Fistula between a Posterior Communicating Artery Aneurysm and the Cavernous Sinus

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Summary: We report the angiographic appearance of a posterior communicating artery aneurysm with a fistula to the cavernous sinus, which had been misinterpreted as a direct carotid-cavernous fistula, on which endovascular repair was unsuccessfully attempted.

Index terms: Aneurysm, intracranial; Fistula, dural cavernous sinus

Posttraumatic pulsatile exophthalmos with an audible bruit nearly always denotes a direct carotid-cavernous fistula. Presented here is a patient with such symptoms, who was found to have a fistula between an aneurysm of the posterior communicating artery and the cavernous sinus. The fistula had previously been erroneously diagnosed as a direct carotid-cavernous fistula.

Case Report

A 46-year-old woman was referred for detachable balloon closure of what was said to represent a direct right carotid-cavernous fistula. The patient’s medical history was notable for an accident 31 years before in which she was a passenger in a car that struck a telephone pole. The patient sustained extensive frontal skull and pelvic injuries, which required a 2-month hospital stay. The specifics of this time period are unknown to the patient. A midfrontal skull plate was inserted the following year, and, to her knowledge, no additional surgery was performed. Although she had only light perception in the right eye after the accident, she did not note right exophthalmos until 1979 or 1980. She did not seek medical attention until May 1993, when during a seizure she avulsed her right cornea, after which the exophthalmos became much worse. Presumably because of the metallic plate, magnetic resonance was not performed. However, a computed tomographic scan revealed a right frontal encephalocele.

In June 1993 at another institution, a cerebral arteriogram was performed, and a diagnosis of a direct right carotid-cavernous fistula made. Although no details for this diagnosis were charted, it is believed that the diagnosis was based on the clinical impression and near simultaneous angiographic opacification of the cavernous segment of the right internal carotid artery and the cavernous sinus. An attempt to close the fistula by endovascular placement of steel coils into the cavernous sinus via the right cavernous internal carotid artery failed. It was concluded that tortuosity of the carotid artery precluded accessing the fistula. A test balloon occlusion of the right internal carotid artery for 20 minutes was negative, and surgical ligation of the right internal carotid artery was entertained. It was ultimately elected to send the patient out of state for a balloon closure of the fistula, but the patient lacked financial means and was lost to follow-up.

She presented to this medical center 1 year later with similar but more severe pulsatile exophthalmos. Although present, the audible bruit was neither loud nor high pitched. Another cerebral arteriogram was performed with bilateral biplane internal carotid artery injections and a left biplane vertebral artery injection (Fig 1). These demonstrated rapid opacification of the right cavernous sinus and superior ophthalmic vein. The A1 segment of the right anterior cerebral artery was aplastic. On closer inspection an opacified “appendage” was noted in close association with the superior aspect of the right cavernous sinus. This was inseparable from the posterior communicating artery. Although the vertebral artery injection rapidly opacified the right cavernous sinus and superior ophthalmic vein after ipsilateral carotid compression, the right supraclinoid internal carotid artery was not seen. A Fast-Tracker catheter (Target Therapeutics, Fremont, Calif) was subsequently advanced through the right internal carotid artery and to the origin of the posterior communicating artery. Angiography performed in the lateral projection demonstrated immediate opacification of an aneurysmal posterior communicating artery with decompression into the right cavernous sinus (Fig 1D). No fistula of the cavernous segment of the right internal carotid artery was found. Figure 2 provides an illustration of the pertinent vascular anatomy at the skull base. The cerebral arteriogram from the previous year was reviewed and demonstrated no fundamental differences. At a subsequent surgery, a clip was...
Fig 1. A, Anteroposterior right internal carotid arteriogram. Note the aplastic A1 segment. The cavernous sinus, superior ophthalmic vein (arrowheads), and inferior petrosal sinus (arrows) opacify immediately.

B, Lateral right internal carotid arteriogram. In addition to the opacification of the cavernous sinus and superior ophthalmic vein (arrowheads), there is an opacified appendage (curved arrow) associated with both the supraclinoid internal carotid artery and superior aspect of the cavernous sinus. Also note the posterior venous drainage into the petrosal sinuses.

C, Lateral angiogram of left vertebral artery injection with immediate opacification of the aneurysmal appendage (curved arrow), the cavernous sinus (arrowheads), and the venous decompressive pathways.

D, Lateral angiogram with the tip of a microcatheter (open arrow) placed in the anterior aspect of the right posterior communicating artery. There is immediate opacification of the aneurysmal posterior communicating artery (the appendage) (arrowhead) with decompression into the cavernous sinus (closed arrows) and venous decompressive pathways.

Fig 2. The pertinent vascular anatomy.
placed occluding the anterior origin of the right posterior communicating artery. Angiographically the posterior aspect of the right posterior communicating artery continued to decompress through the fistula. Although the patient’s exophthalmos has improved, a second surgical approach to place a clip posteriorly occluding the right posterior communicating artery was planned. The patient declined further intervention.

Discussion

Debrun et al (1) categorized carotid-cavernous fistulas into one of four types based on the origin of the feeding vessel and velocity of flow through the fistula. In their series of 132 patients, 76% had as their origin a rent in the cavernous segment of the internal carotid artery. The remaining patients had slow-flow, communicating vessels constituting dural arteriovenous malformations decompressing into the cavernous sinus from branches of the cavernous carotid artery, the external carotid artery, or both. Although most of the directly communicating carotid-cavernous fistulas are a result of posttraumatic tears, a small percentage of cases result from ruptured cavernous carotid aneurysms.

Unusual cases have been reported in which an aneurysm arising from the primitive trigeminal artery or from its junction with the internal carotid artery ruptured, forming a direct carotid-cavernous fistula (2–5).

In our case, close scrutiny of the radiographs demonstrated subtle changes suggesting an unusual fistulous source. The vertebral artery injection opacifies the cavernous sinus but not the supraclinoid internal carotid artery. Additionally, there was an unusual structure cephalad to and in continuity with the cavernous sinus. This structure could not be completely separated from the supraclinoid internal carotid artery or the posterior communicating artery. Also, the intracranial vessels from the ipsilateral carotid injection were unusually well opacified for exophthalmos of the degree exhibited by this patient, probably because the posterior circulation provides much of the fistulous supply. The posterior communicating artery source was confirmed by subselecting this vessel from an internal carotid artery approach. Rapid (greater than 10 frames per second) digital-subtraction angiographic imaging, when available, might be a simpler means of confirming the fistula origin.

While at the previous hospital, the patient had passed a test balloon occlusion of the ipsilateral internal carotid artery. A surgical ligation was contemplated but fortunately never performed. Such a procedure not only would have failed to obliterate the fistula, but could have greatly complicated future diagnosis and treatment options.

References