

Dural Arteriovenous Fistula Between Inferolateral Trunk of the Internal Carotid Artery and Superficial Sylvian Vein

—Case Report—

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Abstract

A 40-year-old Brazilian man presented with headache followed by consciousness disturbance. Computed tomography showed subarachnoid hemorrhage with right frontal hematoma. Angiography revealed a dural arteriovenous fistula (dAVF) fed by the inferolateral trunk of the internal carotid artery and draining into the superficial sylvian vein with varix formation. The shunting point was directly obliterated through a pterional approach. Postoperative angiography showed complete disappearance of the fistula. A ventriculoperitoneal shunt was needed for normal pressure hydrocephalus during his hospitalization. The modified Rankin scale at discharge was grade 2 with mild cognitive dysfunction. This case of dAVF may represent congenital dAVF.

Key words: dural arteriovenous fistula, internal carotid artery, surgery

Introduction

Dural arteriovenous fistula (dAVF) is a direct shunt between the dural arteries and a dural venous sinus or cortical vein, commonly located in the cavernous sinus.¹²⁾ Patients with cavernous sinus dAVF often present with ocular symptoms such as chemosis and extraocular movement disturbance caused by increased venous pressure in the cavernous sinus. The inferolateral trunk (ILT) is one of the feeding arteries of cavernous sinus dAVF,⁹⁾ but the external carotid arteries are usually important in many cases.⁸⁾ The ILT arises from the lateral surface of the C₄ segment and supplies the roof of the cavernous sinus, adjacent dura, the gasserian ganglion, and cranial nerves.^{2,4)}

We report a case of dAVF between the ILT and superficial sylvian vein without involvement of the external carotid arteries, causing an intracerebral hematoma and successfully treated with direct surgery.

Case Report

A 40-year-old Brazilian man suffered severe headache followed by consciousness disturbance. The patient visited a local hospital, where computed tomography showed subarachnoid hemorrhage with right frontal hematoma (Fig. 1). The patient was transferred to our hospital.

On admission, consciousness level was E3V3M5 in Glasgow Coma Scale with left hemiparesis. Angiography revealed a dAVF fed by the ILT of the internal carotid artery (Fig. 2). The shunting point of the dAVF was located

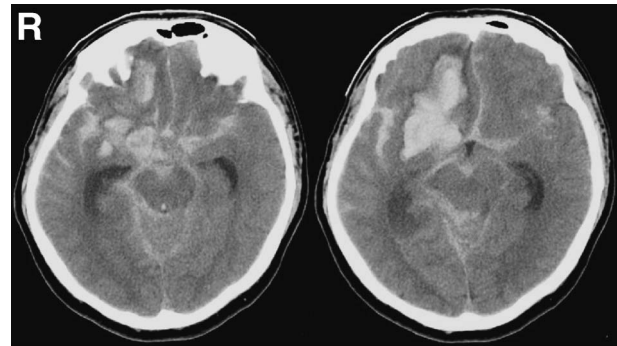


Fig. 1 Computed tomography scans on admission demonstrating subarachnoid hemorrhage and right frontal intracerebral hematoma.

around the right anterior clinoid process. The dAVF with high flow rate drained into the superficial sylvian vein with venous ectasia and varix formation (Cognard type IV³⁾) (Fig. 2). The cavernous sinus was obliterated, and both the anterior and posterior drainage routes were also closed corresponding to stage 3 in Satomi's classification.¹¹⁾ No feeding arteries were seen from the external carotid artery.

The patient underwent right frontotemporal craniotomy. A ventricular drainage was placed through the left frontal horn. The sphenoid ridge and a part of the anterior clinoid process were drilled off to obtain sufficient operative field. The dura was opened and the lesion was approached via a subfrontal intradural route. A

