ARTERIAL GRAFT AND ENDARTERECTOMY IN RECONSTITUTION OF THE COMMON CAROTID ARTERY TWO YEARS FOLLOWING LIGATION

Keasley Welch, M.D., and Ben Eisenman, M.D.

Division of Neurosurgery and Department of Surgery, University of Colorado School of Medicine, and the Veterans Administration Hospital, Denver, Colorado

(Received for publication January 28, 1957)

Developments in the surgery of blood vessels and increasing interest in factors underlying cerebral ischemia have led to attempts to restore the internal carotid circulation after occlusion by obliteratorive disease. 

This is a report of reconstitution of the common carotid artery by endarterectomy and homograft, 2 years after its surgical ligation.

CASE REPORT

A 44-year-old man was admitted to the hospital on May 1, 1956, because of difficulty in the use of his right arm and leg for 1 week.

Two years previously, he had been treated in a hospital elsewhere for subarachnoid hemorrhage, characterized by malaise for 1 day, followed by severe headache, stiff neck, vomiting, and drowsiness, but without focal neurological disturbance. Initially, the spinal fluid was bloody; later it was deeply orange in color. An angiogram made on the 19th day showed no abnormality. On the 29th day, the left common carotid artery was tied 3 cm. proximal to its bifurcation. Recovery was complete except for a minor impairment of memory, and the patient returned to his work as an attendant in a filling station.

Approximately 2 years after the ligation of the common carotid artery, and 1 week before his present admission, movements of his right arm and leg became awkward. He dropped objects held in the right hand, and was unable to use this hand in eating. Weakness of the right leg was observed, particularly when he attempted to arise from the sitting position. He was forced to give up his work.

By the time of his admission to the hospital, most of these symptoms had disappeared, and on neurological examination only weakness of dorsiflexion of the right foot was found. The operative site in his neck was well healed and a definite, though diminished, carotid pulse could be felt above this point.

Angiography, May 9, 1956. On the right side, normal filling and distribution of the internal carotid, anterior and middle cerebral vessels were demonstrated. On the left, the needle was inserted into the vessel above the cervical scar, and although the external carotid artery was well visualized, the internal carotid artery filled only to the base of the skull (Fig. 1).

The episode of right hemiparesis was interpreted to be the result of cerebral vascular insufficiency in the distribution of the left carotid, based on the surgical ligation performed 2 years previously. Because no aneurysm or other vascular lesion was evident in the left carotid angiogram made before ligation of the common carotid, it was decided to try to re-establish blood flow through the left carotid system.

Operation, May 24, 1956. The carotid bifurcation in the left side of the neck was exposed. Although somewhat diminished in caliber, both the external and the internal carotid arteries were patent and pulsating. With occlusion of the external carotid artery, a good back flow through the internal carotid artery was demonstrated. The entire length of the common carotid artery from its bifurcation to the arch of the aorta was exposed, necessitating an incision down the neck and over the clavicle, resection of the medial portion of the clavicle, and splitting of the sternum to its midportion with a Lebsche knife (Fig. 2). Obliterating the lu-
men of the common carotid artery from the aorta to the bifurcation was a firm organized thrombus, and surrounding the upper segment of the artery and its bifurcation was a dense scar, marking the site of the previous ligation. It was felt that blood flow could be re-established between the common carotid artery below the ligation and the internal carotid artery above. Therefore, the thrombus was removed by the use of a circular intraluminal stripper (Fig. 3) as employed for endarterectomy in the lower extremities. Despite the fact that the thrombus had been in place for 2 years, it was relatively easy to insert the stripper between it and the normal intima and to dissect the clot from the wall of the vessel. Slight resistance was felt as the stripper entered the aortic arch, and immediately thereafter the loosened thrombus (measuring 17 cm. in length) was blown out the open end of the carotid artery by a gush of blood. Because of the injury of the vessel at the point of its previous ligation, it was necessary to excise 5 cm. of the common carotid artery and a short cuff on each side above its bifurcation. A lyophilized iliac homograft was used to bridge the lower segment of the common carotid artery to the internal carotid artery, the external carotid artery being sacrificed (Fig. 3). Upon release of the occluding clamps, a bounding arterial pulse occurred in the carotid artery, and its caliber was greatly increased.

Apart from a paralysis of the mandibular branch of the left facial nerve, there were no postoperative difficulties.

Postoperative Angiography, July 9, 1956, 7 weeks after operation. A left common carotid arteriogram revealed continued patency of the left common carotid artery and a normal pattern of cerebral vessels (Fig. 4).
DISCUSSION

Although the precise circumstances that characterize this case must be extremely unusual, questions of broader importance and more general interest arise.

The first deals with interpretation of the carotid angiogram made distal to the ligature. It will be recalled that the internal carotid artery contained no contrast medium beyond the base of the skull. Before exploration, it was thought that this might be caused either by a separate occlusion high in the internal carotid artery, beyond the reach of presently available surgical procedures, or by blood flow in-
sufficient to sweep the dye distally in this artery. The latter was proved to be the case at operation and by subsequent arteriograms.

The technique of clearing the obliterated common carotid artery 2 years after ligature and thrombosis deserves comment. Clearly, the area of ligation required excision and replacement by a graft. The rest of the vessel was normal except for the occluding thrombus, which was easily dislodged by an intraluminal stripper. Although proximal stripping of this artery might be performed blindly, as is practised in the thigh, a tear of the unexposed artery within the thorax would be disastrous. Therefore, surgical procedures on the carotid artery in this area must be done under direct vision, regardless of the local problems of exposure. Methods for exposure of the major vessels within the superior mediastinum have been developed by Elkin and Shumacker.

Cerebral ischemia is the most feared result of carotid ligation. As usually described, early and late forms are separated, the former occurring immediately or within a few hours and the latter appearing after a delay of 24, 48, or even 72 hours. Thus, the cerebral circulatory failure following carotid ligation ordinarily has its onset within several days of the time when the artery is closed. This contrasts with the now widely recognized fact that, in spontaneously occurring obstruction, symptoms of ischemia often commence long after the occlusion is established. Why, following surgical occlusion, these long delayed difficulties are not prominent is difficult to understand. Perhaps insufficient time has elapsed for the subjects of larger published studies to have come forward in compelling numbers with this complication, or perhaps the relative rapidity of even gradual surgical occlusion has separated off at an early date most of those in whom collateral circulation is marginal—those who might under different circumstances have shown long delayed evidences of cerebral vascular insufficiency.
Finally, when surgical closure of a carotid artery seems necessary or desirable, consideration should be given to the fact that internal carotid ligation is irrevocable after a short interval, while common carotid closure is not. The possibility of re-establishing circulation at a later time might be weighed in selecting the site, especially since the available evidence fails to support clear superiority in terms of effectiveness and safety of either one over the other.

SUMMARY

A 44-year-old man began to exhibit symptoms of carotid insufficiency 2 years after the left common carotid artery was ligated. Blood flow was re-established after endarterectomy and arterial graft.

REFERENCES