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Unusual Giant Cerebral Venous Varix Associated With Brain Abscess: Variant of Hereditary Hemorrhagic Telangiectasia

—Case Report—

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Abstract

A 35-year-old man suffered secondary generalized tonic-clonic convulsions due to a large brain abscess. Neuroimaging incidentally revealed another tumor-like lesion. Cerebral angiography confirmed that the lesion was an unusual giant venous varix associated with a high-flow pial arteriovenous fistula (AVF) and showed one more small arteriovenous malformation (AVM). Pulmonary AVF, which can cause brain abscess, was also detected. Surgical ligation of the AVF and removal of the small AVM via individual craniotomies resulted in successful extirpation of the cerebrovascular malformations. Although the typical mucocutaneous symptoms were absent in this patient, the combination of arteriovenous anomalies was highly suggestive of hereditary hemorrhagic telangiectasia.

Key words: hereditary hemorrhagic telangiectasia, cerebral venous varix, arteriovenous fistula, arteriovenous malformation, brain abscess

Introduction

Hereditary hemorrhagic telangiectasia (HHT), so-called Rendu-Osler-Weber disease, is an autosomal dominant angiodysplastic disorder characterized by mucocutaneous telangiectases and visceral arteriovenous malformations (AVMs).[5,8,9] Recurrent epistaxis and gastrointestinal bleeding are common symptoms. Neurological manifestations are observed in about 10% of patients with HHT.[18,21] Over 60% of neurological manifestations reported were secondary to pulmonary arteriovenous fistula (AVF).[21] Cerebrovascular malformations occur in 5–11% of patients with HHT,[5,8,9] but do not always cause significant symptoms. However, brain and pulmonary lesions associated with HHT can cause significant morbidity and even mortality.[21]

We report a possible variant case of HHT consisting of an unusual giant venous varix associated with a high-flow cerebral AVF which were incidentally detected in a patient with multiple brain abscesses.

Case Report

A 35-year-old left-handed man suffered generalized tonic-clonic convulsion that began as partial convulsion of the left upper limb. He experienced postictal left hemiparesis. He had no history of recurrent epistaxis or gastrointestinal bleeding but he had suffered a high-grade fever for a few days before the seizure. His niece had suffered intracerebral hemorrhage and harbored multiple cerebral AVMs. No other family members had a contributory history, but none had been screened for cerebrovascular disease.

On admission, computed tomography (CT) showed two different lesions, a ring-like enhanced lesion with surrounding low density area in the right frontal lobe, and a strongly enhanced tumor-like lesion in the left central region (Fig. 1A). Magnetic resonance (MR) imaging on the same day showed

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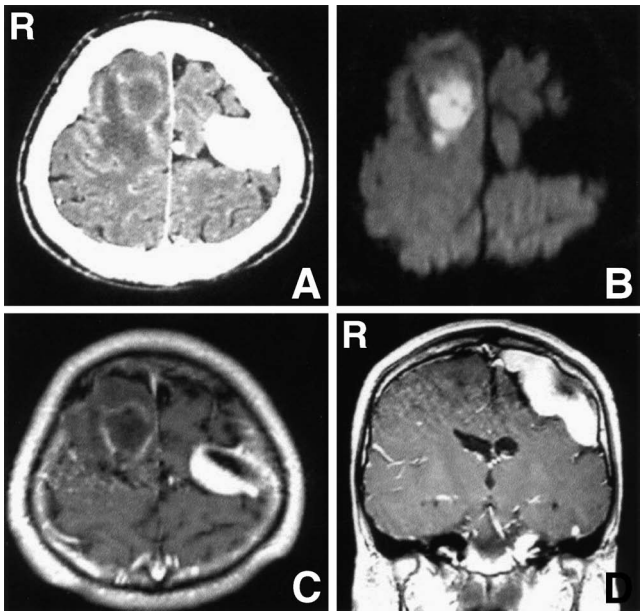

Fig. 1 A: Computed tomography scan of the patient's head showing a right frontal ring-like enhanced lesion with surrounding low density area and a highly enhanced mass lesion in the left central region. B: Axial diffusion-weighted magnetic resonance (MR) image showing multiple hyperintense lesions, with the largest in the right frontal lobe, indicating brain abscesses. C: Axial T_1-weighted MR image with gadolinium showing a ring-like enhanced lesion in the right frontal lobe and a hyperintense enhanced mass lesion in the left central region. D: Coronal T_1-weighted MR image with gadolinium showing a large extra-axial mass lesion with strong enhancement and partial hypointense area.

the right frontal lesion as hyperintense on diffusion-weighted images, and ring-like enhancement on T_1-weighted images with gadolinium (Fig. 1B–D). Diffusion-weighted imaging also revealed hyperintense lesions indicating brain abscesses. T_1-weighted MR imaging with gadolinium showed the tumor-like lesion in the left central region with strong enhancement and partially hypointense flow void pattern. The lesion was located extra-axially and seemed to compress the cerebral surface.

