

# Emerging Sylvian Subpial Hematoma after the Repair of the Ruptured Anterior Cerebral Artery Aneurysm with Interhemispheric Approach: Case Report

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## Abstract

A 60-year-old woman was admitted to the hospital due to a sudden loss of consciousness. Computed tomography (CT) revealed a thick subarachnoid hemorrhage in almost all of the parachiasmatic cisterns, including the sylvian cisterns, with mild hydrocephalus. Three dimensional (3D)-CT angiography showed an irregularly shaped aneurysm at the bifurcation of the left A2 and the frontopolar artery. The aneurysm was successfully obliterated by clipping through the interhemispheric approach. CT performed immediately after the operation showed a newly formed left temporal subpial hematoma. The patient's neurological status improved gradually after surgery, but deteriorated again 2 days after the operation. CT revealed an enlarging right sylviansubpial hematoma. The subpial hematoma was rapidly removed surgically. Slight hemiparesis and impaired higher cognitive function remained after a shunt procedure for subsequent hydrocephalus. Emerging sylvian hematoma associated with a distant site of a ruptured aneurysm is extremely rare. However, adequate attention is required in cases with a thick subarachnoid hemorrhage in distant fissures.

Key words: sylvian hematoma, subpial hematoma, subarachnoid hemorrhage, late complication

## Introduction

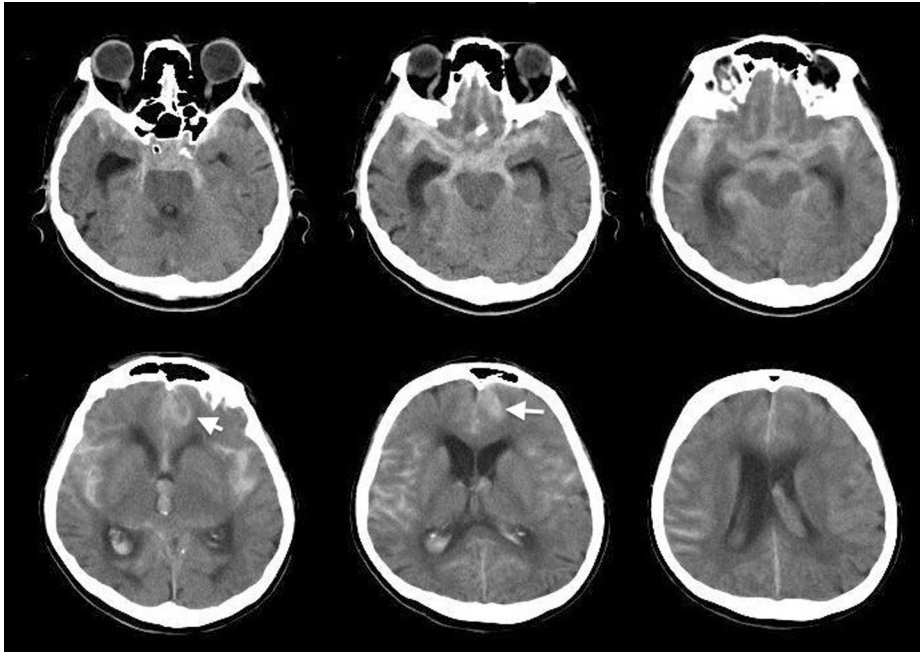
Intracerebral hematoma complicated with rupture of the anterior communicating artery (ACom) and anterior cerebral artery aneurysms is generally localized in medial structures, such as the frontal lobe and corpus callosum. Subpial hematoma in the sylvian cistern, which is idiomatically called “sylvian hematoma,” is usually seen in cases with ruptured middle cerebral artery aneurysms. Sylvian hematoma often induces cerebral artery spasm, and is associated with poor prognosis. Here, we present a rare case of emerging sylvian subpial hematoma after successful clipping of a proximal anterior cerebral artery aneurysm through the interhemispheric approach without opening of the sylvian cistern.

## Case Report

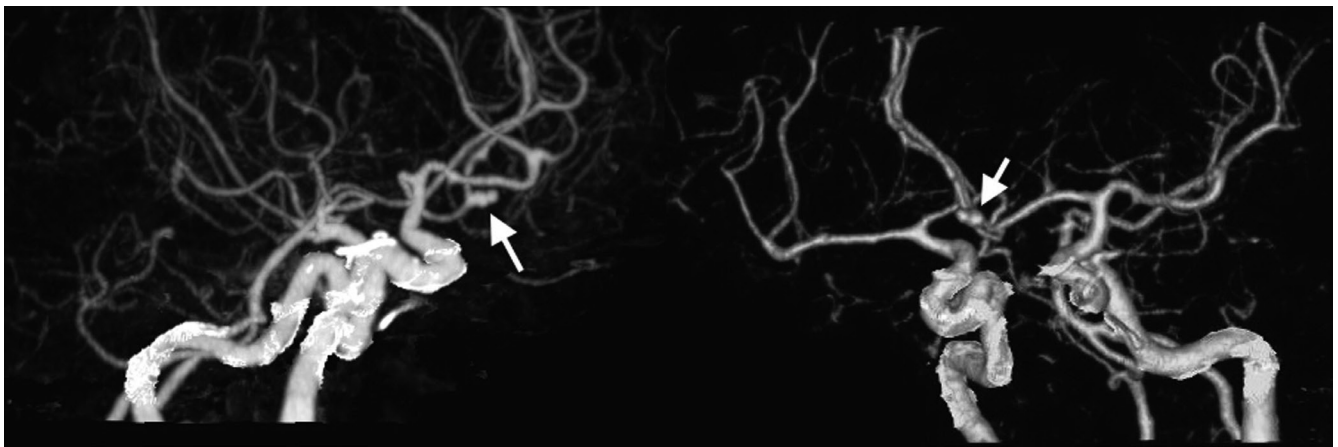
A 60-year-old woman was admitted to hospital because of sudden loss of consciousness after complaining of severe headache. On admission, she was in a stupor state (Glasgow

