Cerebrovasospasm Following Endoscopic Cerebrospinal Fluid Leak Repair

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ABSTRACT

Endoscopic repair of spinal fluid leaks is a commonly performed procedure with low morbidity. However, this is the first report of cerebrovasospasm, following endoscopic repair of a cerebrospinal fluid (CSF) leak. A 51-year-old woman underwent endoscopic repair of a spontaneous CSF leak. She subsequently developed symptomatic cerebrovasospasm on postoperative day 3. This was successfully treated with intraarterial verapamil infusion.

KEYWORDS: Cerebrospinal fluid leak, endoscopic repair, cerebrovasospasm, verapamil

Cerebral vasospasm is a potentially life-threatening event that is well documented in association with subarachnoid hemorrhage (SAH).¹ The most common inciting event is aneurysmal rupture. However, cerebral vasospasm has been reported with other conditions as well: traumatic SAH, unruptured cerebral aneurysms, and meningitis.²⁻⁴ Other atypical reports of cerebral vasospasm have occurred after tumor resection of various intracranial and skull-base locations and pathologies.⁵⁻⁸ The etiology of cerebral vasospasm is not completely understood but appears to be partly related to blood within the subarachnoid space.^{9,10}

Blood within the subarachnoid space occurs in many anterior skull-base procedures, including repair of cerebrospinal fluid (CSF) leaks. Endoscopic techniques for CSF leak repair have been utilized since the early 1980s with 90% success rate on initial attempts.¹¹ These less invasive techniques have decreased the morbidity of such surgical repairs, but there are still significant risks such as meningitis, subdural hematoma, and intracranial abscess that each occur at a rate of less than 1%. We

report the first case of cerebral vasospasm related to endoscopic repair of a CSF leak.

CASE REPORT

A 51-year-old woman was treated at an outside facility for meningitis and a spontaneous CSF leak. CSF culture showed growth of *Staphylococcus salivarius* that was pansensitive to antibiotics. She received intravenous ceftriaxone and steroids for 2 weeks before being sent home with oral cefuroxime. She returned to the emergency department 7 days later with worsening headaches, fevers, and decreased mental status. On physical examination, she was found to have clear rhinorrhea from the right nostril. She was transferred to our facility; subsequently, a thin-sliced computed tomography (CT) conducted at our facility showed a possible dehiscence of the skull base in the sphenoid sinus. Seven days later, a sphenoid sinus leak was repaired endoscopically, and a lumbar drain was utilized for spinal-fluid drainage for 3 days. Ceftriaxone was administered postoperatively,

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until the lumbar drain was removed. The morning after the lumbar drain was discontinued, she complained of malaise and dizziness. Approximately 6 hours later, she had acute and progressive right-sided weakness and aphasia. A brain-attack protocol was initiated for stroke evaluation and treatment as per hospital guidelines.

Her initial National Institutes of Health stroke scale was 12. Examination revealed a partial left-gaze deviation with right-sided neglect and a mixed-component aphasia with both expressive and receptive qualities. She subsequently developed meningismus, bilateral babinski, increasing lethargy, decreasing verbal output, and her right arm was in a flexure position. A CT scan of the head was obtained, and there was no evidence of bleed and expected minimal pneumocephalus. A CT perfusion study showed patchy, delayed perfusion in the left-middle cerebral artery territory. A CT angiogram was obtained that showed a filling defect in the left M3/A3. Intravenous phenylephrine was administered for blood-pressure support.

The patient then underwent an angiogram demonstrating vasospasm of the left M1 and A1 (Fig. 1). A verapamil infusion was administered with improvement of the vasospasm. A lumbar puncture was performed, and the CSF evaluation revealed normal glucose and no organisms on gram stain or subsequent culture. Antibiotics were restarted empirically with vancomycin and ceftriaxone. The patient continued to improve over 36 hours with complete resolution of symptoms. Postinfusion angiogram revealed resolution of vasospasm (Fig. 2). She was discharged home on postoperative day 10. At 6 months follow-up, there was no evidence of CSF leak and no neurologic sequelae.

Figure 1 Left internal carotid artery angiogram before verapamil infusion showing narrowing of M1 (small arrow) and A1 (large arrow).

Figure 2 Left internal carotid artery angiogram, at 3 days following verapamil infusion, and showing resolution of vasospasm in M1 (small arrow) and A1 (large arrow).

DISCUSSION

CSF leak is a serious condition that may lead to life-threatening events. Common etiologies include head trauma, surgical trauma, tumor related, and spontaneous.¹² Spontaneous CSF leaks are less common and often related to elevated intracranial pressure.¹³ Although conservative, nonsurgical measures may be utilized, surgery is often necessary in the treatment of CSF leaks. Although morbidity associated with endoscopic repair of CSF leaks is rare, this is the first reported case of life-threatening cerebrovasospasm following leak repair.

Whereas cerebrovasospasm is a known complication of subarachnoid hematomas, it is also reported to occur following resection of intracranial and skull-base tumors.^{5-8,14-21} Surgery in proximity to the basal cisterns is common to all of these events, including several tumor resections at the sella. Bejjani et al²² reported 9 incidences of cerebrovasospasm in 470 cranial-base surgeries. In these cases, the vasospasm occurred up to 30 days postoperatively. The precise mechanism of cerebral vasospasm in both SAH and tumor resections is not known, but it is postulated that blood in the subarachnoid space near the basal cisterns plays a critical role. Oxyhemoglobin is known to cause secretion of endothelin-1, which acts as a vasoconstrictor and inhibits nitrous oxide and its vasodilatory effects.²³

The case in this report has some features common to previous reports of cerebrovasospasm after tumor resections. The repair of the dural defect was near the central skull base, located near the anterior wall of the sphenoid sinus. There was no unexpected bleeding during the procedure, and no significant blood was

seen in the CSF that was drained postoperatively. However, it is very likely that a small amount of blood was located in the subarachnoid space near the basal cisterns due to the repair. It is also possible that meningitis in the 2 weeks prior to the repair contributed. Cerebrovasospasm occurring as late as 9 days after meningitis has been reported following a lumbosacral surgery.²⁴ We cannot separate the effects of meningitis from those associated with blood in the subarachnoid space.

As early intervention can limit morbidity and mortality, prompt diagnosis is necessary for good outcomes. Patients may be asymptomatic until ischemic changes begin to manifest.²⁵ Early symptoms include excessive sleepiness, lethargy, and stupor. As the condition progresses, hemiparesis, language disturbances, and visual-field defects develop as was demonstrated in the above case. Angiography is the gold standard for diagnosis. Transcranial Doppler ultrasonography has been utilized, but it is still less effective in the diagnosis of cerebrovasospasm.²⁶ In addition to superior diagnostic capabilities, angiography can be useful in the treatment of vasospasm. Treatment of cerebrovasospasm requires a multidisciplinary team for effective and efficient management, including neurology, interventional radiology, and possibly neurosurgery. Initial medical management includes hypervolemic hypertensive therapy (HHT). Reported results have not been consistent with HHT, but it is still considered important in the initial treatment.²⁷ Angiography can begin while HHT is being administered. This allows for prompt diagnosis and intervention with balloon angioplasty or vasodilatory agents such as nicardapine or verapamil.^{28–32}

CONCLUSION

This is the first report of vasospasm following repair of a CSF leak. Although a rare complication, it should be recognized as a potentially life-threatening event with any skull-base procedure, including endoscopic CSF leak repairs and endoscopic resection of skull-base tumors. As these types of procedures become more prevalent, cerebrovasospasm will likely be seen more frequently in the otolaryngology literature.

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