The right frontal lesion was drained through a burr-hole craniotomy. Yellowish, dense pus was aspirated. Bacteriological culture of the pus yielded *Streptococcus intermedius*. After 5 days of continuous drainage, antibiotics were administered. Three months later, all signs of infection had completely disappeared on MR images. Severe dental caries

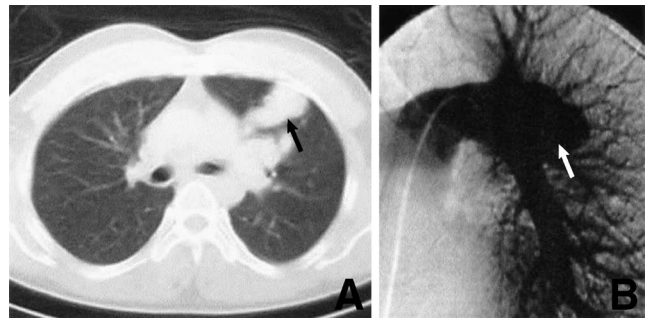

Fig. 2 Chest computed tomography scan with contrast medium (A) and left pulmonary artery angiogram (B) revealing an abnormally dilated vessel in the upper lobe of the left lung (*arrows*).

that required extraction of teeth were treated by a dentist after resolution of the brain abscesses. Chest CT revealed a mass lesion in the upper lobe of the left lung (Fig. 2A), which was confirmed by pulmonary angiography to be an enlarged vessel associated with a pulmonary AVF (Fig. 2B). Radiologists and pulmonary surgeons suggested that the pulmonary AVF was the cause of the multiple central nervous system infections. Right upper lobectomy, which included the AVF, was performed.

Cerebral digital subtraction angiography (DSA) was performed to evaluate the tumor-like lesion in the left central region. Left internal carotid artery DSA showed a high-flow AVF fed only by the distal end of the expanded pericallosal artery (Fig. 3). The tumor-like lesion was a giant venous varix that had expanded due to the high-flow shunt. Vertebral artery DSA showed another small AVM at the cortical surface of the right occipital lobe, which was about 1 cm in diameter and not detected by MR imaging (Fig. 4).

Surgical ligation of the artery feeding the AVF was performed via left frontoparietal craniotomy. The expanded vessel below the point of ligation was partially resected. Histological examination showed only the structure of the dilated vein. After surgery, the patient complained of numbness and tingling of his right hand, but he did not suffer any permanent deficits. One month later, postoperative CT showed the thrombosed varix without enhancement. The occipital AVM was removed via right occipital craniotomy. There were no neurological deficits after the surgery.

Discussion

An unusual giant cerebral venous varix was inciden-

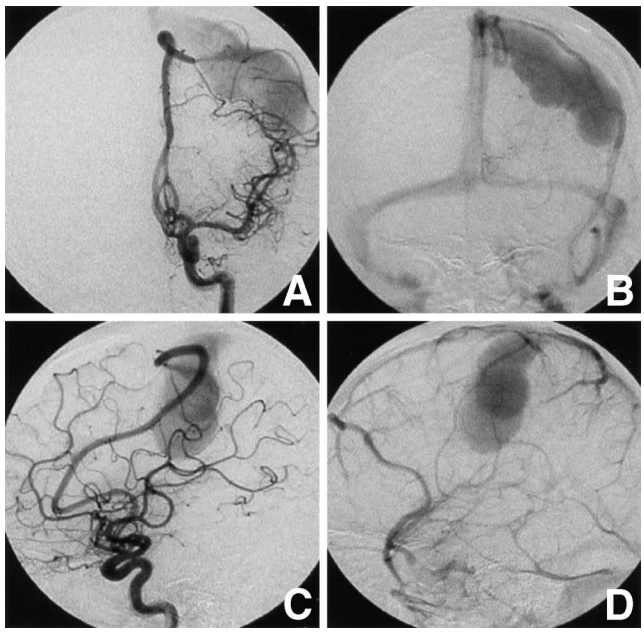

Fig. 3 **Left internal carotid artery angiograms, anteroposterior (A, B) and lateral views (C, D), showing an expanded pericallosal artery feeding a venous varix through an arteriovenous fistula (AVF), which is indicated by a ''jet'' on the early-phase angiograms (A, C), and the giant venous varix associated with the AVF appearing as ''pooling'' on the late-phase angiograms (B, D).**

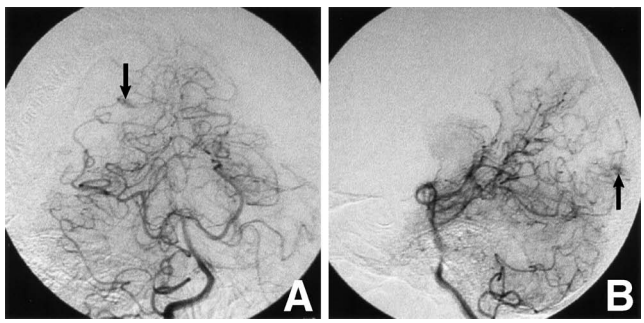

Fig. 4 **Right vertebral artery angiograms, anteroposterior (A) and lateral views (B), showing a superficial arteriovenous malformation fed by the calcarine artery (*arrows*).**

tally detected in the present patient who had brain abscesses that were probably secondary to pulmonary AVF. This giant varix was associated with a high-flow pial AVF with a single feeder. In addition, another small cerebral AVM was detected only by DSA. This combination of various arteriovenous anomalies in multiple organs is rarely seen in the same patient.

