Aneurysms of the Posterior Cerebral Artery

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Aneurysms of the posterior cerebral artery are unusual; their surgical treatment demands great care for the central perforating branches of this vessel irrigate the midbrain and thalamus while the main trunk nourishes the optic radiation and visual cortex.

Experience has been gained with eight cases of which six were operated on, with one death (Table 1 and Fig. 1). Although there were no field defects, one patient had an incomplete hemisensory deficit and another developed a delayed hemiplegia from postoperative temporal lobe swelling.

Aneurysms arise from the posterior cerebral artery most commonly at the first major branching as it winds around the midbrain hidden under the hippocampal gyrus; more rarely, they arise from the first portion of the posterior cerebral artery in front of the crus cerebrum at or near the junction with the posterior communicating artery.

Their incidence in the Co-operative Study was 22 in 2672 cases (0.8%). Undoubtedly this figure is too low, in that vertebral angiography was done in only 27% of cases. None of our cases had multiple aneurysms, although in Case 8 there was an associated arteriovenous malformation in the ipsilateral occipital lobe.

There are very few reports of surgical treatment of posterior cerebral aneurysms except for isolated cases. Of those cases cited in the Co-operative Study, four were operated on directly and two died; one did well and the other survivor was disabled.

Case Reports

Case 1. This 56-year-old man was admitted in June, 1957, 1 month after a verified subarachnoid hemorrhage. During the previous week he had developed a complete right third nerve palsy, and in the preceding 24 hours, a left hemiparesis.

Vertebral angiography revealed a large saccular aneurysm arising from the proximal segment of the right posterior cerebral artery. The patient refused operation, and is still alive 11 years later although now confined to a wheelchair with a complete left hemiplegia and right oculomotor palsy.

Case 2. This 66-year-old Scottish woman was admitted in April, 1960, after three subarachnoid hemorrhages. She was drowsy, with bilateral extensor plantar responses and paresis and analgesia of the right arm. A saccular aneurysm arose from the left posterior cerebral artery at the point of first branching. Operation was delayed for 25 days because of continuing stupor; the aneurysm was then clipped under moderate hypothermia. Although the patient remained aphasic for several weeks, her ultimate recovery was excellent, without residue. There was never a field defect.

Case 3. This 59-year-old woman was admitted in September, 1962, for the investigation of an incomplete left third nerve palsy which had begun with ipsilateral orbital and temporal pain 6 weeks before. Angiography revealed a saccular aneurysm arising from the first portion of the posterior cerebral artery near the junction with the posterior communicating artery. As the palsy was showing early signs of recovery and there was no certainty that a rupture had occurred, she declined operation. There was eventual complete recovery of third nerve function and she has remained well for 6 years.

Case 4. This 42-year-old nurse was admitted stuporous following her first hemorrhage in June, 1963. There was a large fusiform aneurysm of the right posterior cerebral artery at the point where it curved around the crus about 2 cm from its origin. Three more hemorrhages occurred in rapid succession. The last, 1/2 hour before operation, rendered her deeply unconscious with a complete left hemiplegia. The aneurysm was fusiform and fragile, and in spite of attempts to do other-
wise, it proved necessary to clip the posterior cerebral artery on either side to control bleeding when the sac burst. She survived only a few hours.

Case 5. This 49-year-old man was admitted following a single subarachnoid hemorrhage in January, 1964. He was found to have subacute bacterial endocarditis, and a mycotic aneurysm was demonstrated on the right posterior cerebral artery at the first major branching on the side of the midbrain. Operation was delayed for 6 weeks in the hope that under antibiotic therapy the arteritis might resolve. Angiography at the end of this period showed that the aneurysm was larger. Under artificial hypotension, both a ligature and clip were used to obliterate the neck. The postoperative angiogram showed complete occlusion of the sac and filling of the distal branches. The subsequent course was uneventful and the patient remains well.

Case 6. This 56-year-old housewife had had two hemorrhages, in 1964 and February, 1966. The second was followed by blurring of vision in the right visual field and impairment of memory. The aneurysm was large, saccular, and arose at the bifurcation of the left posterior cerebral artery. She was well at operation 8 weeks later.

Through a left temporal flap this large aneurysm was exposed by removing the overlying hippocampal gyrus using moderate hypotension (70 mm for 2 hours). The aneurysm was broad enough that a preliminary ligature had to be used to narrow the neck enough so that dissection could be completed. A second ligature was tied down tightly beyond the first and the sac was opened to collapse its bulk. Postoperative angiography revealed that the aneurysm was obliterated and that the peripheral branches filled, though faintly. There was no field defect but the patient was confused and dysphasic for a week. Thereafter improvement was rapid and at the end of 6 weeks she was perfectly well without neurological deficit.

