Subarachnoid Hemorrhage Caused by Dural Arteriovenous Fistula of the Sphenobasal Sinus

—Case Report—

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Abstract

A 59-year-old woman presented with a rare middle fossa dural arteriovenous fistula (AVF) unrelated to the cavernous sinus manifesting only as subarachnoid hemorrhage. Angiography revealed shunts between the meningeal branches of both the internal and external carotid arteries and the sphenobasal sinus. The AVF drained into the superficial middle cerebral vein (SMCV) which had a varix and an anastomosis to a superior cerebral vein. The arterial supply vessels were eliminated surgically and the sinus was excised. Bleeding did not recur and there was no venous infarction. Dural AVF of the sphenoparietal sinus is associated with pulsatile exophthalmos and dural AVF of the sphenopetrosal sinus with tinnitus, but dural AVF of the sphenobasal sinus has no obvious symptom. Simple interruption of the SMCV at the penetration of the arachnoid membrane was possible because of the absence of a draining vessel to preserve AVF patency, but the arteries were eliminated in this patient to prevent formation of another AVF.

Key words: dural arteriovenous fistula, subarachnoid hemorrhage, leptomeningeal venous drainage, varix, sphenobasal sinus

Introduction

Cerebral dural arteriovenous fistula (AVF) is most frequently located on the transverse or sigmoid sinus, followed by the middle fossa. Dural AVF of the middle fossa often presents with carotid-cavernous sinus fistula (CCF) or intracranial hemorrhage from the leptomeningeal venous drainage. Here, we report a case of middle fossa dural AVF, which manifested as subarachnoid hemorrhage (SAH) without any history of exophthalmos or tinnitus. We suspect that the clinical manifestations of AVF may be determined by the pattern of dural venous sinuses present in the middle fossa of the patient before formation of the AVF.

Case Report

A 59-year-old woman suffered onset of acute headache during bowel movement, followed by consciousness disturbance and right hemiparesis. She had no previous history of head trauma, hypertension, headache, tinnitus, exophthalmos, or progressive neurological symptoms such as dementia. Computed tomography (CT) demonstrated SAH mainly in the left sylvian fissure, extending to the basal cistern and partly invading the left temporal lobe (Fig. 1).

Internal carotid angiography revealed a vascular tangle of the meningeal branch of the inferior cavernous sinus artery, which then continued to a venous sinus in the middle fossa floor (Fig. 2A). No draining vein from this sinus to the extracranial vein was present, but the sinus flow was directed retrograde toward the superficial middle cerebral vein (SMCV). The SMCV was enlarged, with a varix, and an anastomosis to a superior cerebral vein, and finally flowed into the superior sagittal sinus (SSS) (Fig. 2B).
External carotid angiography visualized the sinus and leptomeningeal draining vein via the middle meningeal artery (MMA) (Fig. 2D). The left cavernous sinus is normally stained in the venous phase, indicating no communication between the AVF and cavernous sinus (Fig. 2C). Three-dimensional CT angiography demonstrated the varix in the SMCV, the entrance of the inferior cavernous sinus artery to the venous sinus, and the remnants of the sinus projecting backwards (Fig. 3). The venous sinus on the dura was identified as the sphenobasal sinus because of its location and the absence of continuation to the cavernous and superior petrosal sinuses (Fig. 3).

The hematoma enlarged within a few hours despite restrictive control of blood pressure. Emergency excision of the AVF with a combination of intradural and extradural subtemporal approaches was performed. The temporal bone was dissected until the middle fossa floor was easily visible. The MMA was identified extradurally and cut at the foramen spinosum. The dura was opened to expose the thickened wall of the SMCV, indicating longstanding venous hypertension. Gentle retraction of the temporal lobe allowed visualization of the sphenobasal sinus on the inner surface of the dura. The meningeal branches of the internal carotid artery entered the sinus. During elimination of the arterial supply vessels, the bulging of the sphenobasal sinus and the SMCV decreased. The sinus had no part in the drainage from the normal circulation, so the dural portion of the sinus was excised as far as the point of penetration into the arachnoid membrane. The wall of the varix was thin in contrast to the arterialized SMCV. The wall thickness and the hematoma location indicated that the SAH originated from the varix.

Postoperative angiography confirmed removal of the AVF. The unexcised varix was not stained (Fig. 4). The continuation of the SMCV to the superior cerebral vein and SSS was not stained, and the veins from the left inferior frontal and anterior temporal regions drained to the SSS and transverse sinus, without prolongation of the cerebral circulation. Her consciousness disturbance and right hemiparesis improved gradually, and she had no neurological deficit at discharge.
Dural AVF of the Sphenobasal Sinus

Fig. 3 Three-dimensional computed tomography angiogram demonstrating the sphenobasal sinus (arrowheads), the entrance of the inferior cavernous sinus artery (arrow), and the varix in the superficial middle cerebral vein (thick arrow).

Fig. 4 Left internal (left) and external (right) carotid angiograms after surgery, showing absence of the superficial middle cerebral vein, together with the varix.

Discussion

Middle fossa dural AVF connects the meningeal arteries to dural veins and is therefore a major cause of non-traumatic CCF.31 Most posterior convexity and some middle fossa dural AVFs present with pulsatile tinnitus. However, our patient had neither exophthalmos nor tinnitus. These symptoms would be determined by the venous drainage, as well as by the location of the AVF. Various types of venous sinuses occur in the middle fossa, the outflow of the SMCV.2,4,7,10,11) The most usual form, seen in 60% of individuals, is the sphenoparietal sinus, which is located medially in the middle fossa and drains into the cavernous sinus.11) The sphenopetrosal sinus occurs in 2%, is located laterally, and drains into the transverse or sigmoid sinus. Based on the direction of blood flow, the sphenoparietal and sphenopetrosal sinuses would cause CCF and tinnitus, respectively. Our patient had a rare type of venous drainage, the sphenobasal sinus,7) so she had no symptom before the onset of hemorrhage. Preoperative angiography showed the sphenobasal sinus was already obstructed, but a remnant of the sinus was observed posterior to the AVF at surgery, and demonstrated by three-dimensional CT angiography.

Leptomeningeal venous congestion causes hemorrhage, venous infarction, and intracranial hypertension. Hemorrhage has the most influence on the prognosis. The venous drainage pattern among the risk factors reported correlates most closely with the incidence of hemorrhage.1,5,6) The type IV pattern, as in our case, consists of cortical drainage with multiple venous ectasia and obstruction of the sinus, and is associated with the highest incidence (65%) of hemorrhage. Bleeding from such a high-risk AVF is difficult to control by only medical therapy, so emergency surgery was required.

The following surgical treatment options are accepted: excision of fistulas, including adjacent arteries and veins8); interruption of the leptomeningeal draining vein12); and feeder embolization by endovascular surgery.9) All arterial supplies were eliminated in our patient. Interruption of the leptomeningeal draining vein is a less-invasive technique. Venous interruption requires only mild retraction of the temporal lobe even for deep-seated AVF. However, venous interruption may aggravate the underlying venous hypertension and lead to the development of another dural AVF. Endovascular feeder embolization reduces and may stop influx toward the intracranial veins and carries a low risk of cerebral venous infarction or pulmonary infarction in a case of long-standing leptomeningeal venous drainage. Endovascular intervention is also an important option.

References

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