Artificial Embolic Occlusion of the Terminal Internal Carotid Artery in the Treatment of Carotid-Cavernous Fistula

Technical Note

I. Z. Kosary, M.D., M. A. Lerner, M.B., M. Mozes, M.D.,* and M. Lazar, M.D.

Departments of Neurosurgery and Radiology, Tel-Hashomer Hospital, Israel

The most radical and effective treatment of carotid-cavernous fistula consists of isolation of the cavernous portion of the internal carotid artery by ligation in the neck after intracranial clipping of its terminal portion. Because of its hazards, however, this procedure is often avoided, and the results are correspondingly poor. This report describes the successful intraluminal occlusion of the terminal internal carotid artery by embolization with a porcelain bead, thus eliminating the need for craniotomy.

Case Report

A 42-year-old man had been brutally beaten about the head. He was admitted in deep shock in a stuporous condition with severe facial and scalp lacerations, multiple linear fractures, and a severe right parietal depressed fracture. After treatment for shock, the depressed fragment was removed, a large epidural hematoma was evacuated, and the middle meningeal artery occluded close to the foramen spinosum. The dura had not been damaged. The patient made an uneventful recovery.

Two months after discharge the patient became aware of a pulsatile bruit over the left eye; in the course of the next 2 weeks this eye protruded severely. There was chemosis and engorgement of conjunctival vessels in both eyes, more marked in the left. The optic discs were normal but the retinal veins were slightly engorged. There was no visual impairment. Intraocular pressure was elevated to 22 mm Hg in the right eye and 24 mm Hg in the left eye. All over the cranium a blowing bruit could be heard, louder over the left eye, and synchronous with the pulse and abolished by carotid compression.

Left carotid angiography (Fig. 1 left) demonstrated a carotid-cavernous fistula, the principal venous drainage being through dilated orbital and facial veins. Right carotid angiography showed normal vessels on that side; when the injection was repeated during left carotid compression, the contrast medium passed to the left anterior and middle cerebral arteries and also flowed into the left internal carotid artery, demonstrating the fistula (Fig. 1 right). From these investigations it was clear that mere ligation of the left carotid artery in the neck would not cure the fistula, while, on the other hand, the anterior communicating artery could be relied upon to supply the left hemisphere were the left carotid to be occluded at its termination. During the following days the exophthalmos increased alarmingly and with it the chemosis and conjunctival injection, making operation imperative.

Operation. Under general anesthesia, the bifurcation of the left common carotid artery was exposed and vascular clamps applied to the artery and its two divisions. On the basis of measurements of the reduction in caliber of the supraclinoid portion of the internal carotid artery on the anteroposterior and lateral angiograms, a 5 mm porcelain bead was selected in the anticipation that it would traverse the cavernous portion of the artery but not its supraclinoid portion. This bead was then introduced through arteriotomy of the left external carotid artery and milked into the origin of the internal carotid. The external carotid artery was then clamped at its origin, while the clamps in the common and internal carotids were released. The blood flow thus carried the artificial embolus up to the cranial portion of the internal carotid artery.

A plain radiogram of the skull showed the naturally radiopaque bead arrested in the artery just below the anterior clinoid process. Angiography was performed forthwith on the exposed vessel, confirming complete occlusion of the carotid artery at that point; as an-
FIG. 1. Left: Left carotid angiography; lateral view, arterial phase, showing immediate filling of varicose orbital veins through a carotid-cavernous fistula. Bone defect from right craniectomy and fracture lines from original injury 2 months previously. Right: Right carotid angiography during compression of the left carotid artery in the neck. There is cross-filling through the anterior communicating artery with reflux into the left internal carotid artery and filling of the dilated left orbital veins (arrows) through the fistula.

anticipated, the fistula was still patent. To occlude the fistula, three pieces of gelfoam, carrying with them two silver clips, were introduced into the vessel by the same method. A further radiogram showed the bead and the silver clips (attached to the gelfoam) lodged throughout the entire cavernous portion of the artery (Fig. 2). The three carotids exposed were then ligated and the common carotid artery divided.

Postoperative Course. Recovery from the anesthetic was rapid, and no neurological deficit developed, the patient being alert and well oriented. The bruit had disappeared. By the following day the chemosis had subsided and, at the end of a week, the exophthalmos and congestion had all but disappeared. Vision was 6/6 in both eyes, and the intraocular tension had dropped to 12 mm Hg in each eye. There has been no recurrence nor other abnormality at the time of this writing, 11 months after the operation (Fig. 3). Repeated skull films show no change in the position of the bead and silver clips.

Discussion

Because of the operative and postoperative risks many surgeons shrink from ligating the terminal internal carotid artery even though without it continued leakage, in greater or lesser degree, is inevitable by reflux down the internal carotid artery after ligation in the neck. The trapping operation is known to have good results in most patients, while only 35 to 40% benefit can be expected from proximal ligation alone.

Lang and Bucy, following the technique of Brooks, reported successful treatment of a case by muscle embolization alone, while they were able to find descriptions of eight cases in which this technique was only part of the treatment. Although simple, the risks of this method are manifest. Sunder-Plassmann and

FIG. 2. Postoperative lateral skull film showing porcelain bead arrested just beneath the anterior clinoid process, and the silver clips indicating the position of the gelfoam lodged throughout the cavernous portion of the internal carotid artery.