Case Report

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Remote cerebellar hemorrhage after unruptured cerebral aneurysm surgery
-two cases report-

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Remote cerebellar hemorrhage (RCH) occurring distant to the site of original surgery, such as supratentorial or spinal surgery, is rare but potentially fatal. Because the pathophysiology of RCH is thought to be excessive cerebrospinal fluid drainage during the perioperative periods, its diagnosis usually depends on the occurrence of unexpected neurologic disturbances and/or postoperative brain computerized tomography imaging. Because of its rarity, RCH-associated neurologic disturbances such as delayed awakening or nausea and vomiting may often be misdiagnosed as the effects of residual anesthetics or the effect of postoperative analgesic agents unless radiologic images are taken. Treatment for RCH ranges from conservative treatment to decompressive craniectomy, with prognoses ranging from complete resolution to fatality. Here, we report two cases of RCH after surgical clipping of an unruptured cerebral aneurysm of the anterior communicating artery and review anesthetic considerations. (Korean J Anesthesiol 2014; 67: 213-216)

Key Words: Cerebellum, Intracranial aneurysm, Intracranial hemorrhages.

Remote cerebellar hemorrhage (RCH), which occurs distant from the original surgical site, is rare but may cause mortality and serious morbidity after supratentorial neurosurgical procedures or spinal surgeries [1,2]. Its pathophysiology is probably associated with massive cerebrospinal fluid (CSF) loss during the perioperative period. The recognition of RCH occurring depends on unexpected neurologic disturbances and/or postoperative brain CT findings. Especially if the patient has been neurologically intact throughout the preoperative evaluation, neurologic symptoms and signs of RCH could be confused with other clinical situations such as the effects of postoperative pain control agents [3] or the effects of residual anesthetics. Modern neurosurgical anesthetic technique is designed to allow postoperative neurologic evaluation promptly using volatile anesthetic

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gas with low solubility and an ultra-short acting opioid; this requires considering postoperative pain control using opioids, even after a craniotomy. Although many cases of RCH have been reported from a surgical viewpoints [4,5], there is one report of RCH from an anesthetic perspective after spine surgery [3]. In this article, we report two cases of RCH after surgical clipping of an unruptured cerebral aneurysm of the anterior communicating artery and review anesthetic considerations.

Case Reports

Case 1

A 57-year-old male, 75 kg in weight and 167 cm in height, diagnosed with an unruptured aneurysm of the right anterior communicating artery measuring 5.3 × 3.8 mm underwent surgical clipping of the aneurysm. He had no previous medical history of hypertension, coagulopathy, or any hematologic abnormality. Anesthesia was induced with thiopental and maintained under endotracheal intubation with 0.6–1.0 MAC of desflurane in air and 0.05–0.15 μg/kg/min of remifentanil infusion.

A left pterional craniotomy (slight rotation and accentuated extension of the head) was performed with intraoperative monitoring of the somatosensory evoked potential. During the operation, 2,500 ml of crystalloid fluid was given, and 930 ml of urine output was measured. Five hundred milliliters of blood loss was measured. At the end of the surgical procedure, ketorolac 60 mg and ondansetron 4 mg were given intravenously. The surgical and anesthetic durations were 280 and 470 minutes, respectively. The patient was hemodynamically very stable during the whole anesthetic procedure. The patient regained consciousness without any neurologic deterioration after completion of the surgery and was transferred to the postanesthetic care unit (PACU). The course of anesthetic recovery was even, except that the patient complained of a strange feeling in his right eye when he blinked at about 2 hours after operation. A postoperative brain CT scan

