



Remote Multiple Intraparenchymal Hemorrhages Following Aneurysmal Clipping of the Anterior Communicating Artery: A Case Report and Literature Review

Anterior Komünikan Arter Anevrizmasının Kliplenmesi Sonrasında Uzak Çoklu İntraparankimal Kanama: Bir Olgu Sunumu ve Literatür Derlemesi

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ABSTRACT

Remote intraparenchymal hemorrhage after clipping of a ruptured aneurysm is rare. The pathogenesis is variable, and the therapeutic strategies remain controversial, because the natural history is unclear. Here we report a woman with subarachnoid hemorrhage (SAH), who had an aneurysm of the anterior communicating artery identified by computed tomography angiography (CTA). A 51-year-old woman, who was in a good preoperative condition without movement disorders before operation, went on to exhibit left hemiparesis after aneurysmal clipping as she recovered from anesthesia in the operating room. CT images performed immediately after surgery showed that two intraparenchymal hemorrhages were present contralateral to the site of the operation. After conservative treatment, the patient recovered, but still displayed a movement disorder in the left limb. SAH induced-vasospasm, defective vascular autoregulation, excessive drainage of the cerebrospinal fluid, a change in the intracranial pressure after craniotomy, and brain shift may contribute to the pathogenesis of remote hemorrhage after surgery.

KEYWORDS: Subarachnoid hemorrhage, Anterior communicating aneurysm, Clipping, Remote multiple intraparenchymal hemorrhages

ÖZ

Rüptüre bir anevrizmanın kliplenmesinden sonra uzak intraparankimal kanama nadirdir. Patogenez değişkendir ve doğal seyir açık olmadığından terapötik stratejiler tartışmalıdır. Burada subaraknoid kanaması (SAK) ve bilgisayarlı tomografi anjiyografi (BTA) ile tanımlanan bir anterior komünikan arter anevrizması olan bir kadını bildiriyoruz. Ameliyattan önce hareket bozukluğu olmayan, genel durumu iyi 51 yaşında bir kadın hastada anevrizma kliplenmesinden sonra ameliyathanede anestezinin etkisinin geçmesi beklenirken sol hemiparezi gelişti. Cerrahiden hemen sonra çekilen BT görüntüleri ameliyat yerinin kontralateralinde iki intraparankimal kanama olduğunu gösterdi. Konservatif tedaviden sonra hasta iyileşti ama halen sol tarafında bir hareket bozukluğu mevcuttu. Cerrahiden sonra uzak kanamanın patogenezinin SAK nedeniyle oluşan vazospazm, hatalı vasküler otoregülasyon, beyin omurilik sıvısının fazla drenajı, kraniyotomi sonrasında intrakraniyal basınç değişimi ve beyinde kayma (şift etkisi) katkıda bulunabilir.

ANAHTAR SÖZCÜKLER: Subaraknoid kanama, Anterior komünikan anevrizma, Klips yerleştirme, Uzak çoklu intraparankimal kanama

INTRODUCTION

The occurrence of intraparenchymal hemorrhage within the site of the operative field is common following neurosurgical procedures. Intraparenchymal hemorrhage at a site remote from the initial neurosurgical procedure is not common (1, 2, 4, 5, 8). Here we report a rare case of remote contralateral intraparenchymal hemorrhage following aneurysmal clipping in a patient with ruptured aneurysms of the anterior communicating artery. We also explore the pathogenesis of remote intraparenchymal hemorrhage after aneurysmal clipping.

CASE REPORT

A 51-year-old woman was admitted to our hospital, presenting with severe headache with nausea and vomiting. The patient had a Hunt-Hess grade III subarachnoid hemorrhage. Images from head computed tomography (CT) performed immediately after admission showed cord-like hyperintensive signals in the suprasellar cistern, ambient cistern, lateral fissure cistern, quadrigeminal cistern, and interhemispheric fissure cistern. Transverse section showed no abnormality in the brain parenchyma above the lateral ventricle, and the local sulci were observed. The patient had

Fisher Grade 3 aneurysmal subarachnoid hemorrhage (Figure 1A-D). Angiograms from head CT angiography (CTA) showed a saccular aneurysm in the anterior communicating artery. The aneurysm was irregular in shape with a size of approximately 6.4 mm × 2.7 mm. No abnormalities were observed in the arteries in the anterior and posterior circulation (Figure 1E, F). The patient was diagnosed with aneurysms in the anterior communicating artery, with subarachnoid hemorrhage.

