Anterior Cranial Fossa Dural Arteriovenous Fistula With Bilateral Cortical Drainers

—Case Report—

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Abstract

A 58-year-old man presented with sudden onset of severe headache. Computed tomography demonstrated subarachnoid hemorrhage and right acute subdural hematoma. He had no neurological deficits. Cerebral angiography showed an anterior cranial fossa dural arteriovenous fistula (AVF) supplied by the bilateral ethmoidal arteries. A fistula was suggested on the right side, and the dural AVF drained into the superior sagittal sinus via the bilateral frontal cortical veins. Venous varix was observed at both drainage sites. Bifrontal craniotomy with right-side dural incision was performed and the fistula was interrupted. Postoperative angiography demonstrated a persistent fistula draining into the left cortical vein. Nineteen days later, bifrontal craniotomy with left-side dural incision was performed and the draining vein was completely coagulated with the aid of intraoperative angiography. Postoperatively, there was no detectable residual fistula. He was discharged without neurological deficits 2 weeks after surgery. The present case of anterior cranial fossa dural AVF with bilateral cortical drainers shows that drainer occlusion at two points may be needed for complete obliteration of the drainers because the fistulous connection may not be simple.

Key words: arteriovenous fistula, anterior cranial fossa, bilateral cortical drainers

Introduction

Anterior cranial fossa dural arteriovenous fistula (AVF) accounts for about 5.8% of all dural AVFs.4) Anterior cranial fossa dural AVF has a very high incidence of intracranial hemorrhage, ranging from 62% to 91%.2,4) Bleeding typically occurs as intracerebral hematoma (73%), subarachnoid hemorrhage (49%), or subdural hematoma (19%).9) Cerebral angiography demonstrates a venous aneurysm or varix near the site of the dural-to-pial anastomosis in patients with intracranial hemorrhage from anterior cranial fossa dural AVF.4,6–8) Hemorrhage from such dural AVF occurs only after long-standing hemodynamic stress has caused dilation and then rupture of a draining vein.2,7) Anterior cranial fossa dural AVFs are typically supplied by the anterior ethmoidal artery, sometimes bilaterally,4) and usually drain into the superior sagittal sinus via a unilateral cortical drainer. Bilateral drainers are rare.1)

We describe a case of anterior cranial fossa dural AVF with bilateral cortical drainers.

Case Report

A 58-year-old man presented with sudden onset of severe headache. Computed tomography demonstrated subarachnoid hemorrhage and right acute subdural hematoma. He had no neurological deficits. Cerebral angiography showed an anterior cranial fossa dural AVF supplied by the bilateral ethmoidal arteries. A fistula on the right side was suggested, but the dural AVF drained into the superior sagittal sinus via the bilateral frontal cortical veins. Venous varix was observed at both drainage sites (Fig. 1).

A bifrontal craniotomy with right-side dural incision was performed. The fistula was identified by following the dilated cortical vein inferiorly to the dura around the lamina cribrosa. The dilated cortical vein and the venous varix were observed (Fig. 2A). The venous varix, which was observed as ruptured point, was excised. The cortical drainer was coagulated. The falk adjacent to the fistula site was incised, which revealed the contralateral drainer (Fig. 2B). The left drainer was coagulated. He developed no neurological deficit, but postoperative angiography revealed a persistent fistula draining into the left cortical vein (Fig. 3).

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which appears to be the source of hemorrhage. AVF. In the present case, we removed the dura of the left histological sections of transverse and sigmoid sinus dural and the dural vein near the venous sinus based on serial dural AVF was a shunt between the dural artery detection. We previously reported that the essential muscle tissue was present in the borderless intimal and hemorrhage due to dural AVF found that the wall thickening and formation of elastic lamina. The histological findings may indicate that the dural AVF was located near the dura of both the right and left anterior cranial fossae. We speculate that the essential lesion of dural AVF not directly involved in the dural venous sinus is the fistula between the dural artery and the dural vein.

Anterior cranial fossa dural AVFs are typically supplied by the ethmoidal artery, bilaterally in about half of cases. Any supply from the external carotid artery usually passes through the distal ethmoidal branches of the internal maxillary, superficial temporal artery, or anterior meningeal artery. Anterior cranial fossa dural AVFs usually drain exclusively into the pial veins of the unilateral anterior frontal lobe coursing to the superior sagittal sinus, and rarely to the basai venous system, vein of Galen, vein of Labbe, or sphenoparietal sinus. In most cases, the vascular malformation consists of simple fistulous connections between the dura and the pial veins without a significant dural nidi.10) Only one previous surgically treated case of anterior cranial fossa dural AVF with bilateral cortical drainers has been reported.11) We have experienced 5 previous cases of anterior cranial fossa dural AVF. Three cases had bilateral feeders, but all had a single drainer. In the present case, the dural AVF was supplied by the bilateral anterior ethmoidal arteries, and the bilateral cortical drainers ultimately drained into the superior sagittal sinus.

