Detection of blood blister–like aneurysm and intramural hematoma with high-resolution magnetic resonance imaging

Case report

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Blood blister–like aneurysms (BBAs) tend to have a more precipitous clinical course, enlarging rapidly and rebleeding frequently. Nevertheless, they often present a diagnostic challenge because of the characteristic morphologic features of a wide neck and shallow outpouching of the medial wall. The authors present the case of a 34-year-old woman who suffered a subarachnoid hemorrhage whose cause could not be determined on the initial imaging with digital subtraction (DS) angiography and CT angiography. Interestingly, MR imaging studies obtained on the 7th day revealed an intramural hematoma on the dorsal wall of the left internal carotid artery, which helped in the diagnosis of BBA on the third DS angiography study obtained on the 8th day, and in the surgical intervention on the 10th day. This case supports the hypothesis that focal dissection contributes to the formation of BBAs. Use of MR imaging in the subacute stage, in addition to DS and CT angiography, might be helpful in the diagnosis of BBAs.

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Key words • blood blister–like aneurysm • intramural hematoma • high-resolution magnetic resonance imaging • dissection • vascular disorders

Blood blister–like aneurysms are rare, tiny aneurysms on the dorsal wall of the supraclinoid ICAs.¹–⁴,¹²–¹⁶,¹⁹ This type of aneurysm has characteristic morphologic features (wide neck, shallow outpouching of the medial wall), and it often presents a diagnostic challenge.⁴ These lesions are extremely fragile and are often complicated to manage with surgical intervention or endovascular treatment.¹,¹²,¹⁵ Treatment strategies for BBAs have included clipping, clipping on wrapping, trapping with bypass, coil embolization, and stent-assisted coil embolization.⁶–⁹,¹³,¹⁹ The pathogenesis of BBAs is still unclear due to a lack of histological evaluation, and there have been no reports to date showing the use of imaging modalities other than DS and CT angiography. We describe a case of ruptured BBA in which intramural hematoma was detected with MR imaging in the subacute stage, and discuss its clinical implications.

Case Report

History and Examination. This 34-year-old woman was referred to our neurosurgery department for sudden onset of severe headache; she had a history of high blood pressure and smoking. On admission, physical examination revealed neck stiffness with no neurological deficits.

Neuroimaging Studies. Computed tomography scans of the brain demonstrated SAH, mainly in the left basal cistern (Fig. 1). However, immediate CT angiography showed no vascular abnormalities in the intracranial vessels, and DS angiography studies obtained on the same day also failed to detect abnormal vessels (Fig. 2A–C). The patient was treated conservatively. The CT and DS angiography studies repeated on Day 4 again failed to detect abnormalities (Fig. 2D–F).

On Day 7, MR imaging (3-T Signa HD; General Electric Medical Systems) was performed to evaluate vasospasm following SAH as well as to visualize a possible aneurysm. For the T1-weighted imaging we used 3D spoiled gradient–recalled acquisition, TR 30 msec, TE 1.9 msec, flip angle 20°, matrix 256 × 160, field of view 12 cm, slice thickness 1.6 mm with zero-fill interpolation, fat saturation technique; for T2-weighted imaging the specifications were TR 3000 msec, TE 55 msec, echo train 16, matrix 384 × 256, field of view 12 cm, slice thickness 2 mm, interslice gap 0.5 mm. Interestingly, a high-signal-intensity spot was clearly detected on the dorsal wall of the left ICA in the sagittal plane on T1- and T2-weighted imaging (Fig. 3A–C), which suggested intramural hema-
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Fig. 1. Initial CT scan demonstrating SAH predominantly in the left basal cistern.

toma due to focal dissection of the vessel. This finding supported the diagnosis of BBA in the third DS angiography study obtained on the 8th day (Fig. 3D and E).

