Packing with Muscle of Internal Carotid Artery for Aneurysm with Immediate Occlusion and Subsequent Establishment of Flow

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Occasionally, while operating on intracranial aneurysm, the aneurysmal sac may be torn inadvertently from the parent vessel. If the parent vessel must be clipped to control the resultant hemorrhage, grave neurologic sequelae result frequently. Obviously it is most desirable to control the hemorrhage without sacrificing the involved artery. The problem is probably most severe in cases involving aneurysms of the internal carotid artery.

Recently, the authors were faced with such a situation involving an aneurysm of the internal carotid artery. We were able to control bleeding successfully by packing muscle between the torn artery and the underlying sphenoid bone. Postoperative angiography revealed a markedly diminished flow of blood past the point of operative intervention. Subsequent repeated angiography, however, revealed progressive re-opening of the vessel.

Report of Case

B. McG., an 18-year-old right-handed negro female, was admitted to the Detroit Receiving Hospital on July 7, 1961. During an argument, 1 month prior to admission, she felt something snap in her left temple, following which there developed a sudden severe, throbbing headache, a high-pitched ringing sound in both ears, diplopia, a twitching movement of the left eye, and the eye gradually became red and swollen. The severe headache persisted and, because she felt too weak, she remained home in bed. In the next 2 weeks, there developed gradually a ptosis of the left eye. Subsequently, the ptosis began to clear. At the time of admission the patient complained of diplopia, pain in the left eye, and photophobia.

Past history was noncontributory except for a short period of bitemporal headaches associated with hypertension 4 years before.

Examination. The patient was alert and oriented. Blood pressure was 150/100 mm. Hg. There was a slight ptosis of the left eyelid. The left pupil measured 2.5 mm. and the right pupil 3 mm. Both pupils were round, regular, and reacted to light and in accommodation. The left eye deviated downward and outward and did not move appreciably from this position.

Laboratory examinations included hemoglobin, count of white blood cells, urinalysis, fasting blood sugar, blood urea nitrogen, prothrombin time, bleeding time and serology, and findings were all normal except the hemoglobin, which was 10.4 gm. per cent. Roentgenogram of the skull was normal.

Hospital Course. Lumbar puncture was performed on July 10, 1961; initial pressure was 230 mm. of cerebrospinal fluid and closing pressure, 55 mm. The fluid was clear and colorless, and contained 10 lymphocytes. The protein level of the spinal fluid was 37 mg. per cent. On July 12, 1961, the following additional neurological findings were noted: diminished sensation of the left cornea, minimal weakness of the right arm on performing the arm-deviation test, slight increase in the deep tendon reflexes of the right arm and leg, limited bilateral straight-leg raising, and unsustained left ankle clonus. Bilateral carotid angiograms revealed an aneurysm, 4 mm. in size, with a narrow neck arising from the left internal carotid artery at the origin of the posterior communicating artery (Fig. 1 A, B, C). The left anterior cerebral artery was hypoplastaic and the distal left anterior cerebral artery filled from both sides. Bilateral brachiovertebral angiography failed to show any evidence of other aneurysms. By July 18, 1961, the involvement of the 3rd nerve had improved and the left eye was able to cross the midline. Prior to operation left carotid compression for 2 min. failed to produce any untoward symptoms.

Operation. A left frontotemporal craniotomy was performed on July 20, 1961. The left internal carotid artery was identified and followed posteriorly until the aneurysm was visualized pointing inferolaterally and surrounded by a small clot. A portion of the clot and several fine arachnoid fibers were separated from about the neck of the aneurysm and an Olivecrona clip was applied across the neck. On closure of the clip, brisk bleeding began. The clip was removed and inspection of the aneurysm revealed that its neck had been severed between the clip and the internal carotid artery. Several attempts then were made to apply a clip to the 1-2 mm. stump, but were unsuccessful. Between attempts at clipping the stump, Gelfoam and cottonoid packed between the artery and underlying bone controlled the bleeding. Since this pack controlled the bleeding, it was decided to see if control of bleeding could be attained by packing the bleeding point with muscle rather than by permanently clipping the internal carotid artery. A piece of temporal muscle was macerated, packed about the stump of the aneurysm, and wedged between the artery and underlying bone. After this maneuver, a small leak was noted, and a second piece of muscle was placed about the area, slightly more lateral. This controlled the bleeding. Blood pressure on completion of the packing procedure was 80 mm. Hg systolic. Closure was delayed until the systolic pressure rose to 95 mm. Hg; the systolic pressure at the beginning of the operation had been 108 mm. Hg.

Postoperative Course. Two hours following operation,
the patient was awake, talking, and moving all extremities. The palsy of the 3rd nerve, however, was profound. On the 1st day after operation the palsy of the left 3rd nerve had improved and the left eye moved past the midline. A left carotid angiogram on Aug. 3, 1961 revealed only a slight trickle of dye past the siphon of the left internal carotid artery (Fig. 1D). The patient was discharged to her home on Aug. 8, 1961. The palsy of the left 3rd nerve had improved considerably.

Follow-up. On Oct. 13, 1961, the patient was readmitted for angiography. The operative scar in the left temporal region was well healed. Neurologic examination revealed the pupils were round, regular and equal and reacted to light and in accommodation. Movements of the left eye were entirely normal. The remainder of the findings were normal except for a slight increase in deep tendon reflexes on the right. Bilateral carotid angiograms (Fig. 2 A, B) revealed that the proximal and distal left anterior cerebral artery filled only from the right side. There was now filling of the left middle cerebral artery from the left side; however, the lumen of the internal carotid artery in the region of the posterior communicating artery was irregular. The patient was discharged and followed in the outpatient clinic.

