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Case Report

Differentiating between Mycotic and Dissecting Aneurysms in a Case of Ruptured Distal Superior Cerebral Artery Aneurysm

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Objective: We present a case of subarachnoid hemorrhage (SAH) due to ruptured mycotic aneurysm found in the distal superior cerebellar artery (SCA).

Case Presentation: A 64-year-old man was admitted to our hospital with sudden unconsciousness. He had a history of alcoholism but no family history of SAH. Computed tomography (CT) showed apparent SAH; however, CT angiography (CTA) showed no apparent cause of SAH except for two small aneurysms in the same branch of the left distal SCA. We suspected mycotic aneurysm and prescribed antibiotics. It was difficult to diagnose the condition as mycotic aneurysm because there were no vegetations or caries at the time of admission. Because there were two aneurysms in the same branch with partial dilatation and stenosis, we suspected dissecting aneurysm, but continued to administer antibiotics for possible mycotic aneurysm. After the first operation, we diagnosed mycotic aneurysm because a vegetation and valve degeneration was found.

Conclusion: It is difficult to distinguish mycotic aneurysms from dissecting aneurysms because of similar appearance on imaging, especially if no vegetation is found. Nevertheless, it is important to start treatment for mycotic aneurysm. If there is the possibility of mycotic aneurysm, appropriate antibiotics should be administered, and endovascular treatment could be considered for patients with deteriorating conditions.

Keywords ▶ distal SCA aneurysm, subarachnoid hemorrhage, mycotic aneurysm

Introduction

Mycotic aneurysms often cause subarachnoid hemorrhage (SAH). The administration of appropriate antibiotics is one of the most important treatments.[1,2] Because the disease is fatal, rapid diagnosis and appropriate treatments are essential. Nevertheless, in our case, we could not make a rapid diagnosis of mycotic aneurysm because of difficulty in distinguishing this condition from dissecting aneurysm. There have been no previous reports of cases in which it was difficult to distinguish between mycotic aneurysm and dissecting aneurysm. We present the case and discuss the differential diagnosis and treatment.

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Case Presentation

A 64-year-old man was admitted to our hospital because of sudden unconsciousness (Glasgow Coma Scale [GCS] score 6 [eyes 1, verbal 1, motor 4]). His medical history included alcoholism. There was no remarkable family history of SAH. Computed tomography (CT) showed apparent SAH (**Fig. 1A**) and CT angiography (CTA) scan showed no apparent cause of SAH except for two small aneurysms in the same branch of the left distal superior cerebellar artery (SCA) (**Fig. 1B** and **1C**). Magnetic resonance imaging showed infarction in the region of the left distal SCA (**Fig. 1D**). His World Federation of Neurosurgical Societies

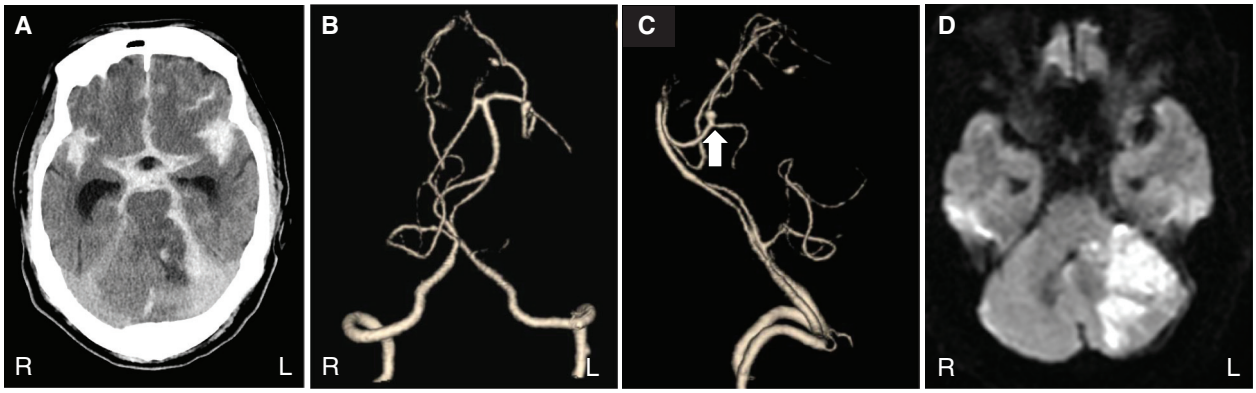

Fig. 1 Preoperative CT and DWI images. (**A**) CT scan revealing subarachnoid hemorrhage surrounding the brainstem. Angiography revealing the aneurysm in the distal SCA: (**B**) frontal view, (**C**) lateral view (arrow), (**D**) DWI revealing infarction in the SCA territory. CT: computed tomography; DWI: diffusion-weighted imaging; SCA: superior cerebral artery

(WFNS) grade was 5 with hydrocephalus, and he underwent external ventricular drainage. The laboratory data suggested inflammation (white blood cell [WBC] count: 18630/μL, C-reactive protein [CRP]: 6.2 mg/dL, procalcitonin: 2 ng/mL), and we suspected mycotic aneurysm due to myocarditis.

