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Case Report

Location of hemorrhage with nontraumatic acute subdural hematoma due to ruptured microaneurysm

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ABSTRACT

Background: Nontraumatic acute subdural hematoma (ASDH) may be caused by rupture of a microaneurysm of a cortical artery. In some cases, microaneurysms may have been caused by earlier trauma. Although it is difficult to detect microaneurysms on contrast-enhanced computed tomography (CT) angiography or digital subtraction angiography, it may be suspected based on the plain CT scan results and the clinical course.

Case Description: We experienced three cases presumed to be ASDH due to rupture of a microaneurysm. Plain CT scan showed that the midline shift was smaller than the hematoma thickness, and we judged from the clinical course that there was no trauma immediately before the onset. All three patients had decreased consciousness after arrival and underwent craniotomy for hematoma removal. The source of hemorrhage was in the distal part of the cortical artery, and a microaneurysm was found. In one case, histopathological examination was performed, and traumatic pseudoaneurysm was diagnosed. The postoperative course was good in all three cases.

Conclusion: If nontraumatic ASDH is suspected, the source of hemorrhage may be located more distally to the middle cerebral artery than in traumatic ASDH; hence, extensive craniotomy is required to search for the location of hemorrhage.

Keywords: Cortical artery, Microaneurysm, Nontraumatic acute subdural hematoma

INTRODUCTION

Acute subdural hematoma (ASDH) is often caused by severe head trauma. However, a nontraumatic ASDH that develops without apparent trauma, such as a cerebral contusion, is also seen. In these cases, even patients without vascular disorders, such as ruptured cerebral aneurysm, and without a clear hemorrhage source are reported to have ASDH.[5,6,12,13] Most are presumed to be caused by a ruptured cortical artery, but its pathological condition and clinical features remain unclear. This condition may involve tiny cortical artery aneurysms; however, only a few reports have been published to date with many unclear points.

Aneurysms in tiny cortical arteries are often difficult to detect without using a microscope and cannot be detected by preoperative imaging examination, such as with digital subtraction angiography. In our hospital, all ASDH-related surgeries involve detailed microscopic observation of hemorrhage sources. In this study, a ruptured microaneurysm was defined as bleeding from an aneurysm-like bulge of the cortical artery.

We experienced three cases of nontraumatic ASDH that could be intraoperatively identified as hemorrhage from a ruptured microaneurysm.

CASE DESCRIPTIONS

[Table 1] shows the clinical characteristics and CT findings of the three cases. The locations of the hemorrhages are shown in [Figure 1], intraoperative findings in [Figure 2], and the pathological image of Case 3 in [Figure 3].

Case 1

A 63-year-old man was taking warfarin due to a history of valvular disease of the heart. He noticed a sudden headache that did not improve, so he visited our hospital several hours after the onset. Computed tomography (CT) of the head revealed a right ASDH. He was somewhat alert on arrival but experienced a sudden decrease in level of consciousness. He underwent emergency craniotomy for hematoma removal. Intraoperative findings showed hemorrhaging from a microaneurysm of the anterior parietal artery. Postoperative course was uneventful, and he was discharged without complication.

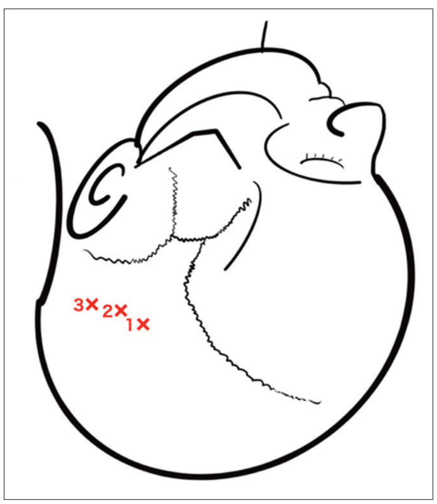

Figure 1: The location of microaneurysms of each case is illustrated.

Case 2

An 85-year-old woman who was taking two antiplatelet drugs due to a history of angina was brought to our hospital with a sudden headache and impaired consciousness. Head CT showed a left ASDH. At the time of admission, Glasgow Coma Scale (GCS) score for consciousness level was GCS 13 (E3V4M6), but 1 h later, it progressed to GCS 7 (E1V1M5) and anisocoria appeared, so an urgent craniotomy hematoma removal was performed. Intraoperative findings showed hemorrhaging from a microaneurysm of the posterior parietal artery. Postoperative course was uneventful, and she was discharged without severe damage.

Case 3

A 63-year-old man who had no significant medical history was brought to our hospital with acute left hemiparesis. CT of the head revealed a right ASDH. He was awake on arrival, but after about 1 h, his level of consciousness decreased. He underwent emergency craniotomy hematoma removal. Intraoperative findings revealed bleeding from a microaneurysm in the angular artery, which was submitted for pathological examination. After the operation, his level of consciousness recovered, and he was discharged within a few weeks.

DISCUSSION

This study highlights two important clinical issues. First, in nontraumatic ASDH when the source of hemorrhage is a microaneurysm, these sources are often located in the distal part of the cortical artery.