Coma Scale: E1V3M5), but she showed normal motion of the extremities. Blood pressure was 172/82 mmHg, and electrocardiogram showed normal sinus rhythm with mild tachycardia. Computed tomography (CT) scan of the brain revealed a thick subarachnoid hemorrhage with intraventricular extension (Fisher group III) and mild hydrocephalus (Fig. 1). A small subpial hematoma was also identified in the left frontal lobe. An irregularly shaped saccular aneurysm was also detected at the bifurcation of the left A2 and the frontopolar artery on three-dimensional computed tomography (3D-CT) angiography (Fig. 2). Laboratory data indicated normal coagulation status (platelets: 280,000/ $\mu$ L; activated partial thromboplastin time (APTT): 26.9 s; prothrombin time-international normalized ratio (PT-INR): 0.98; fibrinogen/fibrin degradation products (FDPs): 9.6  $\mu$ g/mL; D-dimer: 7.4 mg/L; bleeding time: 1.5 min), although the white blood cell count (WBC) and C reactive protein (CRP) level were increased. After the smooth induction of general anesthesia, the aneurysm was successfully obliterated with a clip through the anterior interhemispheric approach on the day of admission.

Blood pressure showed little fluctuation during the preoperative and operative periods. During the operation, a ventricular drain was placed before opening the dura,



**Fig. 1** Computed tomography on admission revealing thick subarachnoid hemorrhage with intraventricular extension and mild hydrocephalus. The small subpial hematoma was identified in the left frontal lobe (*arrows*), but not in the right temporal lobe.



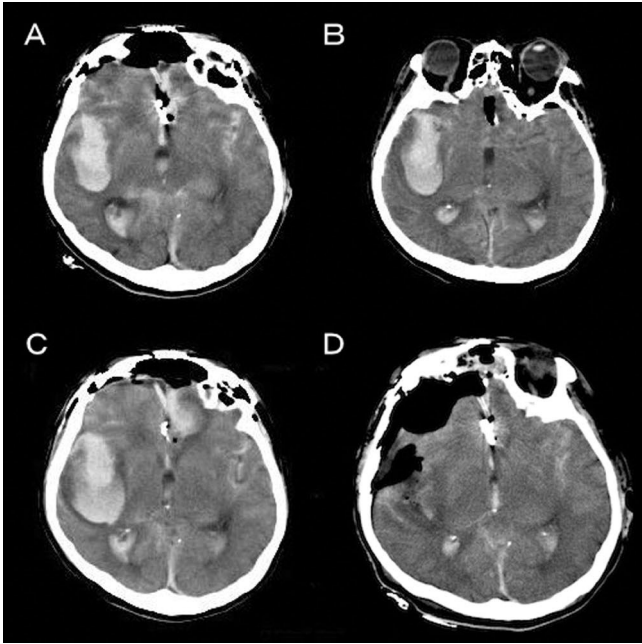
**Fig. 2** Three-dimensional computed tomography angiogram on admission revealed an irregularly shaped saccular aneurysm at the bifurcation of left A2 and frontopolar artery (*arrows*). No apparent spasm of the right middle cerebral artery was seen.

and the interhemispheric fissure was opened meticulously with irrigation with urokinase (60,000 international units (IU)/500 mL of saline). The sylvian cistern was not opened because it was distant from the callosal cistern where the aneurysm was located. We also recognized and attempted to remove a small subpial hematoma at the medial side of the left frontal lobe. However, this was difficult due to the severe damage and edema of the rectal gyrus. CT performed immediately postoperatively showed the subpial hematoma in the right temporal lobe, which was distant from the surgical corridor, but it was not removed because the patient's neurological condition was good and it would have required an extensive and invasive surgical procedure. After the operation, systolic

blood pressure was controlled between 110 mmHg and 140 mmHg. No additional intrathecal urokinase injection was given. CT performed 12 h after surgery showed no change (Fig. 3).

