Case Report

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Bloody cerebrospinal fluid during replacement of descending thoracic aorta
-A case report-

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Cerebrospinal fluid (CSF) drainage is a routinely used adjunct to thoracoabdominal aortic surgery which may reduce the incidence of preoperative paraplegia by improving spinal cord perfusion. However, this procedure infrequently causes complications. Bloody or bloody-tinged CSF may be associated with intracranial or spinal hematoma. We present herein a case of bloody CSF during the replacement of the descending thoracic aorta. (Korean J Anesthesiol 2010; 59: S107-S109)

Key Words: Cerebrospinal fluid drainage, Complication, Thoracoabdominal aortic surgery.

Neurologic deficits such as paraplegia may occur due to the disturbance of spinal blood flow caused by cross-clamping of the descending thoracic aorta during the resection of the descending and thoracoabdominal aortic aneurysms [1]. The frequency of the neurologic deficits can be reduced to <5% by cerebrospinal fluid (CSF) drainage along with distal aortic perfusion [2]. Although CSF drainage has a relatively high success rate, it rarely leads to intracranial hemorrhage [3]. There have been few reports on bloody CSF that has occurred during the replacement of the thoracoabdominal aorta. Therefore, we present herein such a case with a brief review of the literature.

Case Report

A 60-year-old man was diagnosed with type 3 chronic aortic dissection and scheduled for the replacement of the descending thoracic aorta. The patient complained of no symptoms, and the extent of aortic dissection was between the left subclavian artery and the bifurcation of the common iliac artery. He had a history of hypertension and underwent thrombectomy of the right iliac artery 3 years before this presentation.

Without premedication, intravenous anesthesia was performed using etomidate, propofol, remifentanil and rocuronium. Invasive monitoring of blood pressure was executed through the right radial artery, and central venous catheters were inserted into the right internal carotid artery and left subclavian vein. Bispectral index (BIS), cerebral oximeter, electroencephalogram (EEG), somatosensory evoked potential and motor evoked potential were monitored during anesthesia. After induction of anesthesia, dural puncture was conducted

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at L4-5 in the right decubitus position using a Tuohy needle through the median approach. After identifying CSF drainage, a drain catheter with an outer diameter of 1.5 mm (Hermetic™ Lumbar Catheter) was introduced 10 cm cephalad. After identifying clear CSF drainage, the drain was fixed. The drain was connected to a 3-way stopcock; a pressure transducer was connected to one end for continuous monitoring of CSF pressure, and a closed drain bottle was connected to the other end for continuous drainage of CSF. During the procedure, the initial CSF pressure was 10 mmHg, and there were no specific events such as bleeding. After left thoracotomy was performed, heparin was administered. Forty minutes later, the descending thoracic aorta was cross-clamped and replaced. Ten minutes after cross-clamping, CSF pressure was increased from 10 to 17 mmHg. CSF pressure was periodically measured at a 10-minute interval as 10 ml of CSF were drained through natural drainage by gravity. After 50 ml of CSF were drained, the CSF became pink. After 60 ml of CSF were drained, the CSF turned out to be red. Then, the surgeon was informed of the event and stopped the drainage. Thereafter, the CSF pressure was maintained 11 to 13 mmHg. After the completion of the operation, he was transferred to the intensive care unit. Total aortic clamping time was 22 minutes, the lowest bladder temperature was 23.5°C, cardiopulmonary bypass time was 97 minutes, and total operation time was 305 minutes. Since CSF was bloody at the intensive care unit, CSF drainage was stopped and the CSF pressure was maintained at 11 to 16 mmHg. There were no findings suggestive of coagulopathy. Thirteen hours after the operation, his consciousness returned to an alert state, and neurologic examination revealed normal findings. The drain was removed the day after the operation without any problems. Although he had no postoperative complications, he required a mechanical ventilator due to pulmonary edema, which was weaned and extubated 18 days after the operation.

