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Case Report

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Hydrocephalus Following Surgery of Thoracic Intradural Arachnoid Cyst: A Case Report

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ABSTRACT

Spinal intradural arachnoid cysts (SIACs) are cerebrospinal fluid (CSF) sacs formed by arachnoid membranes. They may be idiopathic or acquired. Treatment is resection, fenestration, or cyst drainage.

A 41-year-old female patient presented with myelopathy symptoms and complaints. Magnetic resonance imaging (MRI) revealed a T6-T10 dorsal intradural arachnoid cyst. A T6-T10 laminectomy was performed and an arachnoid cyst was excised under surgical microscope. The cyst contained a clear liquid that was surrounded by a transparent membrane. At 7 weeks postoperatively, the patient experienced severe headache, excessive sleepiness, vomiting, loss of coordination, difficulty walking, and difficulty concentrating. A head computed tomography (CT) scan showed marked ventricular dilation that was diagnosed as delayed hydrocephalus. The patient underwent ventriculoperitoneal shunt (VPS) placement one day after admission.

This is a rare condition of hydrocephalus that develops due to CSF leakage after SIAC surgery.

KEYWORDS: Cerebrospinal fluid leakage, Hydrocephalus, Intradural arachnoid cyst, Ventriculoperitoneal shunt

ABBREVIATIONS: CSF: Cerebrospinal fluid, **CT:** Computed tomography, **MRI:** Magnetic resonance imaging, **SIACs:** Spinal intradural arachnoid cysts, **VPS:** Ventriculoperitoneal shunt

INTRODUCTION

Spinal intradural arachnoid cysts (SIACs) are generally of congenital origin. They are most commonly found in the thoracic region and posterior to the spinal cord (7). They can elicit various neurological symptoms, such as pain, fatigue, sensory changes, and incontinence (2). Many SIAC lesions are detected by coincidence due to the increasingly frequent use of magnetic resonance imaging (MRI) in neurological sciences. Good postoperative results have been reported in symptomatic patients (3). Postoperative cerebrospinal fluid (CSF) leakage may occur, but this leakage, which is common after intradural spinal surgery, usually resolves spontaneously. However, excessive leakage can give rise to unwanted problems, including infection and other serious complications. For this reason, antibiotics should be administered and the dura should be repaired safely. The occurrence of hydrocephalus due to CSF leakage is very rare after spinal intradural interventions (5). Here, we report a rare case of delayed hydrocephalus due to CSF leakage after thoracic SIAC surgery.

CASE REPORT

A 41-year-old female patient presented with a walking disorder. In the past two years, she had experienced bilateral weakness and numbness in her lower extremities.

A clinical examination revealed spastic paraparesis (4/5 overall), an increased ankle clonus, and a positive Babinski sign bilaterally. Her detailed neurological examination revealed hypoesthesia to pain, temperature, and light touch below the 6th thoracic dermatome. Proprioception was intact, and no sphincter disturbance was observed.

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MRI revealed an intradural hyperintense lesion extending dorsally along the spinal cord from T6 to T10, consistent with an arachnoid cyst, in T2W images (Figure 1A, B). A decision was made to treat patient surgically and we performed a T6-T10 laminectomy, incised the dura mater at the midline. We performed a careful dissection and achieved a nearly total removal of the cystic membrane (Figure 1C, D). Pathological inspection of the cyst wall showed normal arachnoid tissue.

After the operation, the patient noted improvement in her ability to ambulate and in her neurological deficit. She presented with a headache at 2 weeks after the thoracic SIAC surgery, but a head computed tomography (CT) scan was normal (Figure 2).

At 7 weeks after the surgery, she complained of a severe headache, excessive sleepiness, vomiting, loss of coordination, difficulty walking, and difficulty concentrating. A postoperative MRI revealed a severe collection of CSF at the surgical site (Figure 3A, B). A cranial CT demonstrated obstructive hydrocephalus (Figure 3C). The patient's neurological status showed rapid deterioration, so she underwent a ventriculoperitoneal shunt (VPS) placement one day after admission (Figure 3D). At 4 months after the VPS placement, the CSF leakage decreased, and no CSF leakage has occurred since then (Figure 4A, B). Cerebral ventricle shrinkage was apparent at 4 months after the VPS placement (Figure 4C, D).

