CASE REPORT

Subdural Hematoma Induced by Cerebrospinal Fluid Drainage

Potentially Catastrophic Complication of Spinal Cord Protection after Thoracoabdominal Aneurysm Repair

A 50-year-old man underwent replacement of the descending thoracic aorta for a DeBakey type III-b chronic dissecting aortic aneurysm. During the surgery, lumbar cerebrospinal fluid (CSF) drainage with a 10 cm H_2O pop-off pressure was used to protect against spinal cord ischemia. During cardiopulmonary bypass, the patient's pupils were isocoric, but anisocoric at end of the operation. As computed tomography of the brain showed right subdural hematoma, neurosurgical drainage was instituted emergently. Although some neurological deficit remained, the patient recovered well and was discharged. This case provides a strong reminder that CSF drainage for spinal cord protection against ischemia might induce subdural hematoma, which can be catastrophic during an operation for thoracoabdominal aortic aneurysm. (Jpn J Thorac Cardiovasc Surg 2004; 52: 466–468)

Key words: thoracoabdominal aortic aneurysm, subdural hematoma, cerebrospinal fluid drainage

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C erebrospinal fluid (CSF) drainage is a common adjunct for protection from spinal cord ischemia, and has been advocated as a way to lower risks of paraplegia during repair of thoracoabdominal or descending aortic aneurysm.¹ Few cases of possible complications have been reported, including subdural hematoma caused by CSF drainage.^{2,3} We report a case of postoperative subdural hematoma, probably induced by CSF drainage during aortic surgery.

Case

A 50-year-old man with a diagnosis of a DeBakey type IIIb chronic aortic dissection complained of a severe back pain. In the middle of the descending thoracic aorta, computed tomography (CT) showed a dissection of 6×7 -cm maximum diameter, indicating

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a slight enlargement compared with one year before. We planned to replace the descending thoracic aorta in semi-emergency surgery because the aneurysmal diameter was large enough for surgical treatment and the patient continued to feel back pain even when his blood pressure was kept within a normal range. He also had a 6-cm abdominal aortic aneurysm and a 2-cm bilateral common iliac artery aneurysm; these were scheduled for secondary treatment.

The day before the thoracic operation, an epidural catheter was inserted into the Th $_{67}$ interspace. No dural trap was observed. A spinal drainage tube was inserted into $L_{3/4}$ using a 16-gauge needle, and an epidural catheter was fed into the subarachnoid space and attached to a closed collecting system.

A general anesthetic technique was used. After heparin was administered (300 units/kg), extracorporeal circulation (ECC) was established with aortic cannula at the right femoral (14Fr) and left brachial (14Fr) arteries, and with venous cannula at the pulmonary trunk (28Fr) and the right femoral vein (22Fr). At the same time, spinal drainage was started with pop-off pressure of CSF maintained at 10 cm H_2O during the operation and after surgery. An open proximal anastomosis was performed during 33 minutes of deep hypothermic circulatory

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arrest (20 degree centigrade). The dissected descending aorta was replaced with a woven Hemashied 28 mm one-branched graft with reconstruction of intercostal arteries (right Th_{8,9}); ECC time was 218 minutes. At the termination of ECC, the patient's pupils were isocoric. However at the end of the operation, anisocoria was found (right: 10 mm, left: 1 mm). An emergent CT revealed massive right subdural hematoma (Fig. 1). Emergent neurosurgical drainage was performed 5 hours after the operation. The spinal drainage tube was removed during this operation. The total amount of CSF drainage was 300 ml for 15 hours. Then anisocoria disappeared, but right ptosis and right exotropia due to oculomotor paralysis and left homonymous hemianopsia remained. The patient's neurological condition improved and he underwent elective repair of the abdominal aortic aneurysm 39 days after the first operation. He was discharged in a good condition 72 days after the first operation with some degree of neurological defects remaining.

Discussion

Paraplegia, the most catastrophic complication of repair of the thoracoabdominal or descending aorta, is relatively common. It occurs in 5% to 20% of cases.^{4,5} Among the many clinical adjuncts used to prevent spinal cord ischemia, no optimal method has been established. Among them, CSF drainage is a commonly applied option in thoracoabdominal or descending aortic aneurysm repair and improves perioperative spinal cord perfusion by decreasing the CSF pressure and thereby decreasing the incidence of paraplegia.

Dardik reported 8 cases of CSF drainage-related subdural hematoma out of 230 patients (3.5%) undergoing the thoracoabdominal aortic aneurysm (TAAA) repair.² Only one other case has been reported.³ Both acute and chronic types (day 1 to 164) have been observed. The clinical symptoms are headache, fixed dilated pupil, anisocoria, and vomiting.^{2,3} Total death rate is up to 50%, and can be worsened unless there is neurosurgical intervention. Therefore, once subdural hematoma is observed, immediate diagnosis and neurosurgical intervention, such as drainage and the application of lumbar patch are vital.

Various causes of subdural hematoma during spinal drainage have been hypothesized; the size of the needle has been reported as a contributing factor.⁶ Leakage of CSF from the puncture site might induce the reduction of intracranial pressure, followed by tearing of the dural veins. The fact that excessive CSF drainage causes the dural vein to stretch and tear suggests that it is another



Fig. 1. Computed tomography of the brain three hours after operation reveals massive right subdural hematoma.

possible mechanism of subdural hematoma. Dardik et al. commented the volume of CSF drained as only variably predictive factor of subdural hematoma.² In our case we were unable to specify the mechanism of the subdural hematoma. We routinely use 16 gauge needles to puncture, but most patients have been free of subdural hematoma. The total amount of CSF drainage in our case is not directly comparable with that in Dardik's 8 cases because in those cases drainage was continued for 3 days after the operation. Nevertheless, the amount of CSF drainage might have been excessive in the present case. The reason for excessive drainage was unclear. Our experience demonstrated that when excessive drainage is observed, the pop-off pressure should be adjusted to a higher setting, and that the patient's neurological condition should be carefully monitored. Dardik et al. reinforced our learnings that higher (10 cm H₂O) lumbar drain pop-off pressures might be necessary, together with careful monitoring of patient position (no more than 30 degrees upright perioperatively) and of neurological status.

Subdural hematoma induced by CSF drainage is an unusual but potentially catastrophic complication of spinal cord protection after TAAA repair. Prompt recognition and neurosurgical intervention are necessary for survival and recovery after acute presentation.

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