The patient underwent aneurysmal clipping of the anterior communicating artery 2 days after admission. She exhibited no movement disorders preoperatively. The blood pressure was continuously monitored during the operation. The aneurysmal clipping was performed via left pterional approach. Severe subarachnoid hemorrhage was observed during the operation. The aneurysm was found to be located in the anterior communicating artery. The ruptured aneurysm was irregular, and was associated with many daughter aneurysms on its surface. The aneurysm was clipped with FT742 aneurysm clips (Figure 2 A,B). Blood pressure was stably

controlled without the occurrence of hypertension during the operation. No excessive liquid supplementation was given. After the operation, the patient exhibited left hemiparesis. Images from CT performed immediately after surgery showed that two intraparenchymal hemorrhages with an irregular shape were present above the lateral ventricle contralateral to the site of the operation (Figure 3A,B). The patient was discharged with left hemiparesis after conservative treatment for 10 days. At the 6-month follow-up, CT images showed that the intracranial hematomas were completely absorbed. However, the patients still had a movement disorder in the left limb, and depended on others for normal daily activities.

DISCUSSION

Many neurological diseases are commonly associated with a long-term increase in the intracranial pressure, which leads to low cerebral perfusion and impaired vascular autoregulatory function. An abrupt increase in the cerebral blood flow, in response to decreased intracranial pressure after surgery, may

