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Hydrocephalus as a Complication of Durotomy during Cervical Laminoplasty - A Case Report -

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Study Design: Case report.
Objectives: We report a case of hydrocephalus as a complication of durotomy during cervical laminoplasty.
Summary of Literature Review: Hydrocephalus is a very rare complication of cervical laminoplasty.
Materials and Methods: A 72-year-old man had an incidental durotomy during cervical laminoplasty. The dural leak was repaired by secondary surgery. However, the patient continued to complain of headaches and developed confusion and drowsiness. A computed tomographic scan of the brain showed hydrocephalus. After insertion of a lumbar drain, the patient experienced a temporary improvement in the neurologic symptoms. After 6 months, the neurologic symptoms recurred and a ventriculoperitoneal (VP) shunt was placed.
Results: After placement of the VP shunt, the neurologic symptoms improved significantly.
Conclusions: If a patient shows deterioration of neurologic symptoms after an incidental durotomy, surgeons should consider the possibility of hydrocephalus.

Key words: Hydrocephalus, Durotomy, Cervical laminoplasty

Laminoplasty is a reliable surgical procedure for the treatment of cervical compressive myelopathy caused by various etiologies. Laminoplasty is less technically demanding and safe to perform because the spinal cord can be decompressed without direct removal of compressive lesions impinging on the neural tissue. However, some complications of the technique including kyphotic deformity, posterior neck pain, restriction of range of motion and segmental motor palsy are well-known.[1)]

We present a case of hydrocephalus which is a very rare complication of laminoplasty in a patient with ossified posterior longitudinal ligament.

Case Report

A 72-year-old man presented with progressive gait disturbance, hand clumsiness with associated with radiating pain bilaterally down to his upper extremities. No history of trauma was noted. The patient had a history of angina pectoris, but no brain disorder or hemorrhage prior to the present illness. On the neurologic examination, a gross assessment of the muscle strength was 4/5 on upper extremities and sensation was decreased below C5 dermatome. The deep tendon reflexes were hyperactive in all extremities. Bowel and bladder functions were normal.

Computed tomography (CT) of the cervical spine showed segmental type of ossification of posterior longitudinal ligament (OPLL) spanning from C4 to C5 levels (Fig.1). Magnetic resonance imaging (MRI) showed an increased cord signal intensity at C4-C5 with central canal stenosis on a T2-weighted sequence (Fig.2).

The patient underwent a C4-6 open-door laminoplasty with undercutting of the C3 and C7 lamina. During creating a gutter by using high-speed air drill at C4 laminar opening side, pinhole-sized incidental durotomy was occurred. Because

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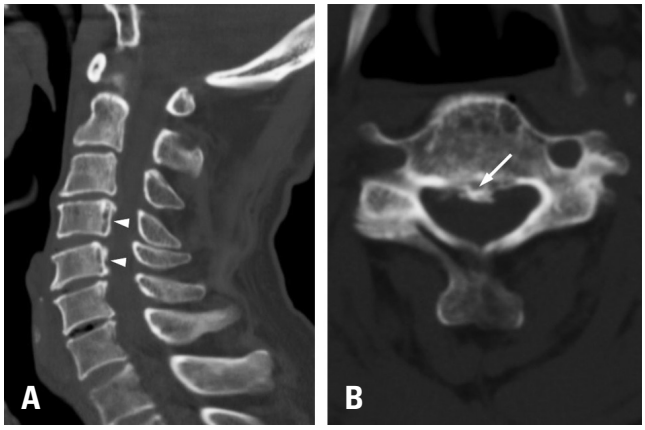

Fig. 1. Preoperative computed tomographic (CT) scan of the cervical spine. **(A)** A sagittal CT scan shows segmental ossification of the posterior longitudinal ligament (OPLL, arrowheads) spanning from C4 to C5. **(B)** An axial CT scan at C4 shows encroachment of the spinal canal by the OPLL mass (arrow).

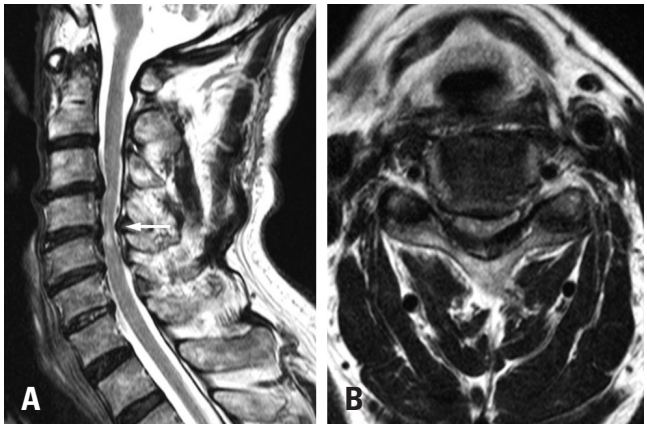

Fig. 2. Preoperative T2-weighted magnetic resonance imaging (MRI) scan of the cervical spine. **(A)** A sagittal MRI scan shows increased cord signal intensity (arrow) at C4-C5. **(B)** An axial MRI scan shows central canal stenosis at C4-C5.

primary suture was not feasible because of technical difficulty, the durotomy was managed with the application of Beriplast (Aventis Behring Ltd., Marburg, Germany) which is a solution of fibrinogen and thrombin.