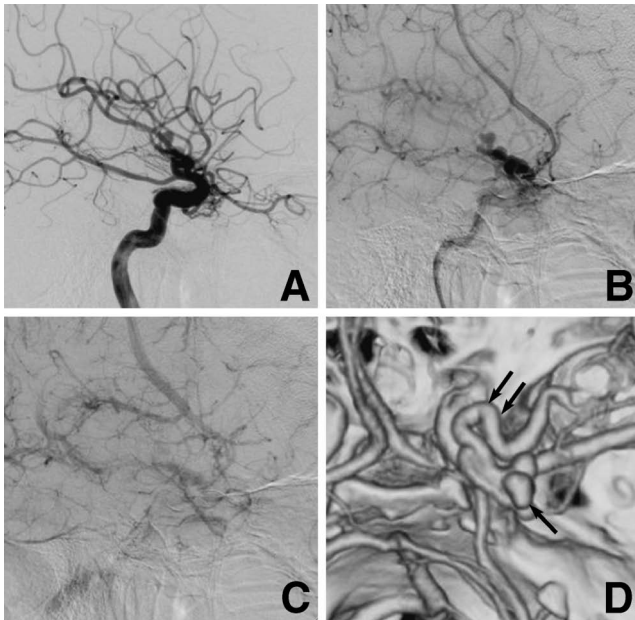


Fig. 2 A-C: Right carotid angiograms, lateral view in the arterial phase (A) and venous phase (B, C), demonstrating a dural arteriovenous fistula fed by the inferolateral trunk and directly draining into the superficial sylvian vein. Note that venous reflux and varix are seen. The cavernous sinus is not visualized. D: Three-dimensional computed tomography angiogram showing a dilated sylvian vein (double arrows) with varix formation (arrow).

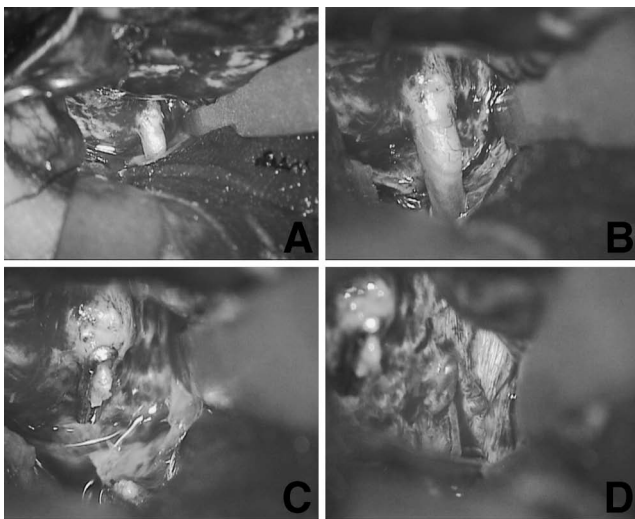


Fig. 3 Intraoperative photographs showing a dilated draining vein and many abnormal dural arteries around the anterior clinoid process. A, B: Before shunt obliteration; C, D: after shunt obliteration.

draining vein and many abnormal dural arteries around the anterior clinoid process were observed (Fig. 3). The vein drained into the sylvian vein. The draining vein was obliterated at the shunting point with hemo-clips and was

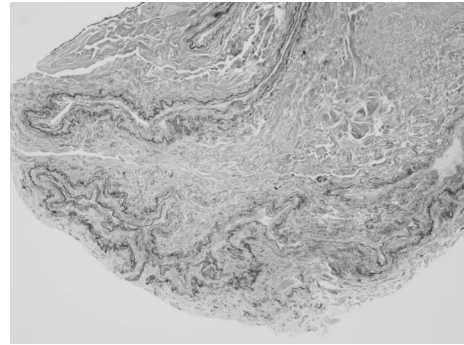


Fig. 4 Photomicrograph revealing malformation of vessels with irregular branches. Elastic van Gieson stain, original magnification $\times 53$.

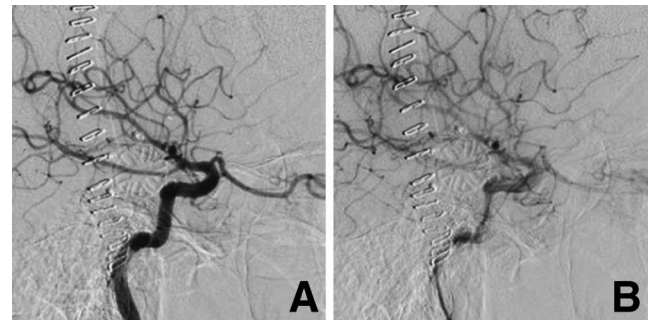


Fig. 5 Right carotid angiograms, lateral view in the arterial phase (A) and venous phase (B), demonstrating disappearance of the fistula.

sectioned following coagulation. A part of the draining vein was obtained for histological confirmation. The dural abnormal arteries were adequately coagulated. The intracerebral hematoma was evacuated and venous varix was found in the hematoma cavity.

