Thalamic Arteriovenous Malformation With an Unusual Draining System

—Case Report—

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Abstract

A 52-year-old man suddenly experienced headache and vomiting. Computed tomography demonstrated a small area of hemorrhage in the right cerebellar hemisphere. Angiography revealed a thalamic arteriovenous malformation (AVM) fed by the bilateral medial posterior choroidal arteries and left marginal tentorial artery, and drained into the confluence via the cerebellar veins without flow into the supratentorial venous system. The draining veins included two varices, one of which, in the right cerebellar hemisphere, was thought to be the source of bleeding. The AVM nidus was removed via the right occipital transtentorial approach. A portion of a drainer adhered to the surface of the great vein of Galen but without opening into the galenic system and all drainers from this thalamic AVM flowed into the infratentorial cerebellar venous system.

Key words: thalamic arteriovenous malformation, unusual venous drainage, meningeal artery, varix, occipital transtentorial approach

Introduction

Thalamic arteriovenous malformations (AVMs) are usually fed by pial arteries and drained via veins flowing into the supratentorial deep venous system.^{2,4,10} Here we report a thalamic AVM partially fed by a meningeal artery, with an unusual draining system flowing only into the infratentorial cerebellar veins.

Case Report

A 52-year-old man was admitted to our hospital complaining of sudden headache and vomiting. Neurological examination on admission revealed no abnormalities. Computed tomography demonstrated a small area of hemorrhage in the right cerebellar hemisphere (Fig. 1A). Magnetic resonance imaging disclosed bilateral curvilinear flow-void structures on the cerebellar surface (Fig. 1B). A portion of the flow-void structure in the right cerebellar hemisphere was dilated. Another flow-void structure was located in the pineal region (Fig. 1C). Left

vertebral angiography demonstrated a nidus (maximum diameter 1.5 cm) in the left medial posterior thalamus near the pineal body (Fig. 2A, B), fed by the bilateral medial posterior choroidal arteries and drained into the confluence via the cerebellar veins that included two varices. Selective angiography with catheterization into the left posterior cerebral artery clearly revealed a nidus in the left thalamus (Fig. 2C, D). Selective left external carotid angiography showed a small feeding artery which was identified as the left marginal tentorial artery branching from the accessory meningeal artery (Fig. 3). No draining pathways were visualized from the nidus to the supratentorial venous system. The varix in the right cerebellar hemisphere was thought to be the source of the bleeding. The diagnosis was a thalamic AVM, not an incisura dural arteriovenous fistula.^{1,5)}

The patient underwent right occipital craniotomy with park bench position. The tentorium cerebelli was cut along the straight sinus. The deep venous system was exposed (Fig. 4). The great vein of Galen, bilateral internal cerebral veins, bilateral basal veins of Rosenthal, and bilateral internal occipital veins were all blue as normal. However, a red varix was noted firmly adhering to the surface of the vein of

Fig. 1 A: Computed tomography scan showing a small area of hemorrhage in the right cerebellar hemisphere. B: Axial T₂-weighted magnetic resonance (MR) image showing curvilinear flow-void structures associated with a hematoma and dilated flow-void sign in the right cerebellar hemisphere. C: Axial T₂-weighted MR image showing another flow-void structure in the pineal region.

Fig. 2 Anteroposterior (A) and lateral (B) left vertebral angiograms showing a small arteriovenous malformation (arrowhead) in the left medial posterior thalamus which is fed by the bilateral medial posterior choroidal arteries, and drained into the confluence via cerebellar veins (arrows). Note the two varices (thick arrow and star). One drainer forms a varix in the right cerebellar hemisphere (star). Anteroposterior (C) and lateral (D) selective angiograms clearly demonstrating the nidus (arrowhead) in the left thalamic region.

Fig. 3 Anteroposterior (A) and lateral (B) selective left external carotid angiograms showing a small feeding artery, identified as a left marginal tentorial artery (arrowhead), branching from the accessory meningeal artery.