We consulted a cardiologist for transthoracic echocardiography (TTE) and a dentist to check for caries; no vegetations or caries were detected. We prescribed 2 g/day of ceftriaxone as antibiotic therapy in case of the possibility of mycotic aneurysm. After 2 days, intra-oral *Streptococci*, *Streptococcus mitis/Streptococcus oralis*, grew on blood culture. We altered the antibiotics to high-dose penicillin (24000000 units/day) considering the higher risk of mycotic aneurysm. Follow-up CTA 7 days after admission showed that the distal SCA aneurysms had changed dramatically. The more proximal aneurysm was over 10 mm (10.4 mm × 6.9 mm) and the more distal one was larger than that seen previously, though the difference was not significant (**Fig. 2A**).

We considered the more proximal aneurysm as the source of hemorrhage. The patient's consciousness improved to GCS score of 8 (eyes 1, verbal 1, motor 6), WFNS grade improved to 4, and the patient became able to obey orders. We considered the diagnosis of dissecting aneurysm rather than mycotic aneurysm because of the presence of both dilatation and stenosis within the same vessel and concurrent infarction in the SCA territory.

We performed endovascular surgery because of his deteriorating condition. A 6-French guiding catheter (ENVOY, Cordis, Miami Lakes, FL, USA), microcatheter (SL-10, Stryker, Kalamazoo, MI, USA), and guide wire (CHIKAI 0.010, Asahi-Intecc, Nagoya, Aichi, Japan) were used. After delivering the SL-10 into the aneurysm, we started coil embolization. Our plan was occlusion of the aneurysm and the parent artery with the aneurysm. After embolization with 19 coils, there was little blood flow in the aneurysm and we expected the target branch to be occluded (**Fig. 2B**). After the first operation, the patient was prescribed an antiplatelet agent (cilostazol 200 mg/day) to prevent thrombosis and spasm. We also continued antibiotics for the possibility of infection.

Although the laboratory data improved, follow-up TTE 2 weeks after admission showed vegetation and valve degeneration. This implied that the aneurysm may be a mycotic aneurysm. Therefore, we changed our diagnosis. According to Duke criteria, echocardiogram positive for infective endocarditis (IE) (vegetation and valve degeneration) is one positive major criterion, with three minor criteria (fever [>38 °C], intracranial hemorrhage, and positive blood culture), suggesting the patient had IE.[3)]

Follow-up angiography 3 weeks after coil embolization showed that the aneurysm was enlarged, and the distal aneurysm had become larger (**Fig. 2C**). Antiplatelet therapy was discontinued. The patient received additional endovascular treatment 18 days after the first operation. The procedure was the same as the previous operation. At the beginning of the treatment, angiography showed a partially thrombosed proximal aneurysm and the distal aneurysm had disappeared probably due to the effect of antibiotics (**Fig. 3A**). During surgery, we added a coil in the neck and parent artery from which the aneurysm arose to prevent re-rupture. Five coils were added, and the aneurysm disappeared completely by the end of the operation (**Fig. 3B**). We did not prescribe antiplatelet agents again. Postoperatively, the aneurysm did not recur. Six weeks after penicillin