On Sept. 10, 1962, the patient came to the emergency
room of Detroit Receiving Hospital. Shortly after her visit to the clinic 2 months before, she began having left frontotemporal headaches with blurring of vision in her left eye and occasional stiff neck. The headaches occurred almost every week, and she had a very severe episode 2 days before. Neurologic examination revealed that the left pupil was slightly larger than the right but reacted to light and in accommodation. There was a slight decrease in sensation over the distribution of the 1st division of the left trigeminal nerve, and there was a questionable meningismus present.

The patient was admitted to hospital where findings of lumbar puncture proved entirely normal. Bilateral carotid angiography was performed (Fig. 2 C, D). As
before, both anterior cerebral arteries filled from the right side. There also was some filling of the peripheral branches of the left middle cerebral artery. On injection of the left common carotid artery there was a distinct area of narrowing of the left internal carotid artery at the previous point of origin of the aneurysm. Despite this narrowing, there was improvement of the filling of the branches of the middle cerebral artery by comparison with the previous examination. The patient was discharged. She was seen in Neurosurgery Clinic on Oct. 5, 1962, at which time she did not have any headaches and the neurologic findings were normal.

Comment

It is not unusual during operation for intracranial aneurysm that application of a clip results in a tearing off of the aneurysm from its arterial attachment. Recently, Carton et al. reported in this Journal a case similar to ours in which a hole in the internal carotid artery was repaired using Eastman 910 plastic adhesive. This method, however, presupposes that the operation be performed under hypothermia, since temporary arterial occlusion is necessary to produce a dry artery to which to stick the adhesive patch; that the adhesive material be readily available; and that the surgeons be familiar with this new technique. Suture of a hole in an intracranial artery (though not the internal carotid artery) has been tried, but only with difficulty and varying success. 

Unfortunately, this situation usually is resolved by clipping the feeding vessels.

In the case presented, the situation was handled by packing of the aneurysmal stump with muscle. Success of this maneuver was made possible by several fortuitous circumstances which the surgeons utilized in deciding to attempt the procedure. Preoperative angiography showed good cross filling from the right anterior cerebral artery, and preoperative carotid compression suggested that temporary occlusion of the carotid artery could be well tolerated. In addition, the neck of the aneurysm as seen by angiography and confirmed at operation was quite narrow, and bleeding from this source was controlled by Gelfoam and cottonoid packs between attempts at clipping the aneurysmal stump. This latter maneuver was made possible not only by the small neck but also by the fact that the packing material could be wedged between the artery and subjacent sphenoid bone. It should be noted that had the muscle-packing procedure failed, the internal carotid artery still could have been clipped subsequently. We feel, however, that complete, acute occlusion of the internal carotid artery intracranially by clips would probably have resulted in neurologic deficit despite the evidence of good potential collateral circulation.

It should be emphasized that the muscle-packing procedure did not result in a completely occluded vessel. Initially only a slight trickle of contrast material was seen to pass beyond the tampon. Subsequent arteriograms, obtained 3 and 14 months postoperatively, showed progressive reestablishment of the circulation through the internal carotid artery. In addition, collateral circulation from the opposite side also increased progressively by way of the terminal branches of the left anterior and middle cerebral arteries, as well as through reconstitution of the anterior circle of Willis, probably because of the stimulus offered by partial occlusion of the internal carotid artery which still persisted 14 months after operation.

A question arises as to the specific cause of the marked narrowing of the artery since it improves progressively. Is the narrowing a consequence of direct compression of the muscle tampon, or is it caused by local spasm produced by manipulation of the vessel as described by Ecker and Riemen-schneider? We believe that in this instance the narrowing is a direct compressive effect of the tampon, with spasm playing little or no part, for the following reasons: 1) The obstruction is localized and irregular in contour in contradistinction to spasm which usually is tapered and smooth over a distance of 1 cm, or more. 2) The narrowed segment had not disappeared completely even after 14 months, certainly an excessive period of time for persistence of spasm. It is probable that gradual reopening of the artery was accomplished either by persistent pulsation of the artery against the mass of muscle, or by gradual fibrosis and shrinkage of the avascular muscle.

The excellent result obtained in this case suggests that, under appropriate circumstances, bleeding from a small opening in the under surface of the carotid siphon in the region of the posterior communicating artery may be controlled by pledges of muscle wedged between the artery and subjacent bone rather than permanent clipping of the artery.

Addendum

Recently, one of the authors (D.R.S.) and Dr. H. Harvey Gass packed the stump of an aneurysm of the internal carotid artery with muscle in a 69-year-old white female (M.S.). The patient had two major subarachnoid hemorrhages within a month from an aneurysm of the left internal carotid artery. At operation, the aneurysm was found lodged between the left anterior clinoid process and the base of the skull pointing inferiorly from the under surface of the internal carotid artery. Because of the lack of available space to accept the jaws of the clip forcep, considerable difficulty was encountered in applying a clip. In attempting to do so, the aneurysm ruptured. Further application of the clip and attempted coagulation were unsuccessful. Hemor-
rhage was then brought under control by packing a piece of temporal muscle against the hole in the underside of the artery. This was reinforced with Oxycel. This effectively controlled the bleeding. Angiograms obtained 2 and 4 weeks postoperatively did not show the aneurysm and there was no significant stenosis of the parent vessel.

References