Galen. Judging from the color difference, the varix did not open into the galenic system. The deep venous system itself appeared to be normal without any findings of thrombosis nor occlusion. Two main draining veins ran along the surface of the cerebellum. The right draining vein was associated with another varix on the cerebellar surface. No precerebral cerebellar veins were seen. After dissecting the connective tissue around the great vein of Galen, the left marginal tentorial artery was found to run from the tentorium cerebelli into the AVM nidus and was cut at the tentorial edge. Then the left draining vein

Fig. 4 Intraoperative illustration of the vascular structures via the right occipital transtentorial approach. ICV: internal cerebral vein, IOV: internal occipital vein, MPCA: medial posterior choroidal artery, MTA: marginal tentorial artery, RV: basal vein of Rosenthal, SS: straight sinus.

Fig. 5 Photomicrograph of the surgical specimen removed from the left medial thalamus showing a typical arteriovenous malformation with thickening of the abnormal vessel walls. Elastica Masson stain, original magnification $\times 40$.

was incised to obtain a wide operative field, because the vein covered the left medial posterior choroidal artery. After all feeders and drainers were coagulated and cut, the nidus was removed.

Histological examination of the surgical specimen showed a typical AVM (Fig. 5). Postoperative angiography revealed no residual nidus or abnormal vessels (Fig. 6). Although the patient developed left mydriasis and upward gaze palsy postoperatively, these symptoms gradually improved and he was

Fig. 6 Postoperative anteroposterior (A) and lateral (B) left vertebral angiograms revealing disappearance of the arteriovenous malformation.

discharged with slight convergence disturbance. After 3 months, his convergence disturbance had completely resolved.

Discussion

Our case of AVM demonstrated a unique draining system. Usually, a thalamic AVM drains into the supratentorial deep venous system, such as the great vein of Galen or internal cerebral vein. In our case, all the draining vessels flowed into the cerebellar veins and finally into the confluence. Only one of a series of 22 thalamic AVMs had a drainer into the superior sagittal sinus, the other 21 drained into the supratentorial deep venous system.⁹⁾ Other cases of thalamic AVM had drainage exclusively into the supratentorial venous system.^{2,4,10)} In our case, no bilateral precentral cerebellar veins were identified. We speculate that, for some unknown reason, the precentral cerebellar veins had failed to gain access to the great vein of Galen. Instead, two major cerebellar veins connected to the nidus and served as drainers. The portion of the drainer that adhered to the great vein of Galen had dilated and developed into a varix due to hemodynamic stress. Another varix, formed on the surface of the right cerebellar hemisphere due to hemodynamic stress, eventually ruptured.

The feeding arteries are also unique in this case. Although the AVM was in a deep-seated parenchymal location, one of the feeders was the marginal tentorial artery. The reported incidence of AVMs fed by the meningeal artery (4%)^{3,8)} has increased due to improvements in cerebral angiographic techniques since the 1950s. In one series, 35 of 129 (27%) AVMs were fed by a meningeal artery, but the

precise location of these AVMs was not reported.⁷⁾ The meningeal artery fed 65% of superficial- and 13% of deep-seated AVMs but none of four nuclear (basal ganglia and thalamus) AVMs.⁶⁾ In other studies of thalamic AVM,^{2,4,9)} none were fed by the meningeal artery.

In the present case, we chose the right occipital transtentorial approach, although the AVM nidus was located in the left thalamus. If the left side approach had been chosen, strong retraction of the occipital lobe would have been unavoidable at dissection of the lateral part of the nidus. By approaching from the right side, we could avoid postoperative neurological deficit such as hemianopsia due to excessive brain retraction. The nidus was mainly fed by the bilateral medial posterior choroidal arteries, which were present in the medial side of the nidus. The bilateral medial posterior choroidal arteries were easily secured by approaching from the right side. Two main drainers also existed in the medial side of the nidus. We thought it was safer to secure these drainers as well as the main feeders in the same operative field by approaching from the right side rather than from the left.

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