Treatment and Postoperative Course. On the 10th day after admission, a left frontotemporal craniotomy was performed after exposure of the left cervical ICA, and the sylvian fissure was opened widely to expose the left ICA. A blood blister–like bulge was clearly located at the anteromedial wall of the C1 portion of the ICA, and the apparent aneurysmal sac was not observed (Fig. 4). Moreover, there was a dark red area on the wall continuing to the bulge in the ICA, suggesting intramural dissection. No apparent clot covering the aneurysm or atherosclerotic changes in the ICA was noted. These findings were compatible with those of the MR imaging. The aneurysm was treated with a clipping on wrapping procedure. The postoperative course was uneventful and the patient was discharged with no neurological deficit.

Discussion

Blood blister–like aneurysms are rare lesions arising from nonbranching sites of the dorsal wall of the ICA, and account for 0.9%–6.5% of all ICA aneurysms. This type of lesion is characterized by negative angiographic findings and a thin aneurysmal wall without a neck. It has been suspected that the formation of these aneurysms follows an unusual pathogenesis, which may include atherosclerosis, arterial dissection, and hemodynamic stress. Dissection of the ICA has been proposed as a causative factor for BBAs based on angiographic findings, but this is still controversial due to a lack of direct evidence.

This case supports the hypothesis that focal dissection could contribute to the formation of BBAs, which...
might be associated with hypertension. Because BBAs occur in middle-aged patients with and without hypertension, arteriosclerosis alone does not explain all BBAs. Moreover, the main aneurysm location is on the dorsal wall where the ICA curves in both lateral and superior directions, and where hemodynamic stress is thought to be high. Hemodynamic stress might affect the ICA directly at the dorsal wall and contribute to the focal dissection in BBAs. Therefore, it is difficult to rule out the possibility of focal dissection for BBAs with angiography alone because of their small size. More data are needed to establish the true pathogenesis of BBAs.

In terms of the imaging modalities, recent advances in DS and CT angiography enable the identification of tiny intracranial aneurysms. However, the imaging of BBAs is still challenging, and it is sometimes difficult to detect tiny BBAs with an initial imaging session in which DS and CT angiography are used. Meticulous technique and a high index of suspicion are often necessary to make this diagnosis. Recently, reports have indicated the usefulness of high-resolution MR imaging in detecting dissection in the cervical ICA and intracranial arteries, because this modality can detect intramural hematoma in a cross-section. To date, no reports have used this modality for intracranial BBAs. A BBA contributing to SAH was suspected in this patient because she was a middle-aged woman and relatively young compared with the general population of patients with aneurysmal SAH. Therefore, we attempted MR imaging with sagittal sections to evaluate intramural hematoma. The third DS angiography, obtained on the 8th day, demonstrated an aneurysm (arrowhead) on the dorsal wall of the left ICA (D: lateral view; and E: 3D rotational view). Insets: The outlines and arrows in panels A–C indicate the vessel lumen. In panel E, the arrow indicates OphA, and double arrows indicate PCoA.

Conclusions

This is the first reported case of BBA in which intramural hematoma was detected with MR imaging in the

**Fig. 3.** Sagittal MR images obtained on the 7th day demonstrating a high-signal-intensity spot on the dorsal wall of the left ICA on T1- (arrow in A and B) and T2-weighted (arrow in C) images, indicating the intramural hematoma. The third DS angiography, obtained on the 8th day, demonstrating an aneurysm (arrowhead) on the dorsal wall of the left ICA (D: lateral view; and E: 3D rotational view). Insets: The outlines and arrows in panels A–C indicate the vessel lumen. In panel E, the arrow indicates OphA, and double arrows indicate PCoA.

**Fig. 4.** Intraoperative photographs showing the BBA on the left ICA (left), which was completely treated with the clipping on wrapping method (right).
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subacute stage. This case supports the hypothesis that focal dissection contributes to BBAs. In addition to DS and CT angiography, MR imaging in the subacute stage may be a useful aid in the diagnosis of BBA.

Disclosure

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References


