External Carotid-Cavernous Sinus Fistulas*

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Persistence or recurrence of signs and symptoms after the surgical treatment of carotid-cavernous fistula has been reported frequently.8,16 That this should occur when only the simple procedure of ligation of the common carotid artery,15 or of the internal carotid artery in the neck, is carried out, is not surprising. However, some patients are recorded as only “improved” after isolation of the fistulous segment of vessel by (1) ligation of the internal carotid artery in the neck, (2) occlusion of the internal carotid artery intracranially proximal to the origin of the posterior communicating artery, and (3) clipping of the opthalmic artery. This is termed the “trap” operation. Hamby8 and Adson1 have pointed out that introduction of an embolus of muscle8 into the affected internal carotid artery has not been effective in all cases. With good reason Echols and Jackson8 termed this “a perplexing therapeutic problem.”

The clinical diagnosis of carotid-cavernous fistula is usually so straightforward that to me the use of angiography as part of the preoperative evaluation seemed superfluous, particularly in view of the basic study of Wolff and Schmid.17 From the experience gained in the management of the cases to be discussed this attitude has been changed. In addition new sources of anastomotic flow to the cavernous sinus via direct channels from external carotid branches have been disclosed.

Case Reports

Of the 26 patients with carotid-cavernous fistulas treated by me, 3 have posed problems of recurrence of signs and symptoms. In view of the course followed by Case 1 there may be others who have had recurrences, but who have been lost to follow-up. This report is not concerned primarily with the clinical signs of this condition which are similar to those seen in internal carotid-cavernous sinus fistulas. Some diagrams of the roentgenograms include vessels seen more clearly on other phases of the angiograms, which to save space are not illustrated.

Case 1. A pulsating exophthalmos and blindness of the right eye developed in June 1950 after the patient was in a jeep accident. A “trap operation” was performed with apparent cure. Late in 1958 he noticed proptosis, chemosis and a bruit on the right. Right carotid angiography was done in November 1960 (Fig. 1 a, b, c). Two branches of the internal maxillary artery entered the posterosuperior and inferior aspects of the cavernous sinus. A more distal branch fed the anterior-inferior cavernous sinus. There was late filling, primarily retrograde, in direction of the ligated and sectioned internal carotid artery with a connection in the neck to an external carotid branch. Injection of the left carotid system revealed a persistent carotid-basilar anastomosis (Fig. 2). There was no cross filling to the right cavernous sinus.

Case 2. The patient was struck by an automobile and rendered comatose for 3 days. There were no signs relating to carotid-cavernous fistula. Eleven months later left-sided headache, pulsating exophthalmos, conjunctival congestion and a bruit developed. Angiography demonstrated a left carotid-cavernous fistula (Fig. 3a). A small branch of the internal maxillary artery was not recognized as a contributor to the cavernous sinus nor was the significance of a branch of the internal carotid artery as it entered the cavernous sinus comprehended. The fistula was trapped. Six weeks later his proptosis was greater, the conjunctival injection was the same and there was still a faint bruit. Repeated angiography demonstrated only the external carotid system in the neck (Fig. 3b, c). The anterior cavernous sinus was filled by two branches of the internal maxillary artery. The posterior cavernous sinus was fed by a branch of the ascending pharyngeal artery.

Case 3. The patient was run over by a truck. He was comatose 16 hours, and a right pulsating exophthalmos with bruit developed within 24

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Fig. 1a. Case 1. Right injection. Needle is in right common carotid artery. Stump of ligated and sectioned internal carotid artery is shown (oblique). Two branches of internal maxillary artery enter and feed posterosuperior and inferior aspects of cavernous sinus. A more distal branch feeds anterior-inferior cavernous sinus. There is late retrograde filling of ligated internal carotid artery (i.c.); the run off from this segment is to a small aberrant branch of internal carotid artery to the paravertebral region. (See also Fig. 1b and c.)

hours. Angiography and a purported “trap operation” were carried out at another hospital. Within 3 months the signs and symptoms recurred. Eleven months after his accident he was seen at Walter Reed Hospital. Right carotid angiography (Fig. 4) showed an anastomosis between the infraorbital and the ophthalmic arteries feeding the carotid-cavernous fistula. The fact that a branch of the internal maxillary artery as well as a branch of the ascending pharyngeal artery supplied the cavernous sinus was not recognized. The left carotid injection (Fig. 4c) showed cross filling to the right cavernous sinus via the anterior communicating system. The ophthalmic artery and internal carotid arteries were clipped intracranially with apparent cure. Seven months later headache, syncope and a subjective bruit developed. The patient refused angiography until 7 months later. Right carotid injection (Fig. 5a) showed filling of the cavernous sinus, chiefly inferiorly, by the previously mentioned branch of the internal maxillary artery and the branch of the ascending pharyngeal artery. Left carotid injection (Fig. 5b) revealed a small branch arising from the internal carotid artery as it entered the cavernous sinus.

Discussion

The capability of the infraorbital, lacrimal or facial arteries to develop collateral circulation through the ophthalmic artery to the internal carotid artery in patients with internal carotid-cavernous fistulas was postulated by Dandy, and demonstrated at operation by Adson and angiographically by Falconer and Hoare. It is necessary to reemphasize that this channel of communication had been closed in the patients who are the subjects of this report. So far as can be determined direct fistulous supply of blood to the cavernous sinus by branches of the external carotid artery has not been demonstrated previously. Woringer et al., in a description of the angiograms of 1 of their patients stated that “L’injection de la carotide externe droite opacifie egalement le sinus caverneux des deux cotes par l’intermediare de la maxillaire interne.” Examination of the original films of their patients (Observation No. 3) made possible by the courtesy of Doctor Braun reveals that, in fact, contrast material which was injected into the external system refluxed into the internal system and then entered the fistula. No anastomosis from the internal maxillary branches to the