Fistula Between the External Carotid Artery and Cavernous Sinus

Case Report

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The most common type of intracranial arteriovenous fistula is the "carotid-cavernous fistula," which occurs at the level of the intracavernous portion of the internal carotid artery. The lesion may develop after trauma, as in 77% of the cases, or it may result from spontaneous rupture of an aneurysm involving this segment of the internal carotid artery (Locke6). Diagnosis of carotid-cavernous fistula is easily made by angiographic examination of the internal carotid artery. The contrast substance is seen to leave the artery in the early phase of the angiogram and to fill the cavernous sinus and its venous communications.

Different sources of anastomotic flow to the cavernous sinus, via direct channel from the external carotid branches, were demonstrated by Hayes2 in three cases of internal carotid-cavernous sinus fistula with persistence or recurrence of symptoms after the trap operation had been performed. His treatment consisted of: 1) ligation of the internal carotid artery in the neck, 2) occlusion of the carotid artery intracranially proximal to the origin of the posterior communicating artery, and 3) clipping of the ophthalmic artery. Angiography demonstrated filling of the external carotid artery and its rami, and partial filling of the cavernous sinus by branches of the internal maxillary artery or by a branch of the ascending pharyngeal artery.

Our report concerns a patient with an arteriovenous fistula between the branches of the external carotid artery and the cavernous sinus, of spontaneous onset.

Case Report

A 67-year-old housewife was admitted with the chief complaint of protrusion of the left eye and visual impairment. Past history was noncontributory. One month earlier the patient had noticed that the left eye was more prominent and that the small vessels of the conjunctiva covering the frontal part of the left eyeball were somewhat congested. Shortly afterwards she started to complain of moving spots before her left eye and progressive loss of vision.

Examination. Moderate, nonpulsating exophthalmos was noted in the left eye with venous stasis of the conjunctival and episcleral vessels (Fig. 1). Hertel exophthalmome-

![Left eye shows venous stasis of the conjunctival and episcleral vessels.](image1)

![Left funduscopic picture showing marked venous engorgement, papilledema, and several hemorrhages around the optic disc and along the main veins.](image2)

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try recorded 17 mm on the right side and 20 mm on the left. Visual acuity corrected was 8/10 in the right eye and 2/10 in the left eye. Perimetry tests of the visual fields were normal, but there was a central scotoma for colors in the left eye. Examination of the left fundus revealed marked left venous dilatation, papilledema, and several round hemorrhages around the optic disc and along the main veins (Fig. 2). No abnormal findings were detected in the right eye. The pupils were of equal size and reacted bilaterally to light. Ocular mobility was normal.

The blood pressure was 160/100. Routine clinical, electroencephalographic, x-ray, and laboratory examinations were normal. The clinical picture suggested an impairment of the venous circulation in the left orbital cavity.

**Angiography.** Carotid angiography showed normal intracranial vessels; the ophthalmic artery also appeared normal. During the examination, the external carotid artery could not be visualized, since the contrast

![Angiography images](image-url)

**Fig. 3.** Subtraction radiograms (top) and corresponding diagrams (below), anteroposterior view. Contrast material injected by catheterization of the external temporal artery enters only the external carotid artery system. A. The arterial phase. There is filling of the cavernous sinus by a branch of the internal maxillary artery. B. Second phase, 3 seconds later. The contrast medium fills also the superior ophthalmic vein.
medium filled only the branches of the internal carotid. External carotid angiography performed later by retrograde injection through catheterization of the external temporal artery showed a normal external carotid artery and branches. During the arterial phase, the posterior part of the cavernous sinus was filled from a branch of the internal maxillary artery; in the successive films there was reversal of flow in the ophthalmic vein from the cavernous sinus (Figs. 3 and 4).

A diagnosis was made of arteriovenous fistula between a branch of the external carotid artery and the cavernous sinus; this had provoked reversal of flow in the ophthalmic vein and resulting stasis of the venous circulation in the retina and orbit.

Operation. Ligation of the left external carotid artery in the neck was performed on November 5, 1965. The postoperative course was uneventful. One week later, the fundus showed slight improvement, with reduction of the papilledema and partial regression of hemorrhages.

Follow-Up. Four months later the patient had normal visual acuity and no more peculiar sensations in the left eye. Visual acuity was 8/10 on the left and 9/10 on the right side. Visual perimetry and fundus examinations were normal; the arterial and venous vessels had a normal size and course, and the papilledema had entirely subsided. There were residual deposits of pigment along the veins in place of the previous hemorrhages (Fig. 5). Hertel exophthalmometry showed 18 mm on the left eye and 17 mm on the right. There was a slight persistent congestion of a few episcleral vessels (Fig. 6).

Comment

The interest of this case lies mainly in the fact that the fistula between the branches of the external carotid artery and the cavernous sinus was a primary and spontaneous abnormality, not associated with trauma or with internal carotid artery-cavernous sinus fistula, as in Hayes' cases.2

Similar malformations between the external carotid and intracranial veins or sinuses have been reported. Fincher1 described a case of arteriovenous fistula between the middle meningeal artery and the greater petrosal sinus of traumatic origin, and Markham3 observed a similar case where the fistula appeared spontaneously. Iraci and Carteri3 reported a case of arteriovenous fistula between the middle meningeal artery and the vein of Labbé which had ruptured spontaneously in the subdural space. Suwanwela7 reported two cases of traumatic arteriovenous fistula between the middle meningeal artery and dural veins draining into the superior sagittal sinus, and Pakarinien,8 one case where the middle meningeal artery communicated with the sphenoparietal sinus.

Selective arteriography of the internal and

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Fig. 4. Subtraction radiogram (top) and diagram (below), second phase (corresponding to Fig. 3B). Lateral projection of external carotid angiography shows same reversal of flow in the ophthalmic vein.
external carotid arteries was necessary in these cases to define the type of vascular malformation and its hemodynamic filling. In our patient, external carotid angiography was obtained by retrograde injection of the contrast medium through the external temporal artery; this examination proved decisive in reaching the correct diagnosis before surgical treatment.

Some physicians found that ligation of the external carotid artery in the neck was sufficient to obtain satisfactory results (Markham, and Pakarinen). Fincher, after occlusion of the external carotid artery, considered it necessary to ligate the middle meningeal artery at the dural level. Iraci and Carter performed intracranial ligation of the middle meningeal artery followed by direct obliteration of the fistula with two silken threads. In our case, interruption of the external carotid artery at its origin was satisfactory; direct intracranial obliteration was not possible.

Summary

We have reported a case of direct fistulous communication between a branch of the external carotid artery and the cavernous sinus, which was a primary abnormality of spontaneous onset. The clinical signs were unilateral exophthalmos, conjunctival venous congestion, papilledema, marked venous dilatation, and hemorrhages at the fundus. Successful surgical treatment consisted in ligation of the external carotid artery in the neck.

References