DISCUSSION

Spinal arachnoid cysts (SACs) that cause spinal cord and nerve root compression are very rare. Arachnoid cysts containing fluid similar to cerebrospinal fluid are categorized according to the area in which they are located. Spinal meningeal cysts are divided into two groups: extradural meningeal cysts and intradural meningeal cysts. Overall, SACs are very uncommon and are often asymptomatic. They are most frequently seen in the middle lower dorsal thoracic spinal canal (11).

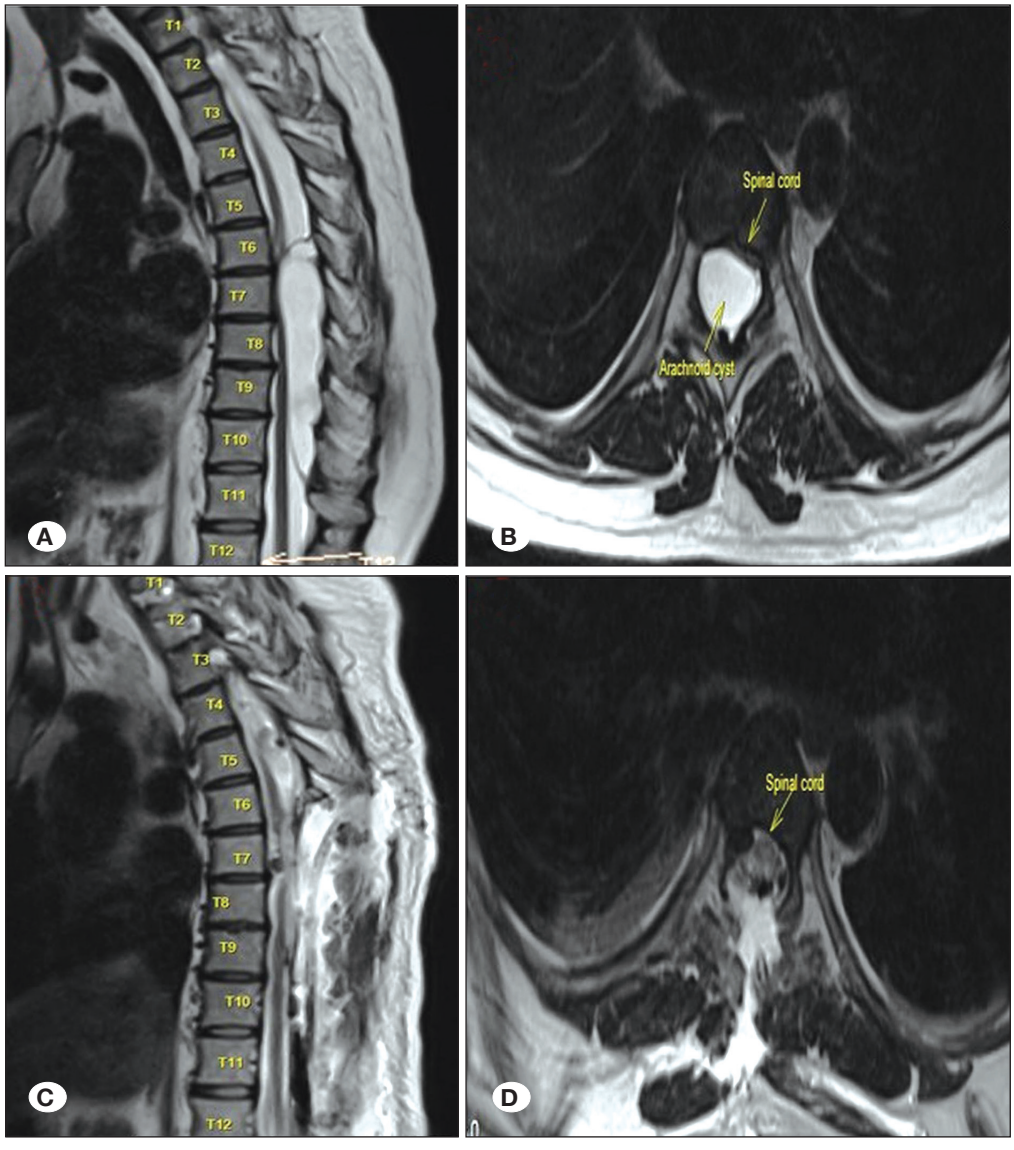

Figure 1: A) A cystic mass lesion extends between T6 and T10 in a preoperative T2W MRI sagittal section; **B)** a cystic mass is located in a right posterolateral position to the spinal cord in a preoperative T2W MRI axial section; **C)** no arachnoid cyst is evident, and the spinal cord anterior subarachnoid space has expanded in a postoperative T2W thoracic MRI sagittal section; **D)** no arachnoid cyst is apparent in a postoperative T2W MRI axial section.