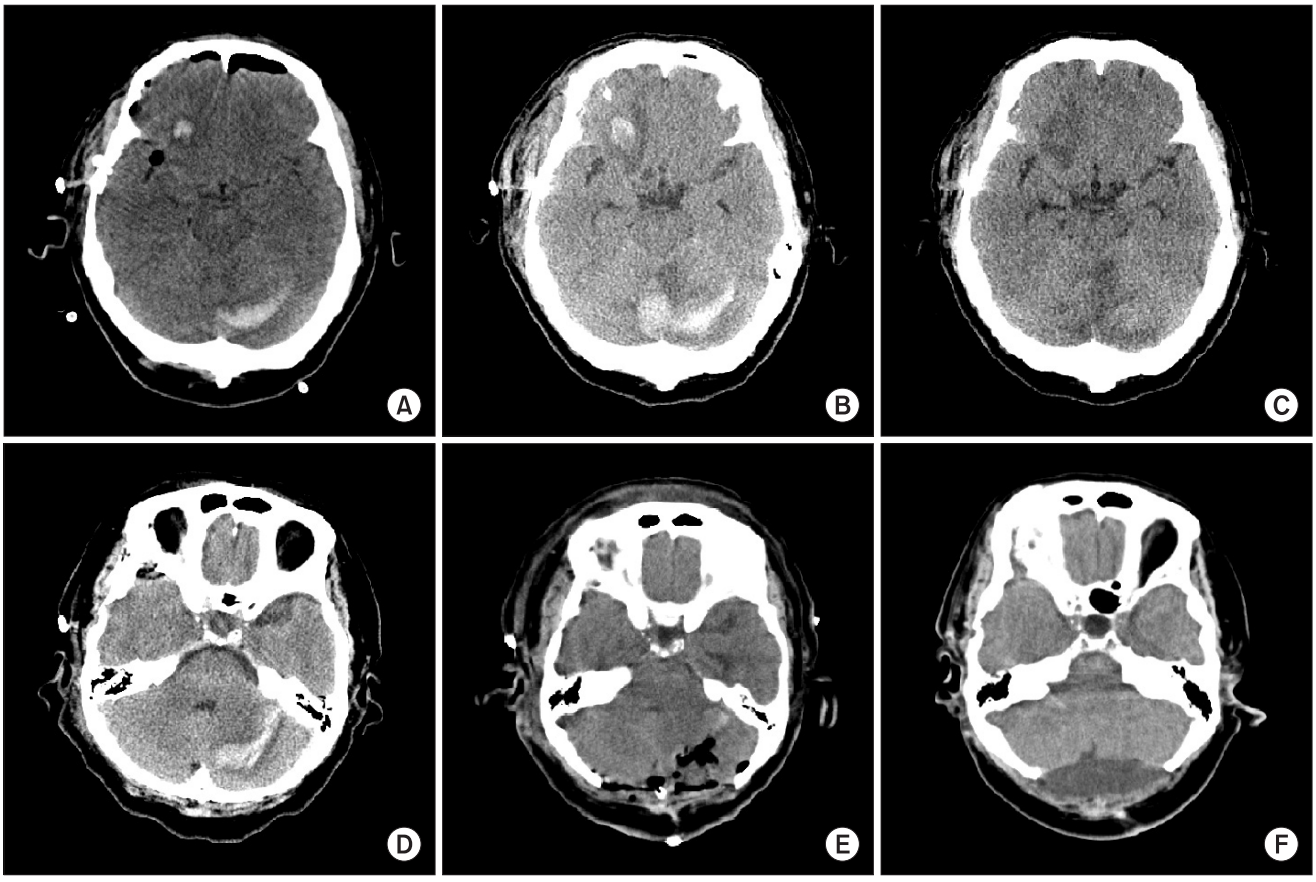

Fig. 1. Brain computerized tomography scans of remote cerebellar hematoma (A–C the first case and D–F the second case) are serially traced at the immediate postoperative period (A, a small amount of parenchymal intracerebral hematoma with swelling on the right frontal lobe and acute intracerebral hematoma on the left cerebellar hemisphere were noted), on postoperative day 4 (B, increased amount of acute intracerebral hematoma on the left cerebellar hemisphere) and on postoperative day 14 (C, resolved intracerebral hematoma on both sides), and at the immediate postoperative period (D, focal intracerebral hematoma on the left cerebellum and minimal subarachnoid hemorrhage at the left Sylvian fissure), after decompressive craniectomy (E), and on postcraniectomy day 12 (F, improved edema of the left cerebellum).

was then taken, and it revealed a small amount of parenchymal intracranial hemorrhage (ICH) with swelling in the right frontal lobe and left cerebellar hemisphere (Fig. 1A). On postoperative day 1, the patient became slightly lethargic and complained of dizziness, nausea, vomiting, and headache. He was treated conservatively. A brain CT scan taken on postoperative day 4 revealed an increased amount of acute ICH in the left cerebellar hemisphere (Fig. 1B), but he was still alert without any focal neurologic deficit. On postoperative day 7, the hematoma on the left cerebellum and right frontal lobe resolved partially. On postoperative day 14, ICH on both sides resolved further (Fig. 1C), and the patient was discharged without any neurologic deficits.

Case 2

A 59-year-old woman, 84.3 kg in weight and 163.5 cm in height, was admitted with an angiographic diagnosis of unruptured lobulated cerebral aneurysm (7.3 × 3.1 cm) at the anterior communicating artery. She had a medical history of hypertension for 20 years and diabetes mellitus and hyperlipidemia for 15 years.

Right pterional craniotomy was performed under somatosensory evoked potential monitoring. Anesthesia was induced with thiopental and maintained with 0.7–1.0 MAC of desflurane in air and 0.05–0.15 μg/kg/min of remifentanil infusion. Five hundred milligrams of thiopental was given for pharmacologic brain protection during the application of the temporary feeding arterial clamps. The surgical and anesthetic durations were 340 and 435 minutes, respectively. In total, 2,950 ml of fluid was administered without a blood transfusion, and 1,900 ml of urine output and 800 ml of blood loss were estimated to have occurred. Considering the patient's preoperative blood pressure of 110–140 over 78–80 mmHg, her hemodynamic variables were well controlled with ephedrine 4 mg or esmolol 10 mg injection during the whole anesthetic procedure. At the completion of the operation, ketorolac 60 mg and ondansetron 4 mg were given intravenously. Endotracheal extubation was performed under a sedated status after complete restoration of spontaneous respiration. A few minutes later, the patient had one episode of projectile vomiting before being tranferred to the PACU. In the PACU, increases in the patient's blood pressure and heart rate to 157 over 86 mmHg and 114 beats/min were managed with esmolol 20 mg. On the immediate postoperative brain CT scan, focal intracranial hematoma on the left cerebellum was noted (Fig. 1D). On postoperative day 1, she was alert but her brain CT scan showed a minimal subarachnoid hemorrhage at the left Sylvian fissure. However, emergent decompressive craniectomy and removal of the ICH were performed because of a lethargic mental change on postoperative day 3 (Fig. 1E). On postoperative day 4 after decompressive craniectomy, she was still lethargic, but light reflex was preserved. On postcraniectomy day 12, the edema of the left cerebellum was improved, and she gradually recovered (Fig. 1F). She was discharged without any neurologic deficits on postoperative day 36.

