MICROSURGERY AS AN AID TO MIDDLE CEREBRAL ARTERY ENDARTERECTOMY*

JULIUS H. JACOBSON II, M.D., LESTER J. WALLMAN, M.D., GEORGE A. SCHUMACHER, M.D., MARTIN FLANAGAN, M.D., ERNESTO L. SUAREZ, M.D., AND R. M. PEARDON DONAGHY, M.D.

Department of Surgery, Divisions of Neurosurgery and Surgical Research, University of Vermont, College of Medicine, Burlington, Vermont

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Attempts to remove obstructions either in the form of emboli or sclerotic plaques from the human vasculature have met with notable success in recent years in the case of the aorta and vessels of the lower extremities. More recently the carotid and vertebral arteries in the neck have succumbed to the surgeon. The intracranial vessels have not been so subdued. Anyone who has attempted to open and close and to maintain patent a vessel measuring less than 3 mm in diameter is no stranger to frustration. The purpose of this paper is to bring to your attention a technique that can be of help in relieving the feeling of inadequacy when confronted by a minute but essential vessel, which must be allowed neither to bleed nor to obstruct, and whose repair must be accomplished at some depth, often with nearly invisible suture. The technique also has promise in many other areas of vascular surgery, ureteral reconstruction, organ transplantation, and in fact in any situation in surgery when smallness of structure or desirability of finely placed sutures is present.

At the meeting of the Harvey Cushing Society in 1955 Welch reported the surgical removal of obstruction from the middle cerebral artery on two occasions.

One patient with an obstruction just beyond the posterior temporal branch was operated upon, and an embolus was removed 28 days following the onset of symptoms.

This patient has shown excellent neurological recovery and repeated angiography reveals patency of the ascending branches of the right middle cerebral artery, but without filling of the posterior temporal branch.

The other patient, with occlusion shortly beyond the intracranial bifurcation of the internal carotid artery, was operated upon the day of onset. An embolus was successfully removed. She remained hemiplegic and her postoperative angiogram showed recurrent closure of the vessel in this same area.

Scheibert at the meeting of the Harvey Cushing Society in 1959 presented his series of 4 cases. He has added 1 case since. In 1 case, that of a 66-year-old male, he was able to establish patency and to maintain this for 8 months, as proven by angiography. This patient died of coronary occlusion 9 months after operation. Patency was not maintained in the other 4. So far as we are aware this is the only case in which a middle cerebral artery has been opened and closed and then remained fully patent.

Piazza and Gaist reported in 1960 a fascinating case of embolism of a shotgun pellet to the middle cerebral artery in a 22-year-old man. Dr. M. Milletti in Bologna operated and milked the pellet back to the internal carotid artery, then occluded the internal carotid above this point, thus preventing the pellet from again entering the middle cerebral circulation, and leaving the carotid of the opposite side to nourish both middle cerebral arteries, which it was demonstrated by angiography to do exceedingly well. This most ingenious procedure, however, cannot have wide application because

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most obstructions of the middle cerebral artery are not so freely movable, and many patients could not tolerate as easily as this 22-year-old healthy male, the loss of the internal carotid supply.

Crawford et al.* have written concerning endarterectomy, "The major limiting factor in the application of these procedures to small arteries has been lumen constriction resulting from arterial repair."

Carton et al.† have devised a method of attaching a patch to small vessels with a glue. Sussman and Fitch‡ have suggested the intravascular use of fibrinolysin. The limitations of each method can best be learned from the words of the authors in the appended bibliography. None is truly ideal.

Our own method is but one additional attempt at circumvention of the situation to which Crawford alluded—a condition exemplified by Poiseuille's Law—the flow of fluid through a vessel is directly proportional to the fourth power of its diameter.†

One of us (JHJ) had come to the conclusion that many failures in small-vessel surgery were caused by errors in placement of sutures, and that these errors were in part ascribable to errors in human vision. An error of 1 mm. in the placement of the suture in a 2 cm. vessel is well tolerated, but in a 2 mm. or 3 mm. vessel such misplacement spells partial occlusion. We experimented with a variety of magnifying glasses and ocular loops to increase visual acuity. Each proved unsatisfactory for one or more of the following reasons: 1) Too low a magnification; 2) too short a working distance between the magnifying device and the operative field; 3) the necessity for holding the head in exactly the correct position, resulting in surgical torticollis; and 4) difficulty in changing easily from the magnified area to the general operative field.

Borrowing a leaf from the otorhinolaryngologists' book, a dissecting microscope* was taken into the laboratory as shown in Fig. 1. First experiences with the microscope may be likened to the first time that the moon is viewed through a powerful telescope. A whole new area of detail is appreciated. Previously unrecognized technical error becomes glaringly apparent.

With the aid of this instrument laboratory success has been achieved in arterial replacement of small vessels.†

In the operating room the microscope is covered with a sterile drape, and a sterile metal ring is fitted over the objective. The ring prevents both slippage of the drape over the lens and inadvertent contamination of the lens (Fig. 2). Depending upon the choice

* Courtesy of Mr. Erich Friedrich, Carl Zeiss, Inc., 485 Fifth Avenue, New York, N. Y. A new double binocular microscopic device (diproscope), allowing both the surgeon and assistant to view the operative field, is available.

Fig. 1 (left). The dissecting microscope.
Fig. 2 (right). Draped microscope in laboratory use.