Case 7. This 26-year-old accountant noted the gradual onset of headache 18 days before operation. The CSF was bloody. He probably had had a previous hemorrhage 1 year before. There was a large multilocular aneurysm arising from the right posterior ce-

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Sex</th>
<th>Hemorrhages Grade</th>
<th>Interval</th>
<th>Method</th>
<th>Adjuncts</th>
<th>Postop Angiography</th>
<th>Results</th>
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<tr>
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<td>56</td>
<td>M</td>
<td>1 C-3 palsy L hemiparesis</td>
<td>30 days</td>
<td>refused operation</td>
<td>hypothermia</td>
<td>SBE</td>
<td>disabled 11 yrs; C-3 palsy and complete hemiplegia</td>
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<td>2</td>
<td>66</td>
<td>F</td>
<td>3 3</td>
<td>2 days</td>
<td>clip</td>
<td></td>
<td></td>
<td>ultimate complete recovery</td>
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<tr>
<td>3</td>
<td>59</td>
<td>F</td>
<td>? 1 partial C-3 palsy</td>
<td>76 wks</td>
<td>refused operation</td>
<td></td>
<td></td>
<td>well 6 yrs; C-3 recovered</td>
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<td>4</td>
<td>42</td>
<td>F</td>
<td>4 5</td>
<td>1 hr</td>
<td>clip &amp; excision</td>
<td></td>
<td></td>
<td>died</td>
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<tr>
<td>5</td>
<td>49</td>
<td>M</td>
<td>1 SBE</td>
<td>43 days</td>
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<td>56</td>
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<td>2 1</td>
<td>8 wks</td>
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<td>18 days</td>
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<td>8</td>
<td>45</td>
<td>M</td>
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<td>36 days</td>
<td>clip</td>
<td>urea, deep hypotension 45 mm for 25 min</td>
<td></td>
<td>fair, left monoparesis C-3 palsy</td>
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TABLE 1
Posterior cerebral aneurysms

Posterior Cerebral Aneurysms
rebral artery at its first branching on the side of the midbrain (Fig. 2).

Deep hypotension (45 mm Hg) was used for 1 hour and 35 minutes during the dissection of the aneurysm which proved to be much larger than had been indicated in the angiogram because of mural thrombus. The two major branches could be freed from the posterior aspect but the base was so broad that the longest clip would reach only three-quarters of the way across. A ligature kinked the parent vessel and its branches, and was removed. The aneurysm was therefore opened, the clot removed and endoaneurysmorrhaphy carried out with No. 60 silk; there was little bleeding. A Mayfield clip was placed across a distal loculus which still filled with blood. The perforating vessels had been preserved and could be seen in the bed in the midbrain and thalamus.
Posterior Cerebral Aneurysms

Fig. 2. Case 7. Preoperative angiograms, lateral (left) and anteroposterior (right) views of large right posterior cerebral aneurysm.

The patient's recovery was uneventful except for an incomplete sensory loss throughout the left side. There was no paresis or visual field defect despite the failure of the posterior cerebral artery to fill beyond the suture line in the postoperative angiograms (Fig. 3). Thrombosis had undoubtedly occurred in the stump of the aneurysm and adjacent segment of the parent vessel. The optic radiation and calcarine cortex must have been irrigated by collateral circulation.

Case 8. A 45-year-old man was admitted 1 day after a hemorrhage which had left him lethargic with a right third nerve palsy and left hemiparesis. There was a long history of "migraine." Angiography revealed an aneurysm projecting backward from the right posterior cerebral artery just lateral to the basilar bifurcation, as well as an ipsilateral occipital arteriovenous malformation (Fig. 4). Shortly after, he bled again, and the neurological deficit became worse. Recovery was slow but at the time of operation 5 weeks later he was reasonably alert with substantial recovery from the oculomotor palsy and hemiparesis. It was considered that the aneurysm, not the angioma, was responsible for the bleeding since there was never a field defect.