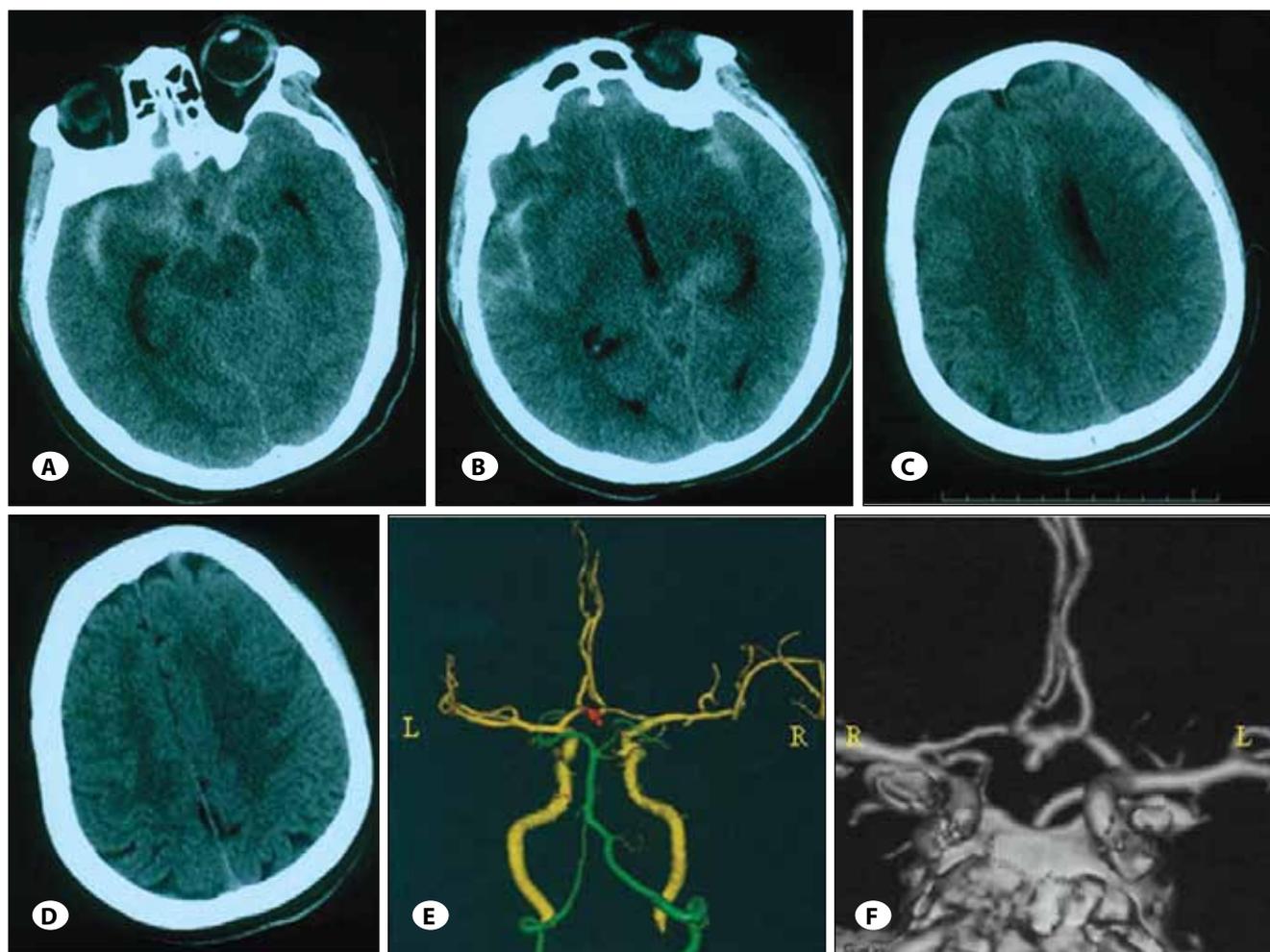


Figure 1: CT and CT angiography (CTA) performed immediately after admission. **A,B)** CT images showing subarachnoid hemorrhage. **C,D)** Transverse sections showing no abnormality in the brain parenchyma. **E, F)** anteroposterior angiograms showing a saccular aneurysm in the anterior communicating artery (red) with normal arteries of the anterior circulation (yellow) and posterior circulation (green).

result in hemorrhage of cerebral vessels with defective vascular autoregulation. Therefore, a decrease in the intracranial pressure, which is common feature after craniotomy, may be the common pathogenesis of remote intraparenchymal hemorrhage after neurosurgical procedures.

Muneza et al. reported a case of multiple intraparenchymal and intraventricular hemorrhages after removal of chronic subdural hematoma (6). Multiple postoperative hemorrhages may have been caused by a sudden increase in cerebral blood flow in the fragile cerebral vessels in response to an increase in the intracranial pressure following removal of hematomas. Impaired vascular autoregulation was also considered as a major cause in this elderly patient (6). Turkoglu et al. reported a case of intraparenchymal hemorrhage after excess drainage of the cerebrospinal fluid (9). In that case, right parietal intracerebral hemorrhage after lumboperitoneal shunt was

likely due to an increase in the transmural pressure after drainage of the cerebrospinal fluid, resulting in ruptured blood vessels (9).

Remote hemorrhage may also result from brain shift after removal of the occupied lesions. In which case, the site of remote hemorrhage would be close to the shifted brain regions (5). Rapana et al. reviewed the literature of remote intraparenchymal hemorrhage after surgery in 44 cases, and proposed that vascular and mechanical factors directly associated with the surgical procedure contribute to remote intraparenchymal hemorrhage. Transient hypertension during the perioperative period may also play a role in the pathogenesis of remote intraparenchymal hemorrhage (7). Similar to our case, 2 of 44 cases with remote intraparenchymal hemorrhage following aneurysmal clipping of the anterior communicating artery were reported (7). Therefore, in our case, it is possible

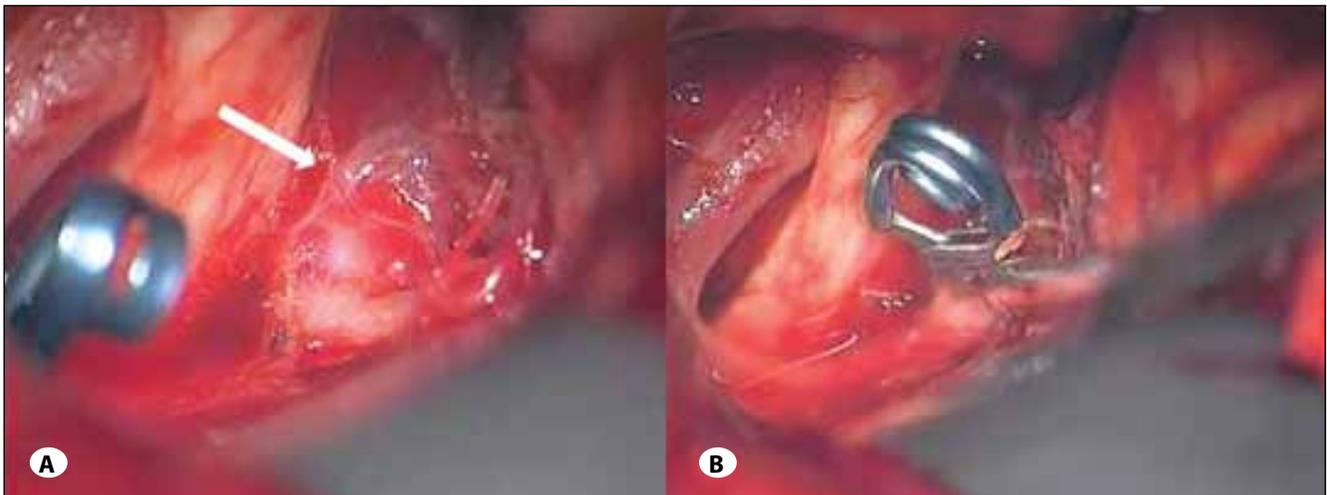


Figure 2: Intraoperative images of the aneurysm. **A)** The ruptured aneurysm (arrow) was irregular, and was associated with many daughter aneurysms on its surface. **B)** The aneurysm was clipped with FT742 aneurysm clips.