## Discussion

Intracerebral hemorrhage associated with subarachnoid hemorrhage indicates poor prognosis, with mortality rate ranging from 21% to 85% even following successfully surgery.<sup>1)</sup> Sylvian hematoma has also been reported to lead to a poor prognosis compared with other types of hematoma with subarachnoid hemorrhage.<sup>2)</sup> It occurs more often than temporal intraparenchymal hematoma, and has



**Fig. 3** A: Computed tomography (CT) scans immediately after the first operation demonstrating the emerging right sylvian subpial hematoma. B: CT scans 12 h after the first operation showing no apparent changes in size or shape of the hematoma. C: CT scans 36 h after the first operation. The sylvian hematoma was definitely enlarged compared with A and B. There was also a left frontal subpial hematoma, which had already been noted, on admission. D: Postoperative CT scans immediately after removal of the hematoma.

a significantly higher risk of symptomatic cerebral vasospasm.<sup>3)</sup> Sylvian hematoma is usually associated with a ruptured middle cerebral artery aneurysm and sometimes shows enlargement, even after complete obliteration of the affected aneurysm. It is assumed that when an aneurysm adhering to the pia mater bleeds, the hemorrhage can spread beneath the pia mater, and as the hematoma extends, the thin arteries running perpendicular to the pia mater are damaged, thus provoking secondary bleeding.<sup>4)</sup> As this bleeding could cause further injury to nearby small arteries, this process could be self-propagating and eventually results in expansion of the hematoma. However, as in our case, the aneurysm and the surgical corridor were distant from the sylvian fissure, and thus the initial formation of the subpial hematoma should be different. This seems to be an extremely rare occurrence. A similar case of an ACom aneurysm was reported previously, in which the pterional approach was employed and the contralateral sylvian hematoma was subsequently enlarged.<sup>5)</sup> However, in that case, the contralateral M1 portion was exposed in the initial operation, and therefore the possibility of injury to the pial artery cannot be excluded. In our case, the sylvian fissure, to which the pia mater originally adhered tightly, was damaged abruptly

by the surging subarachnoid hematoma from the ruptured anterior cerebral artery aneurysm, and the pial vessels were injured. Relaxation of the increased intracranial pressure by ventricular drainage and opening of the cistern may have caused rebleeding of the affected pial artery of the sylvian fissure. If this was true, the same phenomenon could occur even in patients with endovascular coiling procedures.

Cisternal irrigation with urokinase during the initial operation may have been responsible for the observed expansion of the hematoma. Intrathecal irrigation with urokinase or tissue plasminogen activator (tPA) was reported to be effective to remove the subarachnoid clot and is regarded as preventing vasospasm. A randomized trial of intraoperative intracisternal tPA for prevention of vasospasm following aneurysmal subarachnoid hemorrhage revealed no significant difference in the incidence of hemorrhagic complications between the placebo (16.3%; subarachnoid hemorrhage: 2.3%) and tPA group (18.8%; subarachnoid hemorrhage: 4.6%) ( $P = 0.54$ ).<sup>6)</sup> According to a retrospective review of the comparison of intrathecal thrombolytic therapies consisting of a no-treatment group (29 patients), urokinase group (60 patients), and tPA group (22 patients), there was one patient who developed intraventricular hemorrhage in the tPA group, and this was the only bleeding complication encountered in this cohort.<sup>7)</sup> In another report, the rate of hemorrhagic complications was dependent on the dose, and intraoperative irrigation with tPA was safe as long as the proper dose was applied.<sup>8)</sup> We applied urokinase rather than tPA, and the intraoperative dose was at most 60,000 IU diluted in 500 mL of normal saline, which was a lower dose compared to these previous studies. Thus, we consider the risk of bleeding due to urokinase to be quite low, although the possibility that it was responsible for accelerated bleeding cannot be excluded. Indeed, the urokinase may have been responsible for enlargement of the hematoma; the most important observation was that the subpial hematoma was newly formed around the unopened fissure distant from the operative field.

It is also possible that severe brain ischemia on admission and subsequent reperfusion provoked hematoma expansion, but postoperative magnetic resonance imaging (MRI) showed no such severe ischemic infarction.

A subpial hematoma with subarachnoid hemorrhage should be removed as soon as possible to prevent cortical perfusion impairment and subsequent cerebral vasospasm; however, it is usually difficult to completely remove subpial hematoma without parenchymal damage.<sup>2,9,10)</sup> The policy in our facility is to remove subpial hematoma, if possible. In this case, the subpial hematoma was first recognized soon after clipping surgery, but we chose close observation because the patient was in good condition and additional removal would have required an extensive and invasive surgical procedure. The patient's outcome may have been better if the hematoma had been removed earlier, but the

risk and benefit of evacuation of the hematoma should always be assessed carefully.

### Conclusion

A subpial hematoma, which is difficult to remove surgically, may form and gradually expand even when located distant from the site of a ruptured aneurysm. Special attention should be paid to patients with subpial hematoma with subarachnoid hemorrhage, even if they are treated by endovascular coiling. Growing sylvian hematoma should be removed as soon as possible.

### Conflicts of Interest Disclosure

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in the article. All authors who are members of the Japan Neurological Society (JNS) have registered online self-reported COI Disclosure Statement Forms through the website for JNS members.

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