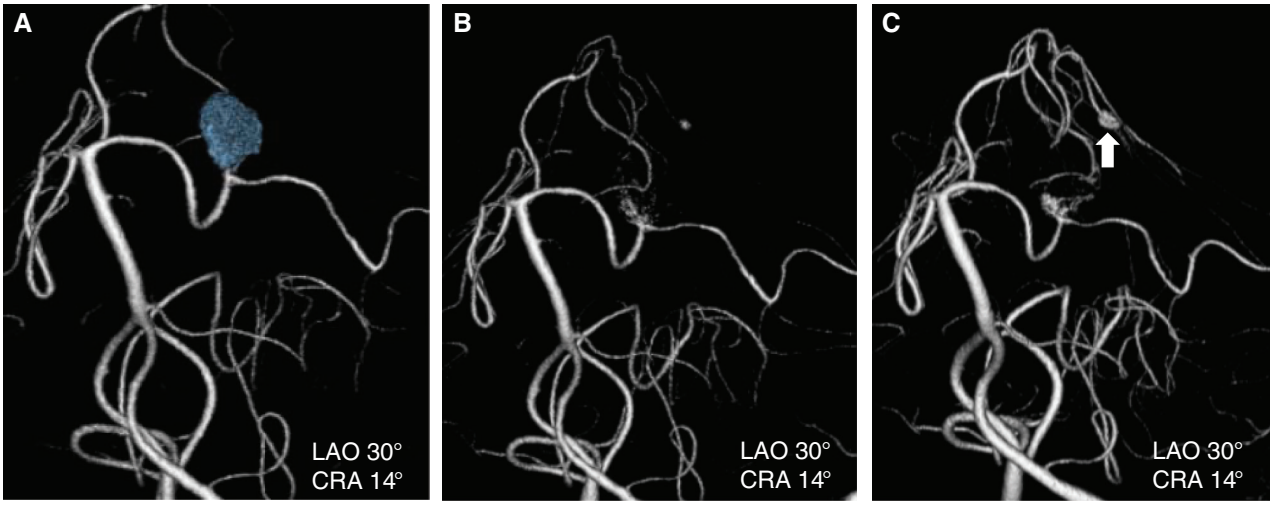

Fig. 2 Preoperative and postoperative angiography (Working angles were LAO 30° and cranial 14). (**A**) Angiography revealing an enlarged aneurysm in the SCA. (**B**) Postoperative angiography revealing little blood flow in the neck of the aneurysm. (**C**) Follow-up angiography revealing that blood flow in the neck of the aneurysm and that the distal aneurysm had become larger (arrow). LAO: lateral anterior oblique; SCA: superior cerebral artery

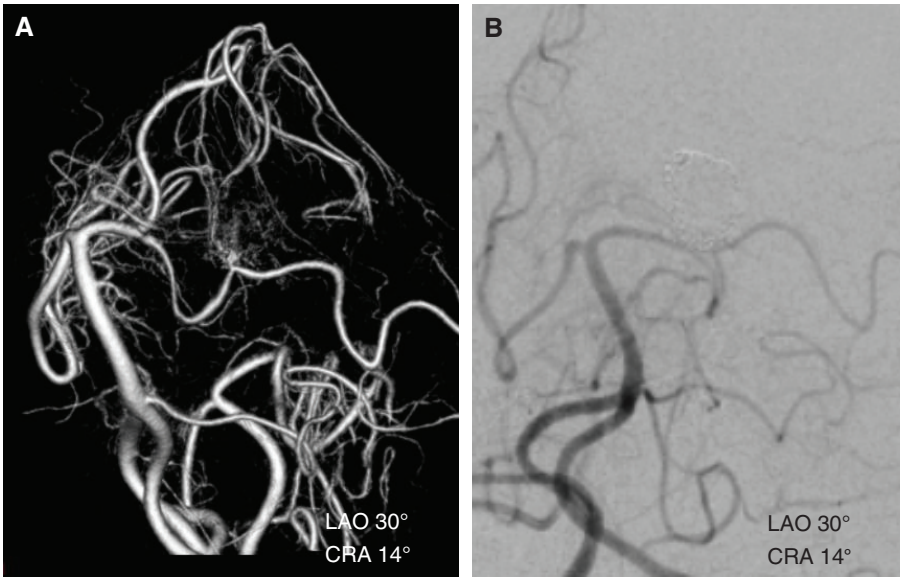

Fig. 3 Preoperative and postoperative angiography of the second treatment (Working angles were LAO 30°and cranial 14°). (**A**) Preoperative angiography revealing that the blood flow was reduced, and the distal aneurysm had disappeared. (**B**) Postoperative angiography revealing no blood flow in the aneurysm. LAO: lateral anterior oblique

injections, we changed the oral antibiotics to 400 mg of moxifloxacin because an artificial coil was present in his body. The course of dosage of antibiotics was as follows: ceftriaxone (2 g/day) for the first 2 days, high-dose penicillin (24000000 units/day) for 6 weeks (refer to previous report[4]), and subsequently moxifloxacin (400 mg) was given. He received an additional shunt operation for hydrocephalus and was transferred to a rehabilitation hospital. On discharge, his condition was GCS score of 14 (eyes 4, verbal 4, and motor 6). The patient and his family provided informed consent for the publication of this report.

Discussion

In this case, we had difficulty distinguishing between mycotic aneurysm and dissecting aneurysm. There have been no reports on the differential diagnoses of these diseases;

ours is the first. In this report, we consider the difference between dissecting and mycotic aneurysm.