Multiplicity of cerebral AVMs is characteristic of cerebrovascular malformations associated with HHT. Review of a large number of patients with HHT revealed multiple AVMs in 33–50% of patients with cerebral AVM associated with HHT.[15,20,28] We were unable to make a definitive diagnosis of HHT in our patient because of the absence of typical symptoms such as repetitive spontaneous epistaxis or mucocutaneous telangiectases.[23] However, the systemic multiple AVMs and the family history of multiple cerebral AVMs supported the diagnosis of variant HHT. HHT is associated with at least two different genetic abnormalities, mutations of the endoglin gene and activin receptor-like kinase 1 gene.[5,8,9] However, the relationship between genotypes and clinical manifestations has not been clarified. Genetic factors may determine such variant phenotypes in individual patients.

Brain abscess may be the first symptom of HHT. Brain abscess occurs in approximately 5% of patients with pulmonary AVM, an incidence which is 1000 times that of spontaneous brain abscess.[4,19,21] Bacteria can easily enter the cerebral circulation via right-to-left shunting without the filtering action of the pulmonary capillaries.[1,12,19,21] In addition, severe dental caries, as seen in our case, may increase the risk of sepsis. Pulmonary AVF is seen in 10–30% of HHT patients, and brain abscess occurs in about 1% of patients with HHT.[19] Such brain abscess can recur even after regression, as long as the pulmonary AVF remains.[13,22,27] Radical treatment, such as direct surgery or endovascular embolization, is necessary for the pulmonary AVF to prevent recurrence of brain abscess in patients with HHT.

Cerebrovascular malformations associated with HHT have specific neuroimaging characteristics compared with sporadic occurrences. First, a single direct pial AVF without nidus was observed in 28–50% of all cerebral arteriovenous anomalies associated with HHT.[13–15] This type of malformation is rare in sporadic cerebrovascular malformations.[25,26] Furthermore, AVFs in patients with HHT commonly drain to the superficial cortical veins, either an enlarged cortical vein or a venous pouch.[7,14,15,17] This drainage pattern is different from drainage to the galenic venous system commonly seen in sporadic cerebral AVFs.[10] Therefore, we consider such a malformation to be highly suggestive of HHT. In the present case, extraordinary cortical expansion of the draining vein had mimicked a tumor on CT and MR imaging. Second, cerebral AVMs associated with HHT are usually so small that even MR imaging often fails to detect them.

Comparison of MR imaging with conventional angiography in 17 patients with HHT found that 25 of 47 cerebrovascular malformations were not seen on the MR images.[6] Angiographic analysis showed that 27 of 28 AVMs were less than 3 cm.[28] Recent studies categorized all AVMs in patients with HHT into two groups: small AVMs (3 cm or less) and micro AVMs (1 cm or less).[14,15] Cortical AVMs are also commonly observed in patients with HHT.[15] These two unique features were characteristic of our case as well.

The therapeutic strategy for incidentally detected cerebrovascular malformations in patients with HHT should be carefully determined. Sporadic cerebrovascular malformations in patients without HHT are often treated by surgical or intravascular procedures to prevent bleeding. The natural course of cerebrovascular malformations in patients with HHT is still unknown, but they seem to develop in a somewhat different way from sporadic cerebrovascular malformations. Investigation of 28 AVMs (including both AVM and AVF) in 22 patients with HHT found that the bleeding risk ranged from 0.36% to 0.56% per year, significantly lower than the bleeding risk for sporadic AVMs.[28] No untreated micro AVMs bled during the follow-up period, although two of eight AVFs caused intracerebral hemorrhage.[15] In one reported case of HHT, a small cerebral AVM regressed spontaneously.[2] On the other hand, intracerebral hemorrhage arising from such malformations has caused severe deficits.[11,13,16] Three members of one family had hemorrhagic central nervous system AVMs.[11] A family history of intracranial hemorrhage may be a risk factor for bleeding from cerebrovascular malformations in patients with HHT. The patient's age at the time of detection should also be taken into consideration.[16,24]

The present case was treated by surgical ligation of the AVF and removal of the small AVM via individual craniotomies, which resulted in successful extirpation of the cerebrovascular malformations. Endovascular occlusion is sometimes effective, especially for deep-seated AVFs.[3] However, surgical ligation via craniotomy is generally safe and more certain than the endovascular approach for high-flow and superficial AVFs.[17]

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