The patient underwent a 48 hours of bed rest in a reverse Trendelenburg position in order to avoid further CSF leakage. A drain without suction was placed and removed at 48 hours. In the first few days after surgery, the patient had improvement of myelopathic symptoms and was well. However, two weeks postoperatively, the patients complained of headaches and posterior neck swelling consistent with dural leak. Because the patient continued to have persistent headaches, one month after the index surgery, he was then taken back to the operating room. After removal of a mini plate for intrasegmental fixation at C4 lamina, widening of the dural opening (1×0.5 cm) due to CSF pressure was revealed. The durotomy was repaired using 6-0 Prolene. The mini plate was repositioned at C4 lamina after repairing durotomy.

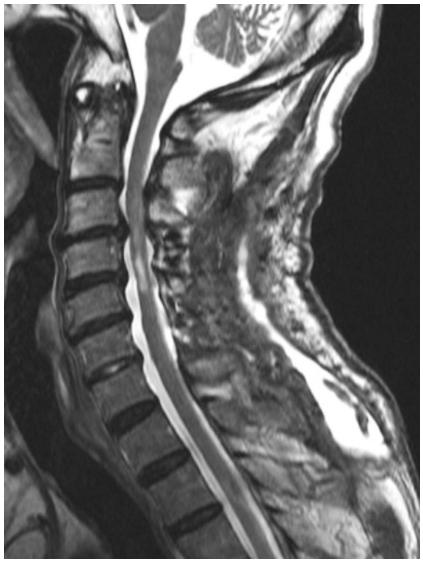

Fig. 3. T2-weighted sagittal magnetic resonance imaging shows adequate decompression and subcutaneous fluid collection.

In spite of these measures, the patient continued to complain headaches and developed confusion and drowsiness. Spine MRI at this time showed an adequate decompression and subcutaneous fluid collection (Fig. 3). CT of the brain revealed gross hydrocephalus, but there was no evidence of cerebral hemorrhage (Fig. 4). After a lumbar drain was inserted, the patient's symptoms were significantly improved.

After 6 months, the patient again began to complain of headache, gait disturbance, dizziness and memory loss. A repeat CT of the brain showed hydrocephalus so ventriculoperitoneal (VP) shunt was placed. After placement of the VP shunt, the patient noted significant improvement in his symptoms with resolution of the headaches. Follow up CT of the brain showed that ventricular size was decreased and remained stable compared to the prior study (Fig. 5). At the 2-year follow up, the patient continues to remain neurologically almost intact.

This paper has been reviewed since IRB approval (2017-11-014).

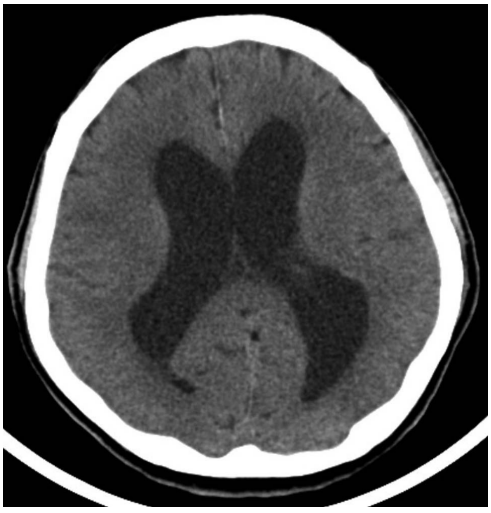

Fig. 4. Computed tomography shows lateral ventricular dilation.

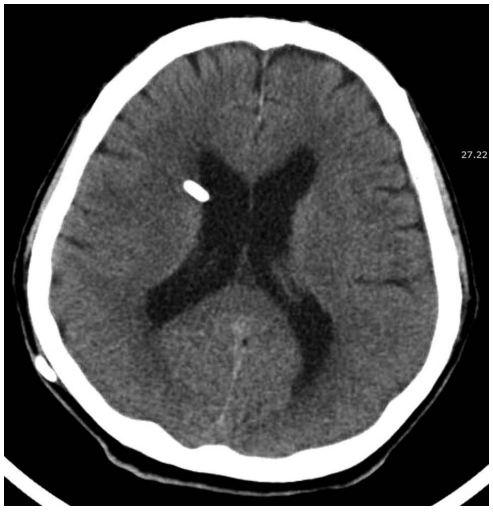

Fig. 5. Computed tomography 30 days after ventriculoperitoneal shunt placement shows normal ventricular morphology.