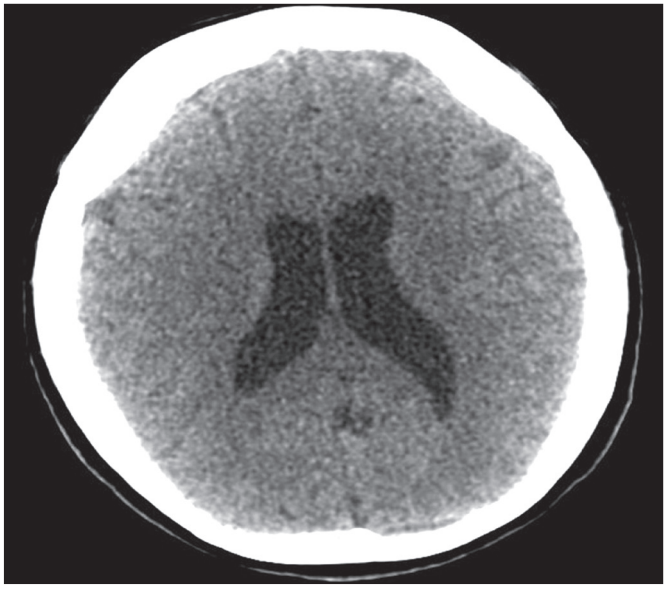

Figure 2: At 2 weeks after SIAC surgery, a cranial CT scan shows no abnormal signs.

When arachnoid cysts become symptomatic, the resulting findings and symptoms may vary depending on the cyst location. SACs on the ventral surface often cause weakness and myelopathy, whereas SACs on the dorsal side primarily cause neuropathic pain and numbness. Compression of the spinal cord or the anterior spinal artery by SACs may cause different symptoms, such as myelopathy and weakness (4).

MRI is the first choice for diagnosis of SACs. The similarity of the MRI signals of the arachnoid cysts and of those with subarachnoid spaces may make cyst diagnosis difficult (10). The advent of MRI has led to an increase in the diagnosis of asymptomatic SACs. SACs show the intensity of CSF in the T1W and T2W sequences in the MRI. However, MRI images do not show diffusion restriction or decreased CSF flow. Nevertheless, communication between SACs and subarachnoid spaces can be detected by flow-sensitive MRI sequences. Cine mode MRIs are more sensitive for diagnosis of SIACs, although signal changes may not be seen in a spinal cord that has been under pressure for a long time (9).