Histological examination of the abnormal vein revealed malformation of vessels associated with irregular branch developments (Fig. 4). Postoperative course was uneventful. The patient's consciousness level and left hemiparesis improved. Postoperative angiography revealed complete obliteration of the fistula (Fig. 5). A ventriculoperitoneal shunt was needed for normal pressure hydrocephalus during his hospitalization. The modified Rankin scale at discharge was grade 2 and he went back to Brazil with mild cognitive dysfunction.

Discussion

Analysis of 402 dAVF cases found that the affected sites were the cavernous sinus (41%), transverse-sigmoid sinus (31%), posterior fossa (8%), superior petrosal sinus (5%), superior sagittal sinus (4%), and anterior cranial fossa (3%).¹²⁾ The most common presenting complaints of cavernous sinus dAVF are ocular symptoms such as chemosis, exophthalmos, and periorbital bruit in the anterior

drainage.¹⁰⁾ Tinnitus is seen in posterior drainage cases.¹⁰⁾ Intracerebral hemorrhage is not a common symptom, but reflux from the draining veins, superficial sylvian vein, superior petrosal sinus, or basilar sinus carries the risk of hemorrhage.^{1,10)}

Cavernous sinus dAVF usually includes a shunt between the dural arteries originating from the external carotid arteries and the cavernous sinus. This shunt results in venous hypertension of various venous channels (inferior petrosal sinus, superior ophthalmic vein, inferior ophthalmic vein, pterygoid plexus, or sylvian vein) connected to the cavernous sinus. Our patient had no ocular symptoms or tinnitus and presented with headache followed by intracerebral hemorrhage. Angiography showed the shunt between the ILT and superficial sylvian vein with cavernous sinus occlusion. The present cavernous sinus dAVF was not related to the external carotid artery.

The ILT is known as a feeding artery of cavernous sinus dAVF.⁹⁾ The ILT arises from the lateral surface of the C₄ segment and distal to the origin of the meningo-hypophyseal trunk. The ILT gives rise to three branches: superior branch, anterior branch, and posterior branch.^{2,8)} The anterior branch divides into the anteromedial branch and anterolateral branch. The posterior branch divides into the posteromedial branch and posterolateral branch. The anteromedial branch and anterolateral branch had fistulas in our patient. The ILT supplies the roof of the cavernous sinus, adjacent dura, and the gasserian ganglion. The ILT also supplies the 3rd, 4th, and 6th cranial nerves,^{2,4)} and has some anastomoses with the intraorbital ophthalmic artery, the artery of the foramen rotundum, the accessory meningeal artery, or the middle meningeal artery.

Cavernous sinus dAVF is commonly treated through the transvenous and transarterial approaches.⁶⁾ Direct surgery was selected for the present case because of the increased intracranial pressure due to intracerebral hematoma. The direct surgery was a simple procedure. The draining veins at the shunting point were divided after coagulation. The hematoma could be evacuated during the same procedure. Although endovascular treatment is effective for dAVF, we assumed this was inappropriate management in the present case. The transvenous approach would be difficult because the cavernous sinus was occluded. In addition, the transarterial approach has a risk of ischemic complication of cranial nerves and cure of dAVF is difficult to obtain.⁷⁾

dAVFs might result from venous occlusive changes caused by tumor compression, venous thrombosis, or agenesis, and widening of dural arteriovenous channels.¹¹⁾ Although the exact etiology of the present dAVF is unknown, dAVFs are usually associated with sinus thrombosis.⁵⁾ Therefore, thrombosis might be the factor that triggers the development of dAVFs. We propose two possible pathophysiological mechanisms in the present case. First, since our patient had no history of head trauma, previous surgery, or infection, the present dAVF resulted from idiopathic cavernous sinus occlusion. The dura receives a rich network of meningeal branches not only from the ex-

ternal carotid artery but also from the internal carotid artery.⁵⁾ The venous hypertension caused the dAVF between the ILT and the superficial sylvian vein. The fistula was caused by the increased venous pressure and the cortical reflux occurred with venous varix development. Second, the present ILT was thicker than usual, and no feeders were seen from the external carotid artery. Therefore, the present case might represent congenital dAVF.

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