The clinical and pathological features, and treatment of dissecting aneurysm are the following: the imaging of dissecting aneurysm often shows the pearl-and-string sign; however, some cases only show stenosis or dilatation.[5,6] Regarding pathology, Mizutani et al. reported that the primary mechanism of arterial dissection involves sudden disruption of the internal elastic lamina (IEL) and subsequent penetration of circulating blood into the media.[7] Sato et al. reported a study of autopsy cases with vertebral artery (VA) dissecting aneurysms and suggested that vascular dissection is attributable to IEL rupture.[8] The gap of ruptured IEL is repaired and SAH occurs often in the acute phase of dissection.[9] Over time, healing becomes complete and the risk of rupture decreases.[9] Regarding the treatment for dissecting aneurysm, many reports include surgical trapping, proximal clipping, and endovascular trapping.[7,9,10] It often occurs in the VA; however, some cases occur in the SCA. A dissecting distal SCA aneurysm is extremely rare. Takei et al.[11] reported a case of SAH with the pearl-and-string sign and infarction of the cerebellum. In our case, the reason to suspect dissecting aneurysm was that the aneurysms were located in the same branch of the distal SCA with dilatation, stenosis, and concurrent infarction.

By contrast, the clinical and pathological features, and treatment of dissecting aneurysm are as follows: Zanaty et al.[2] reported imaging of mycotic aneurysms occurring in peripheral with undefined neck. Some reports suggested that these aneurysms adopt various kinds, including saccular, fusiform, and others.[1] Regarding pathology, three explanations have been offered.[12–14] The reason that is the most accepted is acute neutrophilic infiltration and destruction of the IEL.[12–14] Another reason is hemorrhagic infarcts and pyogenic arteritis distributed in the small arteries with rupture.[14] Regarding treatment for aneurysms include surgical trapping, clipping, and endovascular coiling and trapping.[1,15] Endovascular surgery has become an important treatment for mycotic aneurysm. Many patients with deteriorating conditions and those who have vegetations and require cardiothoracic surgery have been treated with endovascular surgery. Endovascular surgery does not need to be performed prior to cardiothoracic surgery for removal of vegetations if there are large vegetations in the heart.[2] Many reports suggested that endovascular treatment does not cause complications including infection.[15]

The pearl-and-string sign can be a tool for making the diagnosis. Nevertheless, the imaging of both diseases shows various types of aneurysm and it is difficult to make the diagnosis using only imaging. In terms of pathology, both diseases involve destruction of the IEL. Mycotic aneurysms progress to abscess or neutrophilic infiltration. It is difficult to make pathological diagnoses, especially in endovascular treatment because it is difficult to acquire specimens. It is difficult to make the diagnosis, especially in patients with fever or infection. Therefore, we must examine patients considering both diseases and seek carefully correct diagnosis with both treatments. In the process of diagnosis, we should consider many factors, including imaging, physical findings, progress of the disease, and others. In the present case, we suspected dissecting aneurysm first. The vegetation, the intra-oral streptococcus in his blood culture, and the disappearance of the more distal aneurysm were the reasons for changing the diagnosis to mycotic aneurysm.

The treatment of both diseases was similar, including surgical and endovascular methods. Nevertheless, regarding mycotic aneurysms, it is important to take appropriate antibiotics. Intracranial mycotic aneurysm induces SAH and is associated with poor prognosis.[1,2,13,16] The most important management approach to this disease is timely diagnosis and prescription of appropriate antibiotics for each bacterium.[2] Appropriate antibiotics can resolve 30% of aneurysms.[17] In our case, the more distal aneurysm resolved probably because of the effect of antibiotics in the second operation.

To make a correct diagnosis, the detection of vegetation is important; however, vegetation is difficult to detect with TTE compared to transesophageal echocardiography (TEE). TTE detected vegetation in 50% cases, while TEE detected it in 90%–100% of the cases.[18] Nevertheless, we chose TTE because the patient was unconscious, and the aneurysm was unstable. In cases such as ours, the vegetation cannot be detected on admission because of the instability of the patient and the considering the risks of TEE. If the patient is stable, assessment with TEE is recommended. If the patient is unstable, it is best to attempt a repeat TEE after an interval.

In the present case, despite the fact that we initially suspected dissecting aneurysm, we continued antibiotics considering the risk of mycotic aneurysm; a second TEE detected vegetation. Without injection for antibiotics in cases of mycotic aneurysm, the prognosis of the patient become worse. The early initiation of antibiotics may result in good prognosis. This case illustrates the difficulties of making the differential diagnosis between dissecting and mycotic aneurysms, the importance of considering both possibilities, and the initiation of treatment for both.

Conclusions

We encountered a mycotic aneurysm causing SAH. This aneurysm was difficult to diagnose as a mycotic aneurysm and not a dissecting aneurysm. Considering the possibility of both diseases, it is important to administer appropriate treatment, including antibiotics. Endovascular surgery is effective, especially for patients with deteriorating conditions.

Disclosure Statement

None.

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