Case Report and Technical Notes

Arteriovenous Fistula after Removal of Meningioma*

Case Report

J. CLAYTON DAVIE, M.D.,† and FRED HODGES, M.D.,‡
Division of Neurosurgery and Neuroradiology, Washington University and Barnes Hospital, St. Louis, Missouri

There have been a number of reports of traumatic or iatrogenic arteriovenous fistulas7,8,11 and, of course, many studies of meningiomas. We have found no report, however, of a case in which both were present in the same intracranial area at the same time. We are reporting such a case.

Case Report

First Admission. This 47-year-old Negro woman was first admitted to the Neurosurgery Service at Barnes Hospital on November 4, 1958. At that time there was a 6-month history of progressive neurological deficit characterized by personality changes, headache, vomiting, confusion, lethargy, global dysphasia, a spastic right hemiparesis, nonfocal seizures, and progressive nonpulsating proptosis with bilateral papilledema. A firm nontender fullness was present in the left temporal region. There were no cephalic, orbital, or neck bruits. The remainder of the physical examination was normal.

A slow dysrhythmia in the left temporoparietal region was present in the EEG. Plain skull films indicated marked hyperostosis and thickening of the left sphenoid wing. A left carotid arteriogram showed a large left frontotemporal mass with opening of the carotid siphon, medial and upward displacement of the left middle cerebral artery, and vascular stain in a lesion along the sphenoid wing (Fig. 1).

Operation. With the use of hypothermia and urea, a left frontotemporal craniotomy was performed on November 6. The temporals muscle was involved by tumor associated with marked hyperostosis and thickening of the greater and lesser sphenoid wing. A major intracapsular removal of the tumor was accomplished. The operating surgeon felt that none of the important branches of the middle cerebral artery had been sacrificed. The partial dural closure included the use of gelfilm to cover the deficit created by the tumor removal. Microscopic examination of the surgical specimen revealed fibroblastic meningioma in the temporal muscle and narrow spaces of the bone. There were no mitotic figures.

Postoperative Course. The patient's postoperative course was unusually benign, characterized by rapid and dramatic improvement. At the time of her discharge her mental status was normal and she was fully ambulatory, although there was hyperreflexia and very mild weakness of the right leg.

Second Admission. On October 31, 1965, the patient was readmitted to the hospital after suffering progressive loss of vision and proptosis of the left eye for 8 months. Intermittent headache and a firm nontender left temporal mass had developed. She also had a limp in the right leg.

The blood pressure was 140/90, pulse 88. She was alert, cooperative, oriented, and ambulatory. A firm, nontender, nonpulsating 5×5 cm mass was palpable in the left temporal region. Again, there were no cephalic, orbital, or cervical bruits. The left eye was proptosed without conjunctival changes. Funduscopic examination showed old scarring bilaterally and a slight pale left optic disc. Corneal and facial sensation was intact, and there was no motor or sensory deficit.

Left common carotid injections showed

364
immediate filling of a large vein (8 mm in diameter) in the left coronal area draining into the superior sagittal sinus. A brush-like group of vessels in the left pterional region was supplied by the external and internal carotid arteries. The right carotid arteriogram was considered normal except for vascular supply to the tumor in the form of small vessels from the anterior communicating artery region (Figs. 2, 3, and 4).

Second Operation. On November 3, under general endotracheal anesthesia, the left external carotid artery was ligated, and a secondary left frontotemporal craniotomy was performed with excision of recurrent sphenoid wing and orbital roof meningioma. There was tumor in the temporalis muscle and zygomatic fossa which extended from the floor of the middle fossa and pterional region. There was a large cystic area in the region of the anterior portion of the middle fossa but no gross tumor in the parenchymal portion of the brain. Near the superior margin of the dura excised at the first operation there was a meningocortical cicatrix. Above this region of dural adherence a large “red” vein containing arterial blood was visible. The middle cerebral artery was

![Image](image_url)
identified as the primary feeding artery. When this artery was transiently occluded with bayonet forceps, the vein promptly decreased in size and its color changed from a reddish hue to blue. Application of clips to the artery decreased the size of the vessels, reduced the volume of the draining vein, and changed the color of the vein. Although the apparent A-V fistula had not been totally eliminated, blood flow through it was radically reduced.