Discussion

Hydrocephalus is a relatively uncommon complication of spine disorders, but it may develop following intraspinal tumors, spinal trauma and infection.[2,3] To our knowledge, development of hydrocephalus with or without durotomy after cervical laminoplasty has been reported previously by only three cases.[4–6] Two cases reported incidental durotomies during laminoplasty,[4,5] the other did not.[6] We experienced an incidental durotomy in this case too.

Hydrocephalus is classified as either communicating or non–communicating. The non–communicating type is usually the result of obstruction of CSF flow due to various causes, including aqueduct stenosis or tumors. Communicating hydrocephalus is usually post–inflammatory in origin and complicates acute or chronic meningitis, or it may follow hemorrhage or trauma, when blood in the CSF may degrade CSF absorption at the arachnoid villi.[2] In our case, no evidence of direct compression of CSF outlets was observed on imaging studies.

Maezawa et al.[6] who first reported hydrocephalus as a complication of cervical laminoplasty suggested possible relationship between postoperative hydrocephalus and increased protein level of CSF and possibility of the presence of chronic hydrocephalus that was undiagnosed on admission. However, another authors who reported hydrocephalus as a complication of various spinal etiologies postulate that the resulting cascade of postoperative hydrocephalus was most likely the result of the iatrogenic durotomy.[3,5,7,8] CSF leak that persisted after the durotomy might have resulted in intracranial hypotension causing caudal descent of the brain. This would have led to increased tension on the dura, placing tension on the subdural veins, rendering them prone to rupture and thus leading to a subarachnoid hemorrhage (SAH).[7,8] Blood entering the subarachnoid space might have caused delayed absorption of CSF at the arachnoid villi and communicating hydrocephalus.[8] Some literatures have described that fibroproliferative reaction and arachnoiditis caused by SAH may be responsible for impairing spinal CSF reabsorption.[9] Unfortunately, the precise pathophysiology of hydrocephalus resulting from laminoplasty remains uncertain.

Some authors who reported hydrocephalus with durotomy could not reveal SAH. Endriga et al.[8] reported a linear signal loss along the pial surfaces of the medulla, pons and cervical cord that is attributable to siderosis from prior SAH, which would explain the pattern of communicating hydrocephalus. In our case, we could not reveal SAH. We postulate that blood would have dissipated (caudally and cranially) with CSF flow. The others reported hydrocephalus without durotomy, but unrecognized durotomies during surgery might have existed. A high suspicion and proper vigilance can help discover and address occult durotomy.

Hydrocephalus as a complication of durotomy during lumbar spine surgery has been reported previously by only one

case.[8] However, it has not been reported yet whether cervical durotomy is more relevant to hydrocephalus than thoracic or lumbar durotomy or not. As previously described,, the precise pathophysiology of hydrocephalus remains uncertain. However, many authors postulated that the hydrocephalus was likely the result of the durotom y and recommended watertight closure of the durotomy to prevent hydrocephalus. [3,5,7,8] It is generally recommended to treat all durotomies, small or large, aggressively and effectively to prevent headaches, nausea, vomiting, back pain, fistula formation, pseudomeningocele, surgical site infection, meningitis and chronic subdural hematoma. However, primary suture closure is not always feasible, and it does not always result in watertight closure, especially with lateral or ventral defects.[10] We assume that most of the complications encountered with the patient might have been prevented if the dura repair was done watertightly at initial surgery. We could not know exactly when the hydrocephalus developed. However, it took two months to reveal it after the initial surgery.

In conclusion, surgeons performing cervical laminoplasty should consider this rare complication and investigate accordingly patients who present postoperatively with neurological symptoms.

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경추 후궁성형술 중 발생한 경막 파열 후 발생한 수두증 - 증례 보고 -

이제민
단국대학교 의과대학 정형외과학교실

연구 계획: 증례 보고
목적: 경추 후궁성형술 중 발생한 경막 파열 후 발생한 수두증 1 예를 보고하고자 한다.
선행 연구문헌의 요약: 수두증은 매우 드문 경추 후궁성형술의 합병증이다. .
대상 및 방법: 72세 남자에서 경추 후궁성형술 중 의인성 경막 파열이 발생하였다. 경막 파열은 2차 수술로 봉합하였으나 환자는 두통, 혼란, 기면 증상이 지속되었다. 뇌 컴퓨터 단층촬영 검사상 수두증이 발견되었다. 요추부 배액 후 환자는 신경학적 증상이 일시적으로 호전되었다. 6개월 후 신경학적 증상이 재발하였고 뇌실복강단락을 유치하였다.
결과: 뇌실복강단락을 유치한 후 신경학적 증상이 크게 호전되었다.
결론: 수술 중 경막 파열이 발생한 후 환자가 신경학적 증상들의 악화를 보인다면 술자는 수두증의 가능성을 고려해야 한다.

색인 단어: 수두증, 경막 파열, 경추 후궁성형술
약칭 제목: 경추 후궁성형술 후 수두증

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