Discussion

Here, we report two cases of RCH after supratentorial craniotomy with an unruptured cerebral aneurysm. RCH after supratentorial craniotomy, may occur with an incidence of between 0.2 and 4.9% [4] following operations for aneurysm (44.2%), temporal lobe epilepsy (22.7%), tumor (20.8%), and chronic subdural hematoma (3.9%) [5].

The exact etiology is uncertain, but many factors—such as head positioning, hematologic abnormalities, or coagulation abnormalities including use of antiplatelet agents and perioperative hypertension—may precipitate the occurrence of RCH [6]. Because the massive drainage of CSF during perioperative periods may increase transluminal and intracranial pressure or migrate the cerebellum downward to tear the vermian vein, RCH is probably a venous process in origin; it presents the hallmarks of the Zebra sign on CT imaging [1,2,7,8]. Unfortunately, however, the critical volume or rate of CSF drainage, which may result in RCH, is unknown. The onset of symptoms for RCH, such as an altered level of consciousness, headache, cerebellar sign, delayed awakening from anesthesia, and seizure, appears mostly within 10 hours in 46% of cases, but onset may be delayed until after 40 hours in 17% of cases [1]. Because the clinical manifestation is asymptomatic in almost one quarter of reported cases [9], RCH occurrence was only recognized with brain CT scans in our cases even though the patients presented strange feelings upon eye blinking or delayed awakening. It is worth noting that an altered mental status because of RCH may be misdiagnosed as a narcotic effect of postoperative pain control [3].

Our two patients, who were neurologically intact during the preoperative screening, underwent aneurysmal clipping surgery. Therefore, the authors intended to use balanced anesthesia with desflurane and remifentanil infusion for stable hemodynamic controllability and prompt anesthetic recovery. We believe that perioperative hemodynamic variables were stably maintained in both patients, but the second patient had projectile vomiting in the immediate postextubation period, which might increase abrupt intracranial pressure. In fact, we are not confident that the vomiting could have precipitated or resulted from RCH. We must confess that we were not interested in the amount of CSF drainage during the operation. Perhaps this issue may require further collaboration with the surgeon. Regarding prompt neurologic evaluation for neurosurgical anesthesia, desflurane with low blood and body tissue solubility allows for early recovery of consciousness and airway reflexes regardless of the increased

anesthetic time [10]. The properties of rapid biotransformation and short context-sensitive half time make remifentanil superior to other opioids for neurosurgical anesthesia [11]. It is worth mentioning, however, that our patients were at high risk for postoperative nausea and vomiting (PONV) because volatile anesthetics and prolonged anesthetic duration increase the risk of PONV by 84 and 42% [12]. In fact, immediate postoperative vomiting until 2 hours could be caused by the use of volatile anesthetics [13].

Because both patients were neurologically intact during the preoperative screening and the anesthetic and surgical procedures proceeded without complications, we intended to wake them as soon as possible after the operation in the operating room or PACU. The first patient regained consciousness in the operating room. Despite the fact that RCH was found with a routine postoperative brain CT scan, he received conservative treatment and was discharged on postoperative day 14 without any neurologic deficit. For the second patient, endotracheal extubation was performed under sedation after restoration of spontaneous respiration because she received an additional 500 mg of thiopental for intraoperative brain protection. She was expected to regain consciousness somewhat later, considering an awakening time of 12.4 min after balanced anesthesia with desflurane and remifentanil infusion [14]. RCH was also recognized on the postoperative CT scan. Because she became lethargic and the amount of hemorrhage was increased on postoperative day 3, an emergent decompressive craniectomy was conducted. Radiologic and neurologic improvement appeared after postoperative day 12, and she was discharged without permanent sequelae on postoperative day 36. Because the treatment of RCH should be based on the severity of hemorrhage and complications, the prognosis of RCH is usually mild and transient in one third of cases, but in one report, 9.7% of patients had severe neurological deficits remaining and 14.5% died from RCH [1].

Here, we reported two cases of RCH recognized on the postoperative brain CT scan after unruptured cerebral aneurysm clipping surgery; one case was treated with conservative management and the other underwent a decompressive craniectomy. They both were discharged from the hospital without any residual sequelae.

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