Angiographically Occult Dural Arteriovenous Malformation in the Anterior Cranial Fossa

—Case Report—

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Abstract

A 62-year-old male presented with a dural arteriovenous malformation located in anterior cranial fossa manifesting as acute right frontal intracerebral and subdural hematomas. Cerebral angiography showed only mass sign, but surgical exploration disclosed the dural arteriovenous malformation in the anterior cranial fossa. Anterior cranial fossa dural arteriovenous malformation should be considered if computed tomography reveals intracranial bleeding involving the frontal base, even if cerebral angiography does not demonstrate vascular anomalies.

Key words: angiographically occult arteriovenous malformation, anterior cranial fossa, anterior ethmoidal artery, dural arteriovenous malformation, intracranial bleeding, vascular sac

Introduction

Dural arteriovenous malformations (AVMs) are responsible for about 10% to 15% of all intracranial AVMs.⁵⁾ The location is predominantly in the transverse-sigmoid and cavernous sinuses. Dural AVMs involving the anterior cranial fossa are rarely found. We present a case of anterior cranial fossa dural AVM not visualized by angiography.

Case Report

A 62-year-old male suddenly developed headache and nausea, followed by loss of consciousness. He was immediately transferred to National Shizuoka Hospital. On admission, he was comatose, with decorticate posture upon painful stimulation. His pupils were round, of equal size, and reacted sluggishly to light.

Computed tomography (CT) demonstrated acute intracerebral hemorrhage within the right frontal lobe associated with massive ventricular perforation, a subdural hematoma extending to the anterior cranial fossa, marked midline shift to the left, and

generalized brain edema (Fig. 1). Cerebral angiography showed no abnormal vascular lesion, except for vascular displacement resulting from the intracerebral hematoma, and marked circulation delay due to high intracranial pressure (Fig. 2). The preoperative diagnosis was intracerebral and subdural hematomas of unknown etiology. We suspected bleeding from an aneurysm which had become acutely thrombosed after rupture.

Emergency craniotomy was performed within 2 hours of admission and the thick subdural hematoma was removed. Exposure of right frontal cortical surface revealed an enlarged red cortical vein draining medially into the superior sagittal sinus. After partial evacuation of the frontal hematoma, retraction of frontal lobe revealed the vascular connection between the dura in the region of cribriform plate and the pial vessels on the anterior inferior aspect of the frontal lobe. The right olfactory nerve was sacrificed to gain better visualization of the vascular lesion. The branches of anterior ethmoidal artery entered the AVM overlying the dura mater of the right cribriform plate and the olfactory groove. A dilated venous sac was located near the site of the

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Fig. 1 Computed tomography scans showing large intraparenchymal hemorrhage with intraventricular extension in the right frontal lobe, a subdural hematoma, and midline shift.

dural-to-pial anastomosis. The involved dura mater in and around the olfactory groove was extensively coagulated, and the vascular connection between the dura and frontal lobe was divided, resulting in collapse of the vascular sac and the arterialized pial

veins. The nidus was totally excised with removal of the intracerebral hematoma. Histological examination confirmed the diagnosis of AVM (Fig. 3).

Postoperatively, the patient remained comatose due to brain swelling in spite of external decompression, ventricular drainage, and extensive antiedema therapies. He became brain dead within 2 days after surgery and died on the 13th hospital day. No autopsy was carried out.

Discussion

Dural AVMs in the anterior cranial fossa have different clinical symptoms and angiographic features from those in other locations.^{1-4,7)} Patients are predominantly males in the fifth decade. The most common clinical presentation is intracranial bleeding, usually subarachnoid, intracerebral, and/or subdural hemorrhage. Most angiographic findings demonstrate the ethmoidal artery as the feeder and the venous drainage via a pial vein, often with a varix or vascular sac, and ultimate drainage toward the superior sagittal sinus. A vascular sac is often the prime source of bleeding, located near the site of the dural-to-pial anastomosis, resulting in hemorrhage from the intracerebral to the subdural space.

Intracranial AVM may be difficult to visualize by angiography and even intracranial exploration.⁹⁾ An erroneous diagnosis made before histological diagnosis of AVM is not so rare. The possible reasons for AVM becoming "cryptic" are as follows: Thrombosis in the AVM, cavernous angioma, venous angioma, and extremely small AVM.^{6,8)} However, dural AVM is normally easily identified by angiography because of the characteristic features. In our case,

Fig. 2 Right carotid arteriograms, anteroposterior view (left), lateral view, arterial phase (center), and lateral view, capillary to venous phase (right), showing an avascular area in the right frontal lobe and marked displacement of the right anterior and middle cerebral arteries, but no vascular abnormalities.

Fig. 3 Photomicrograph of the surgical specimen revealing several abnormal arteries and veins in close proximity over the cerebral cortex. HE stain, original magnification $\times 10$.

the anterior cranial fossa dural AVM was undetected by preoperative angiography. The intracranial pressure was assumed to be extremely high, but we had no chance to measure the pressure. Flow through dural AVM in the anterior cranial fossa is relatively slow. Therefore, as the patient was in an extremely critical condition due to increased intracranial pressure, we speculate that the dural AVM was compressed exclusively at the pial drainage due to impending herniation, resulting in absence of opacification of the nidus and early venous filling.

Dural AVM in the anterior cranial fossa can be angiographically occult under special conditions. Therefore, we emphasize that anterior cranial fossa dural AVM should be considered if CT discloses intracranial bleeding involving the frontal base, even if angiography fails to identify AVM.

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