In ASDH due to ruptured cortical arteries, some previous reports have revealed that the location of hemorrhage of cortical arteries was near the Sylvian fissure. It has been reported that this area is likely to receive external force due to the convex structure of the skull.[3,4,11] Matsuyama *et al.* reported 19 patients with ASDH originating from cortical arteries. Among them, 15 were traumatic and

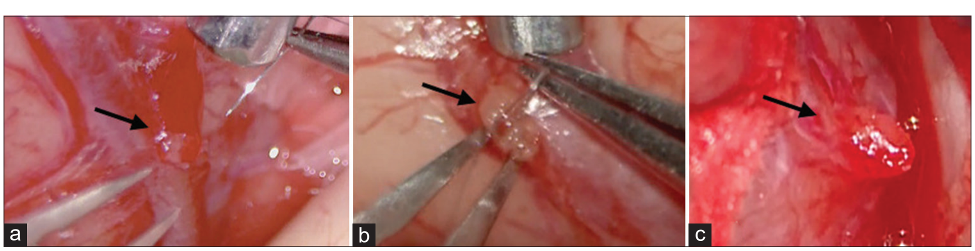

Figure 2: (a-c) Images of hemorrhage sources. Arrows point to microaneurysms.

Table 1: A patient character and finding of CT scan.

Case number	Age	Gender	Medication	Symptom	Hematoma thickness (mm)	Midline shift (mm)	Hemostatic treatment	mRS on discharge
1	63	Male	WF	Headache	19.8	19.2	Suturing	1
2	85	Female	Asp+Clp	Headache	16.1	12.1	Suturing	2
3	63	Male	-	Hemiparesis	15.8	10.0	Trapping	2

WF: Warfarin, Asp: Aspirin, Clp: Clopidogrel, mRS: modified Rankin scale

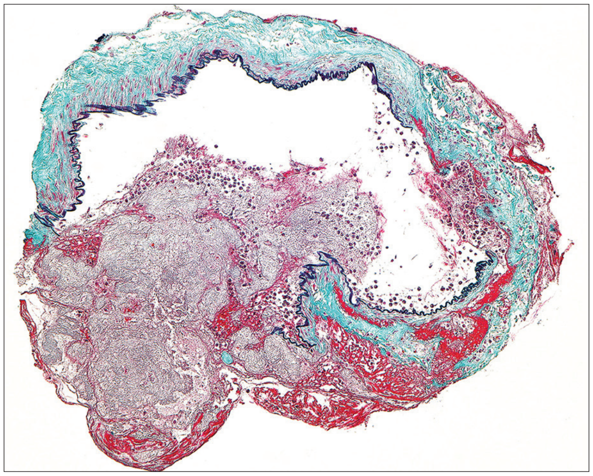

Figure 3: Image of internal elastic lamina loss and blood vessel wall destruction due to trauma.

4 were nontraumatic. The site of each ruptured cortical artery was identified in detail, and the authors determined that appropriate craniotomy including the Sylvian fissure was important.[3] Maxeiner *et al*. reported the location of hemorrhage in 46 cases of ASDH caused by damaged vessels among 600 autopsy cases. Among these 46 cases, 23 were due to cortical artery damage and were located in the Sylvian fissure area, although most of these cases showed damage in the temporal and parietal lobes. Almost all were histopathologically diagnosed with traumatic ASDH.[4]

These studies show that the cortical artery near the Sylvian fissure can traumatically rupture at any location. The pressure is expected to be low, especially in the distal part of the cortical artery, and there is a high possibility that spontaneous hemostasis can be obtained even if hemorrhage has occurred, and a pseudoaneurysm is formed after spontaneous hemostasis. It is presumed that the pseudoaneurysm rebleeds due to an increase in blood pressure or minor trauma. As it takes time for a consciousness disorder to appear with bleeding from a tiny artery, the patient should be carefully monitored. There is a possibility of sudden change in consciousness, even if the consciousness level is relatively good on arrival. Some studies have shown that resolution of consciousness after spontaneous subdural hematomas was relatively prolonged, and the symptoms on admission were often mild.[7-10] In Case 3, there seemed to be no head trauma, but the histopathology finding was consistent with traumatic pseudoaneurysm.

Second, measurement of midline shift and hematoma thickness on head CT is useful for diagnosis of this condition. In nontraumatic ASDH, the thickness of the hematoma is often larger than the midline shifts, as was seen in these cases. This suggests that it is not complicated with brain parenchymal injury. In fact, postoperative brain swelling is rare and often does not require external decompression. If traumatic ASDH can be ruled out from the clinical course, nontraumatic ASDH should be suspected. Extensive craniotomy should be performed, and cortical arteries should be exposed to the distal side to locate sources of hemorrhage.

The previous studies have also reported that the risk of rebleeding was high if proper hemostatic treatment for ruptured cortical artery was not performed.[1,2] Consequently, a good prognosis can be expected with early decompression and proper hemostasis. In the three cases in this report, the outcomes were relatively good.

CONCLUSION

ASDH due to ruptured cortical arteries can be diagnosed according to the clinical progress and head CT, and a good prognosis can be expected by rapid hematoma removal and reliable hemostasis of hemorrhage sources. Although external decompression is not required, extensive craniotomy should be performed, and cortical arteries should be exposed to the distal side to locate sources of hemorrhage. Furthermore, microaneurysms at cortical arteries may form pseudoaneurysms caused by arterial injury due to mild external force. These microaneurysms may rupture, regardless of the timing of trauma.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

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