Discussion

Paralysis of the lower extremities due to spinal ischemia is a fatal complication of the replacement of the descending thoracic aorta. Aorta clamping leads to an increase in CSF pressure and a decrease in systolic pressure of the terminal aorta with a significant decrease in spinal perfusion pressure, which subsequently induces ischemic injury to the spinal cord. Methods for preventing spinal cord injury associated with operation include distal aortic perfusion, sufficient anastomoses of the intercostal and lumbar arteries, hypothermia and CSF drainage. Among them, intraoperative and postoperative CSF drainage decreases CSF pressure, increase spinal blood flow, decrease the frequency of spinal cord injury due to the replacement of the aorta and improves neurologic symptoms and signs such as paralysis of the lower extremities [4]. Complications associated with CSF drainage include CSF leakage, headache, meningitis, intracranial hemorrhage, bleeding in the spinal canal and breakdown of the drain catheter. Estera et al. [3] reported the incidence of the complications of CSF drainage to be 1.5%. As for bleeding, Weaver et al. [5] reported cases of neurologic complications due to bleeding in the spinal canal, Murakami et al. [6] reported cases of cauda equina syndrome due to hematoma around the cauda equina and those of subdural hematoma, and Settepani et al. [7] reported cases of intracerebellar hemorrhage. Bleeding or hematoma in the spinal canal is suspected when bloody CSF is found. In our patient, although bloody CSF was found, his clinical course was closely observed because there were neither neurologic abnormalities nor coagulopathy. His consciousness returned to normal immediately. He received medical treatment including mannitol therapy for the reduction of intracranial pressure. Consciousness, extremity movement and sensory function were closely observed without MRI. In patients with bloody CSF, surgeons usually stop CSF drainage and correct coagulopathy, and thereafter continue the CSF drainage after identifying clear CSF. However, in patients with persistent bloody CSF, surgeons remove the drain catheter and insert a new one into a different site on the basis of neurologic symptoms. In patients with delayed neurologic deficits or paralysis of the lower extremities, CT of the brain and spine was performed to establish a diagnosis of intracranial hemorrhage or spinal hematoma [3]. However, in cases of aortic surgery, the drain catheter cannot be immediately removed because activated clotting time should be maintained ≥ 400 seconds by using anticoagulants for correcting coagulopathy and also because CSF should be drained after operation if needed. Therefore, in such cases it is desirable to perform postoperative neurologic examination, close observation of clinical symptoms, identification of restoration of coagulation function and radiologic examination if needed. Wynn et al. [8] reported that in a total of 24 patients with bloody CSF during or after thoracic aortic surgery, 17 had intracranial hemorrhage on brain CT, only 3 of whom exhibited neurologic symptoms. This result implies that all patients with bloody CSF do not have neurologic symptoms. In this respect, we might have performed brain CT on our patient who had no neurologic symptoms. In our patient, it is thought that bloody CSF was not to the extent that neurologic abnormalities were induced by coagulopathy during the operation.

Bloody CSF is produced by drainage of a large amount of CSF, a high velocity of CSF drainage, venous congestion, rupture of the vein, the pre-existing intracranial lesion and subdural or intracranial hemorrhage due to coagulopathy or hypertension [8,9]. Dardik et al. [9] reported that the amount of CSF drainage was 690 ml in 230 patients with subdural hemorrhage, whereas it was 359 ml in those without, suggesting that there is no significant correlation between the occurrence of bloody CSF and the amount of CSF. Estera et al. [3] demonstrated that in patients with a CSF pressure of ≥10 mmHg, CSF drainage at a velocity of 10 ml/hr did not cause intracranial hemorrhage.

Taken together, although CSF drainage can be performed during aortic surgery in order to protect the spinal cord, neurologic complications may be induced. For this reason, surgeons should be careful not to cause damage to the spinal cord while inserting a drain catheter and should closely monitor the amount and velocity of CSF drainage. In addition, early protection of the brain, neurologic examination and radiologic imaging studies are necessary when there are abnormal findings in drainage, BIS and EEG during the operation.

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