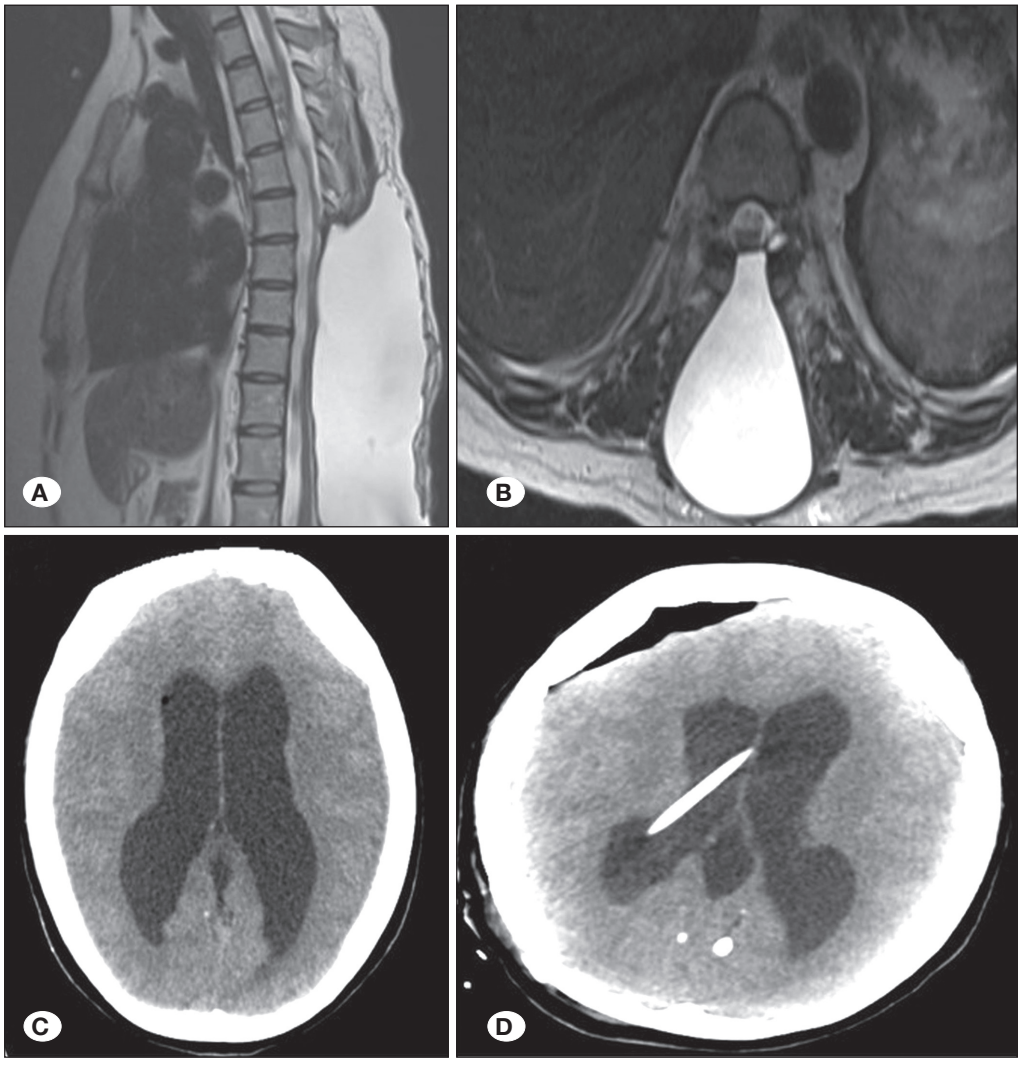

Figure 3: A) At 7 weeks after SIAC surgery, a T2W thoracic MRI sagittal section reveals leakage of cerebrospinal fluid; **B)** at 7 weeks after SIAC surgery, a T2W thoracic MRI axial section reveals leakage of cerebrospinal fluid; **C)** a head CT obtained 7 weeks after surgery reveals enlargement of the lateral ventricles; **D)** after ventriculoperitoneal shunt (VPS) surgery, a head CT axial section reveals immediate cerebral ventricle shrinkage.