Postoperative Course. The postoperative course was uneventful. The patient was walking on the second postoperative day and had no postoperative neurological deficit. Proptosis was present but significantly reduced. The histological pattern of the tumor was unchanged. Postoperative angiograms showed a marked reduction of blood being shunted through the A-V fistula and a reduction in size and caliber of the vessels. The vein did not fill as early as preoperatively (Figs. 3 and 4).

The carotid arteriograms preceding the
Arteriovenous Fistula after Removal of Meningioma

Fig. 4. Preoperative (1965) and postoperative lateral left cerebral arteriograms taken at various time intervals. A and B. Preoperative views, 0.5 sec after injection. C. Preoperative view, 1 sec after injection. Early filling of the malformation and large draining vein is seen. D. Postoperative view, 1 sec after injection. E and F. Postoperative view, 2 sec after injection. Marked reduction in size of vascular malformation and decrease flow into superficial vein, and occlusion of the inferior branch of the left middle cerebral artery are seen.
The carotid arteriograms preceding the second craniotomy (Fig. 2) showed filling of both pericolloidal arteries from a right common carotid injection, as well as the brush-like arterial vessels extending toward the left sphenoid wing from the region of the anterior communicating artery. The left carotid arteriogram (Fig. 3 A), also preceding the second craniotomy, showed nonfilling of the left anterior cerebral pericolloidal artery. The middle cerebral artery appeared quite large and terminated in a prominent arteriovenous shunt which was drained by a large tortuous and irregular superficial vein leading over the convexity to the superior sagittal sinus. The tantalum button overrode a portion of the vascular malformation. A silver clip was visualized below the tantalum button along the distal portion of the main branch of the middle cerebral artery as it coursed into the vascular abnormality. The angiograms made after the second craniotomy and after the subtotal ligation of the A-V shunt (Fig. 3 B) showed four silver clips, the most inferior of which was placed across the major branch of the middle cerebral artery as it entered the A-V fistula. Figures 3 C and D show a marked reduction in the size of the vascular abnormality formation and the superficial draining vein.

The series of left carotid arteriograms taken before and after the second craniotomy at comparable time intervals (Fig. 4) showed that, in addition to changes in the A-V fistula, there was a marked postoperative reduction of density along the sphenoid wing and orbital roof. The left posterior communicating and posterior cerebral arteries were much more prominent preceding the second craniotomy than following (compare Figs. 4 A and F). Figure 4 B shows the bifurcation of the middle cerebral artery with the principal inferior branch going directly to the A-V fistula. The superficial vein draining the fistula reaches its maximum opacification and irregular lobulation in Fig. 4 C. In Figs. 4 D, E, and F, the arterial supply of the fistula has been occluded by a silver clip, with preservation of the superior branch of the middle cerebral bifurcation. These arteriograms show the almost total occlusion of the vascular malformation with some persistence posteriorly; the size of the vein draining the fistula has been markedly reduced.

Discussion

The appearance of a rather typical A-V abnormality in the immediate region of a previously excised meningioma raises several etiological possibilities. If it had been present before the first excision of the meningioma, it could conceivably have exercised a tamponade effect by compressing the feeding arteries and draining veins. However, this possibility is unlikely, since the anomaly would have been recognized at the time of the first craniotomy.

Another possibility might be that recurrent tumor caused the A-V fistula. This explanation would be much more plausible if the tumor had been hemangioblastic rather than fibroblastic. Although there can be stain and vascular shunting related to meningioma and glioblastoma, the picture is not really comparable to that of a large A-V malformation. The problem of “red veins” and vascular circulation in tumors has been discussed, but no one has reported arteriovenous shunting of this magnitude, nor have they reproduced comparable angiograms.

The most likely explanation seems to be that this was a traumatic A-V shunt related to the earlier surgical manipulation associated with the removal of a very large meningioma.

Summary

We have reported a case in which an A-V fistula, apparently of traumatic origin, developed in the time interval between the original removal of a meningioma and its recurrence. The recurrence was excised and the vascular supply of the adjacent A-V fistula ligated. The associated angiograms have been presented and analyzed.
Arteriovenous Fistula after Removal of Meningioma

References