Internal Occlusion of a Carotid-Cavernous Fistula*

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The failure of ligation of the carotid and ophthalmic arteries to arrest the progress of a carotid-cavernous fistula led Brooks¹ to introduce a muscle “embolus” into the internal carotid artery in the neck in an effort to plug the fistula from within. This ingenious method is not always applicable because the muscle may not “embolize” to the fistula after intracranial ligation of the carotid and ophthalmic arteries, and it is probably unsafe before the intracranial operation. Another method of internal occlusion was used in the following case.

Case Report

Mrs. K., a 27-year-old woman, received head and facial injuries in a car accident on July 14, 1962. She was unconscious briefly but had no demonstrable skull fracture. She was transferred to the University of Alberta Hospital on July 15 for treatment of a badly fractured mandible. While awaiting dental surgery there was rapid development of proptosis, ptosis, blindness, and total ophthalmoplegia of the left eye. A bruit was audible over the left globe. On July 19 left carotid angiogram demonstrated a carotid-cavernous fistula (Fig. 1). Right carotid angiogram with cross compression showed no flow through the anterior communicating artery.

Using local anaesthesia, closure of the left internal carotid artery in the neck almost immediately produced right hemiplegia, which disappeared rapidly when the flow was restored. A Selverstone clamp therefore was placed on the left common carotid artery, and during the next 5 days the clamp was closed gradually. After 3 or 4 episodes of temporary right hemiparesis and aphasia which required urgent reopening of the clamp, it finally was possible to occlude the left common carotid artery completely. The signs of the fistula were abolished but returned in 24 hrs.

On July 26, 12 days after the accident and 8 days after the fistula had become manifest, the second operation was performed. Using local anaesthesia again, the Selverstone clamp on the left common carotid artery was replaced by ligatures. The external carotid artery was then occluded and the patient was observed for right-sided weakness or dysphasia. Since no trouble developed, the external carotid artery also was ligated. The patient then was put to sleep and a left frontal craniotomy was performed to clip the internal carotid and ophthalmic arteries intracranially. Following this combined procedure the bruit disappeared, the proptosis and venous engorgement of the scalp and eyelid diminished, and the vision and function of the extracocular muscle improved. However, a few days later the bruit once again became audible intermittently to the examiners, but was much reduced. On August 3 the mandible was wired, and the patient was discharged home on August 8 with a soft bruit and some proptosis, with venous engorgement of the left eyelid, but returning vision and ocular motility in the left eye.

Two months later, the bruit, proptosis and venous engorgement were increasing slowly, while vision and ocular motility remained at a standstill. On October 2, 3 months after the accident, the patient again became aware of the bruit. On October 18 she had the first of a continuing series of minor episodes of tingling in the right face and hand. Right carotid angiogram on October 26 failed to adequately opacify the fistula or its feeding vessels, but we were forced to the conclusion that it was being fed by some of the arterial communications of the subclavian portion of the internal carotid artery.²

The incision in the neck therefore was reopened and

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the ligatures on the common and external carotid arteries were checked and found intact. The internal carotid artery was filled with blood under moderate pressure. Attempts to pass all nature of catheters, probes and guides up to the site of the fistula through the internal carotid artery were unsuccessful. It was decided therefore to occlude the lumen of the artery and the fistula. Silicone rubber (Silastic) and plastic materials, which harden in situ after injection in the fluid state, were considered but rejected because they could not be followed by roentgen ray, and because we did not know what might happen if they passed through the fistula into the cavernous sinus before solidifying. A mesh was made of pieces of Gelfoam, gauze and the radio-opaque markers present in the gauze sponges, mixed with saline to the consistency of good porridge. The fragments were cut quite large in the hope that they would not escape through the fistula into the general circulation, or produce thrombosis of the cavernous sinus. The mesh then was injected under pressure through a No. 14F catheter in the internal carotid artery until no more could be forced in.

Postoperatively the bruit was gone, and proptosis and venous engorgement disappeared rapidly, but the patient had a good deal of orbital pain and a tender lump could be palpated at the superomedial angle of the orbit. Roentgenogram demonstrated the position of the markers in the carotid artery at the fistula, and in the superior orbital vein (Fig. 2). Roentgenogram of the chest failed to show any radio-opaque markers in the lungs. The patient was discharged 8 days after operation and subsequently has recovered full normal extraocular movements and almost normal vision. The pupil remains large and she has discomfort in bright light because of persisting internal ophthalmoplegia. Bruit, proptosis, chemosis, or venous engorgement are not present.

Discussion

Recently, Parkinson has described a case in which he ligated a fistula within the cavernous sinus after proximal and distal clipping of the carotid and ophthalmic arteries had failed to control it. This may become the treatment of choice when more of the serious technical obstacles have been overcome. At the present time, however, internal occlusion of the fistula by the muscle-embolus technique, or direct injection of foreign material into the isolated segment of the carotid artery, would seem to be safer. As already indicated, the use of emboli before intracranial clipping of the carotid artery almost certainly will lead to serious complications in some cases, since there is not always a reversal of flow in the carotid artery above the fistula. However, after the ophthalmic and internal carotid arteries have been clipped above the cavernous sinus, injected material can only (a) enter the cavernous sinus if the particles are small enough, or (b) become stuck in the fistula. There seems to be little danger in using this method for carotid-cavernous fistulae which persist following intra- and extracranial ligation of the accessible feeding vessels. Vision will not be endangered if it has already survived clipping of the ophthalmic artery. Aseptic thrombosis of the cavernous sinus itself might be anticipated and may have occurred in this case. If so, it has not been attended by paralysis of the 3rd, 4th, and 6th nerves.

Summary

A case of carotid-cavernous fistula, which persisted following proximal and distal ligation of the internal carotid and ophthalmic arteries, was treated by injection of particulate material into the internal carotid artery in the neck. The final position of the material in the carotid artery and superior orbital vein was demonstrated radio-