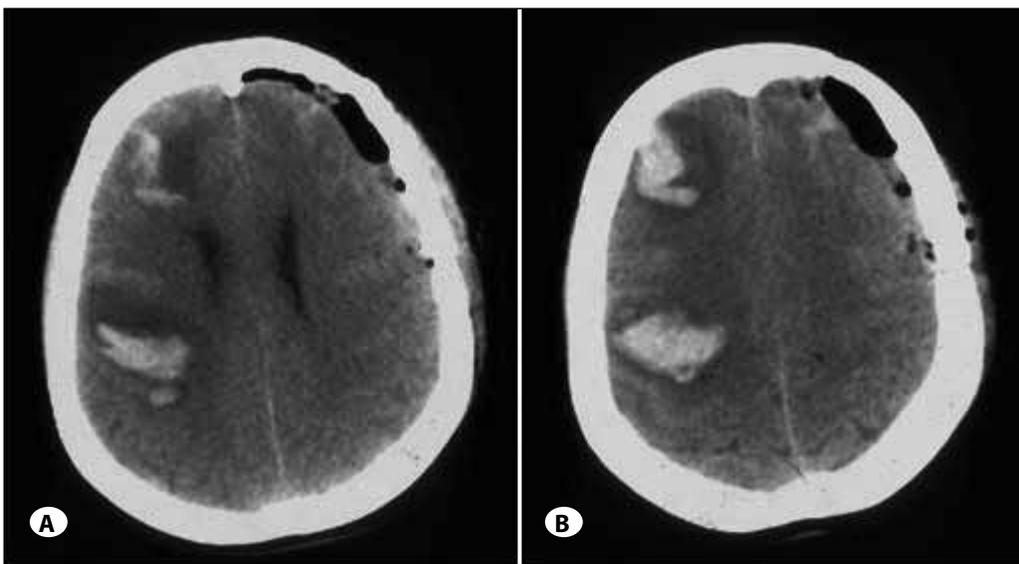


Figure 3: Postoperative computed tomography. CT images showing two intraparenchymal hemorrhages with an irregular shape above the lateral ventricle contralateral to the site of the operation. Edema was observed in the periphery of the hematomas.

that several different mechanisms may have contributed to remote intraparenchymal hemorrhage following aneurysmal clipping of the anterior communicating artery.

Other specific causes of remote intraparenchymal hemorrhage after aneurysmal clipping have also been reported. Kim et al. reported a case with contralateral intraparenchymal hemorrhage 2 weeks after aneurysmal clipping. The remote hemorrhage possibly resulted from a reperfusion injury after anti-spastic treatment and hyperdynamic therapy for vasospasm-induced local hemodynamic disturbance (4). Kamath et al. reported a patient with ruptured aneurysm of the anterior communicating artery, who had contralateral frontoparietal hematoma 4 hours after aneurysmal clipping. Remote hemorrhage is proposed to result from disrupted autoregulatory function of cerebral vessels in combination with persistent hypertension (3). The present case differs from other cases in several ways (3,4). Remote hemorrhage occurred in multiple locations, and was observed immediately after surgery as the patient recovered from anesthesia. In addition, no hypertension or excessive perfusion was observed during the operation. The patient had a Fisher Grade 3 aneurysmal subarachnoid hemorrhage, severe vasospasm, and vascular autoregulatory dysfunction. Therefore, excessive perfusion of cerebral vessels in response to a decrease in the intracranial pressure after craniotomy is believed to contribute to this remote multiple intraparenchymal hemorrhage.

In conclusion, although the pathogenesis of remote hemorrhage after aneurysmal clipping remains unclear, SAH induced-vasospasm, defective vascular autoregulation, excessive drainage of the cerebrospinal fluid, a change in the intracranial pressure after craniotomy, and brain shift may contribute to the pathogenesis of remote hemorrhage after surgery. Once intraparenchymal hemorrhage occurs, the prognosis of patients is very poor (8). In the present case, the prognosis of the patient is poor, and the patient is dependent on others for normal daily activities. Therefore, the present case emphasizes the needs for understanding the mechanism of remote

intraparenchymal hemorrhage after aneurysmal clipping in order to prevent such complications.

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