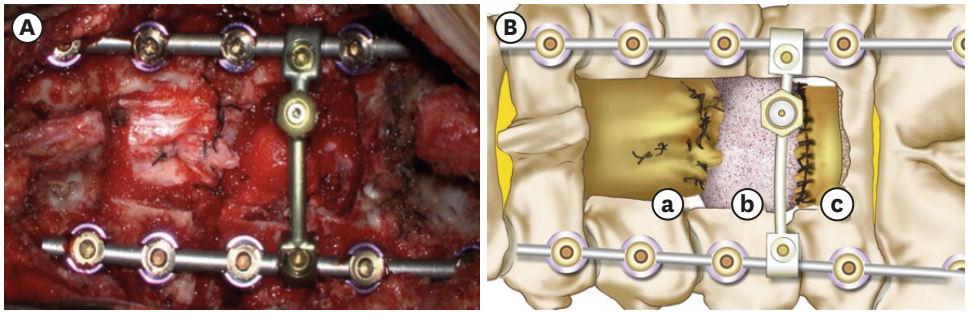

FIGURE 5. (A) Intraoperative photograph showing that both the cranial and caudal ends of the dura defect was sutured. (B) Illustration showing the microsurgical closure by suture on both the proximal and distal ends of the dura (a: proximal end, b: Gelfoam® soaked in thrombin, c: distal end).

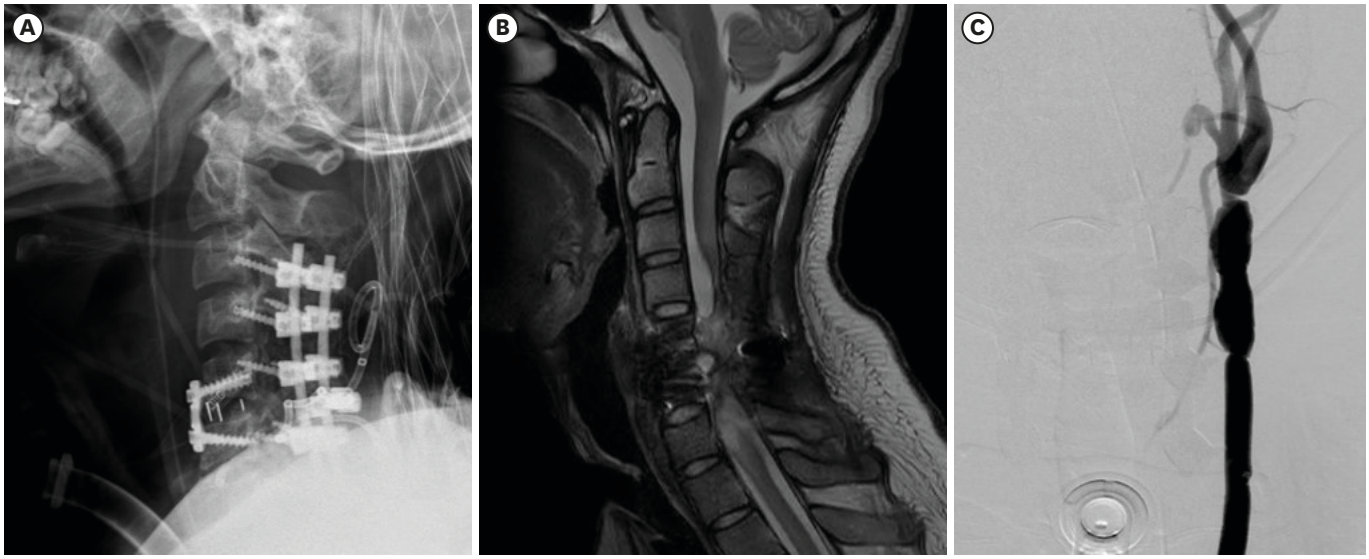

FIGURE 6. (A) Post-operative lateral plain radiograph view of the cervical showing good realignment (B) Post-operative sagittal T2-weighted MRI of the cervical spine showing stability and an absence of CSF leakage. (C) Follow-up cerebral angiography showing no change in internal carotid artery dissecting injury.
MRI: magnetic resonance imaging, CSF: cerebrospinal fluid.

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DISCUSSION

Spondyloptosis is the most severe type of translation spinal injury. It results in complete disruption of the structural elements of the vertebral column and the adjacent paravertebral soft tissue, culminating in intense biomechanical instability.[3-6,14,15] According to the 3-column model of spinal trauma, fracture dislocation injuries are the most unstable fractures and have the strongest association with spinal cord injury of all fracture types.[9] Besides this type of high-energy trauma, the condition can also result from birth trauma, congenital anomaly, inflammation and infection, and neoplastic conditions.[1,2,11,13]

The main mechanism of spondyloptosis is known as hyperextension compression.[3] In our patient, a distraction force after hyperextension compression was produced by a conveyor belt machine; these complex injuries led to complete spinal cord injury.

The most common and preferred treatment of cervical spondyloptosis is combined anterior and posterior fusion.[2,3,7,8,12,14,15] Surgical procedures aim for reduction, decompression, reconstruction and stabilization; the goal of the treatment is to correct the spinal alignment to promote stability and to aid in early rehabilitation. In other words, with an incomplete cord injury, early decompression and stabilization help neurological recovery, and with a complete cord transection, stabilization allows for early rehabilitation and prevention of other complications caused by immobility.

Regarding the reduction, preoperatively, Gardner-Wells tong traction is helpful for correcting the spinal alignment.[3] Intraoperatively, after insertion of a screw and temporary rod connection, the spinal alignment can be corrected by bilateral distraction of the vertebral body for reduction.[16] In this case, although preoperative traction was not helpful in perfecting the spinal alignment, reduction of the fracture dislocation was accomplished without difficulty during anterior cervical fusion.

During spinal surgery, dura tears or defects must be covered by direct suture or duroplasty to avoid an ascending infection and increase the rate of bone fusion. In our case, after we became aware of an unsealable wide defect of the dura and a complete transection of the spinal cord during first anterior cervical surgery, we closed both the proximal and distal ends of the dura with sutures during second posterior cervical surgery. After the patient underwent posterior decompression and fusion with closure of both endings by suture, he had no other complications including CSF leakage.

Because spondyloptosis is associated with high-energy trauma, damage to not only the vertebral column but also surrounding structures may occur. Therefore, a detailed evaluation including vascular injury assessment should also be conducted. In cases of cervical spondyloptosis, it is necessary to conduct an assessment for major artery injury of the internal carotid artery or vertebral artery.[15] It is rather important to note that, in our case, damage to the carotid artery was observed, along with damage to the vertebral artery. This might be due to the mechanism with which the patient was injured. In general, most spondyloptosis cases occur when a high-energy force is exerted in the direction of the sagittal plane. Carotid arteries tend to be affected less by such type of injury than vertebral arteries. However, when the force is also exerted in the direction of coronal plane, the patient can suffer dissecting injuries to carotid arteries due to direct influence from adjacent bony structures.

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CONCLUSION

Traumatic cervical spondyloptosis presenting with quadriplegia is very rare. Reduction, decompression, reconstruction and stabilization are the standard management procedures for early mobilization and rehabilitation. When there is an unsealable dura defect with a complete transected cord, a closure by suture on both the proximal and distal ends of the dura can be a good option to prevent continuous CSF leakage.

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