Anterior cranial fossa dural AVF is difficult to cure with endovascular techniques. The ophthalmic artery branches can be difficult to catheterize and embolization is associated with a risk of occlusion of the central retinal artery.1,4) Transcatheter embolization through the internal carotid artery is also associated with a risk of intracranial thromboembolic complications through reflux.13) Therefore, surgical obliteration of the drainer is required to achieve a cure. The most important step in surgery is occlusion of the vascular connection between the dura and the cribiform plate area and the pial vessels.6) We thought that the drainers were bilateral in our case, but the shunting point was a single vascular connection. Therefore, we thought that surgical obliteration of the ipsilateral and contralateral drainers through the falx would be sufficient. However, postoperative angiography revealed a residual fistula draining into the left cortical vein, so the patient needed additional surgery. In the second operation, the residual contralateral drainer was observed anterior to the falx incision at the first operation. We should have performed the bifrontal approach with bilateral dural incision, or incised the falx anteriorly to observe the wider bilateral anterior cranial fossae. In this case, the right dilated drainer was obliterated after the first operation, but the left dilated drainer was persisted. These findings suggested that the bilateral drainers were separate without communication. We speculated that the fistula was simple, but broadly distributed at the midline just beneath the falx. These rare bilateral fistulas may be difficult to identify using only preoperative angiographical findings, so intraoperative angiography is useful.

The present case of anterior cranial fossa dural AVF with bilateral cortical drainers shows that drainer occlu.

**Fig. 1** Right (A, C) and left (B, D) carotid angiograms, anteroposterior view (A, B) and oblique view (C, D), showing the angiographical shunting point (black arrowhead), the right and left drainers (white arrowheads), and the venous varix (arrow) which appears to be the source of hemorrhage.

Nineteen days later, a second bifrontal craniotomy with left-side dural incision was performed and the draining vein was completely coagulated with the aid of intraoperative angiography (Fig. 4). The dura in the left anterior cranial fossa and the falx was partially removed for histological analysis. No residual fistula was observed. The dura in the left anterior cranial fossa contained dilated dural veins. Slight intimal thickening was observed, and elastic lamina was partially observed (Fig. 5). He was discharged without neurological deficits 2 weeks after surgery.

**Discussion**

Whether dural AVFs are congenital or acquired remains controversial.9,10) Examination of the histopathology of anterior cranial fossa dural AVF in patients with intracranial hemorrhage due to dural AVF found that the wall thickness of venous aneurysms was extremely irregular and little muscle tissue was present in the borderless intimal and medial layers, and the internal elastic lamina was unidentifiable.3,12) We previously reported that the essential lesion of dural AVF was a shunt between the dural artery and the dural vein near the venous sinus based on serial histological sections of transverse and sigmoid sinus dural AVF.10) In the present case, we removed the dura of the left anterior cranial fossa at the second surgery. We examined the specimen in serial sections, but no dural arteriovenous shunt could be detected. However, the specimen showed dilated dural veins and a partially elastic lamina.

Presumably the influx of arterial blood via the dural veins caused these pathological changes, such as intimal thickening and formation of elastic lamina. The histological findings may indicate that the dural AVF was located near the dura of both the right and left anterior cranial fossae. We speculate that the essential lesion of dural AVF not directly involved in the dural venous sinus is the fistula between the dural artery and the dural vein.
Fig. 2 Intraoperative photographs demonstrating the right cortical drainer and varix (A), and the contralateral drainer observed through the falx (B).

Fig. 3 Postoperative right (A) and left (B) carotid angiograms showing the residual left venous drainer (arrowheads).

Fig. 4 Intraoperative photograph showing the left cortical drainer and varix in front of the falx (arrow) cut in the first operation.

Fig. 5 Photomicrographs of the dura in the left anterior cranial fossa showing a dilated dural vein with slight intimal thickening (arrows) (A: hematoxylin and eosin stain, original magnification ×40), and partially elastic lamina (arrowheads) (B: Weigert stain, original magnification ×200).

Anterior Cranial Fossa Dural AVF

Revision at two points may be needed for complete obliteration of the drainers because the fistulous connection may not be simple.

References


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