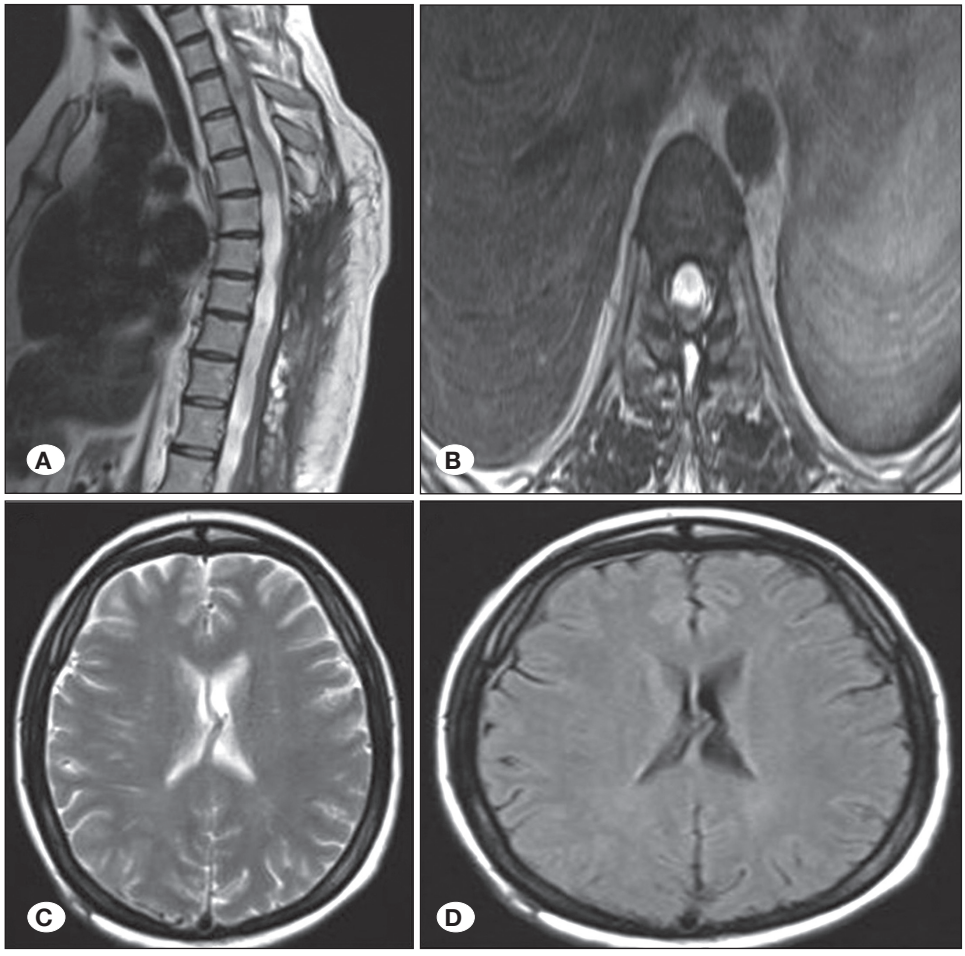

Figure 4: At 4 months after ventriculoperitoneal shunt (VPS) surgery, a T2W thoracic MRI sagittal **(A)** and axial **(B)** sections show no cerebrospinal fluid accumulation. **C)** At 4 months after VPS surgery, T2W cranial MRI axial section shows cerebral ventricle shrinkage; **D)** at 4 months after VPS surgery, T2W cranial tirm MRI axial section shows cerebral ventricle shrinkage.

Treatment options for SIACs include surgical resection, fenestration of the cyst wall, and percutaneous drainage or shunting to the peritoneum, the atrium, or the pleura. Most practitioners prefer to remove the arachnoid cyst completely.

Preoperative aspiration with CT or MRI may determine the communication between the cyst and the subarachnoid space. If symptoms occur after aspiration, this may indicate persistent communication. Most practitioners generally recommend posterior laminectomy to remove a dorsal cyst in the spinal canal. The best results are obtained by cyst resection (11). We preferred the posterior approach in the treatment of our patient. However, CSF leakage was observed in an MRI at the postoperative 7th week. In our opinion, in the long term, hydrocephalus developed as the CSF leakage pressure increased.

Postoperative CSF leakage requires a long time for spontaneous recovery. The patients are treated with antibiotics, but sometimes dural repair may also be required. CSF leakage has been prevented by fascia patches, autologous fat transplants, a combination of a polyglactin acid (PGA) sheet and fibrin glue, and strong compression. CSF leakage usually heals in a short time, and serious cases are very rare. In general, postoperatively leaked CSF is spontaneously absorbed. Therefore, repairing the dura is not usually necessary.

CSF leakage that causes hydrocephalus and requires dura repair is rare after spinal surgery. Kobayashi et al. published a case of late-developing hydrocephalus due to CSF leakage after spinal surgery (5). A 22-year-old male patient had recurrent cervical schwannoma after 17 years. Their case was at the C1-2 level and closer to the cranial region. The patient's hydrocephalus developed at 6 months postoperatively. Neurosurgeons had to perform both a VPS implantation and a dural repair (5).

The Monro-Kellie doctrine may help to explain hydrocephalus after CSF leakage. The Monro–Kellie doctrine, or hypothesis, is that the sum of the volumes for the brain, CSF, and intracranial blood are constant. An increase in one should cause a decrease in one or both of the remaining two. Specifically, a bleed into the brain, which occupies space and increases intracranial pressure (ICP), must cause a displacement of some of the substance in the brain, such as CSF or blood. Conversely, a loss of brain volume results in an increase in blood and CSF to maintain a constant intracranial pressure. The dural arteries and medullary and cortical veins dilate to compensate for decreased CSF volume. Increased pressure in the arteries and veins in the brain leads to decreased CSF absorption from arachnoid villi and increased CSF secretion from choroid plexuses. Although CSF leak is repaired, it continues to

increase secretion and decrease absorption. This may lead to ventricular dilatation and hydrocephalus over time (1,6,8). In our case, both CSF leakage and hydrocephalus were seen postoperatively. The VPS surgery and percutaneous thoracic subcutaneous CSF puncture improved the postoperative hydrocephalus and CSF leakage, and dura repair was not necessary. The patient had no further problems during one year of follow-ups.

CONCLUSION

In the English written literature, we did not find any cases of delayed hydrocephalus due to CSF leakage after thoracic SIAC surgery. This case may be the first case of hydrocephalus requiring VPS implantation due to CSF leakage after a thoracic SIAC operation.

In conclusion, delayed hydrocephalus should be considered in a patient with severe headache, vomiting, and sleepiness following a thoracic SIAC operation. Intervention is required to treat the CSF leakage.

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