Operation was carried out 5 weeks after the second hemorrhage under profound hypotension (45 mm of Hg for 25 minutes) during the dissection and obliteration of the aneurysm. The middle fossa was unusually deep, but with spinal drainage and urea, the temporal lobe could be elevated to provide an excellent view of the first part of the very large posterior cerebral artery. Several large bridging veins from the undersurface of the temporal lobe to the dura had to be divided. The aneurysm arose from the posterior aspect of the artery and projected backward and upward into the medial aspect of the right crus and interpeduncular space. There was local staining to indicate that the aneurysm, not the angio-, had caused the hem-

Fig. 3. Case 7. Postoperative angiogram shows failure of posterior cerebral artery to fill beyond the end oneurosmorrhaphy, yet there was no field defect.
orrage. The neck could be identified and freed from one perforating vessel so that an angled Mayfield clip could be applied accurately. The third nerve was not in the way and had very little manipulation. There was only slight contusion of the temporal lobe from retraction.

Approximately 2 hours following operation, the patient, who had been doing satisfactorily and moving all extremities, suddenly became decerebrate and the right pupil which had been moderately dilated became fully dilated and fixed. The wound was reopened immediately to reveal only temporal lobe swelling. After urea, the position of the clip was found to be satisfactory and there was no evidence of further hemorrhage. The bone flap was removed to provide decompression. The patient subsequently improved gradually so that after 8 weeks he was mentally bright, but had a left hemiparesis and a persistent right third nerve palsy. There was no field defect. The leg function was quite good, but although there was strength in the movement of the hand and fingers, facility was poor because of spasticity.

Discussion

Although there was no specific clinical picture for the distal aneurysms, each of the proximal saccular aneurysms were associated with a third nerve paresis and contralateral hemiparesis. This clinical syndrome might be anticipated, for aneurysms of the first part of the posterior cerebral artery have an intimate relation to the cerebral peduncle and to the third nerve as it emerges between the posterior cerebral and superior cerebellar arteries. An unusual feature was that only one patient had a temporary field defect although this vessel provides the principal blood supply to the optic radiation and cortex.

Exposure of aneurysms of the posterior cerebral artery is not as straightforward as for those on the carotid circulation. As they lie at or just above the incisura, the temporal lobe must be elevated considerably to gain line of sight up the slope of the petrous bone and tentorium. Every means should be taken to achieve a slack brain, including lumbar drainage of CSF, controlled ventilation, and Mannitol if necessary, so that serious temporal bruising or laceration will not occur, particularly on the left side. Aneurysms of the proximal segment carry an additional hazard in common with basilar bifurcation aneurysms, that of lying on a bed in the midbrain surrounded by tiny important vessels which irrigate the midbrain and thalamus. With deep hypotension and magnification of vision, the base of the sac can be separated from these vessels so that a clip or ligature may be applied accurately, flush...
with the parent artery. It is much easier to see the medial aspect of these sacs than in the case of the more centrally placed basilar bifurcation aneurysms.

The more common distal aneurysms are hidden in the choroidal fissure and as the majority have projected laterally or upwards, it has been necessary to remove by suction the overlying hippocampal gyrus (Fig. 5). Deep hypotension will be useful, since this approach requires exposure of the fragile fundus before the neck and origin come into view. The integrity of the bifurcation of the posterior cerebral artery must be preserved to avoid a visual field defect.

Two of the eight cases were not operated on because of refusal to consider surgical treatment. Case 1 was discharged with a right third nerve palsy and a left hemiparesis and 11 years later is confined to a wheelchair because of slow progression to a complete left hemiplegia, probably the result of gradual enlargement of the aneurysm. In Case 3, the third nerve palsy disappeared, and the patient has remained well for 6 years.

In the six cases operated on, there was one death (Case 4) of a patient who was moribund with temporal lobe and intraventricular clot after a fourth hemorrhage and in whom a fusiform aneurysm had to be excised.

Of the five survivors, four are perfectly well except that one (Case 7) has an incomplete hemisensory defect which is of little concern to him. This probably resulted from dissection of the large partially thrombosed aneurysm from its bed in the thalamus.

The hemiplegia and third nerve palsy in Case 8 from postoperative temporal lobe swelling was tragic, for his initial recovery was satisfactory. It is conceivable that these deficits were aggravated by the uncal herniation which occurred, for the handle of the clip would be depressed through the incisura to impinge on the third nerve and at the same time produce traction on the posterior cerebral artery and the perforating vessels irrigating the crus. It remains unknown whether or not division of the large bridging veins, probably related to the angioma, contributed to the rather unusual temporal lobe swelling.

It is remarkable that in none of the operated cases was there a postoperative field defect, even though in Cases 2 and 7 the branches distal to the site of the clip and endoaneurysmorrhaphy respectively did not fill on the postoperative angiograms. It is probable that the visual cortex was preserved by a collateral blood supply.

Summary

Eight cases with ruptured aneurysms of the posterior cerebral artery have been presented. Of two patients who refused operation, one has been well for 6 years, the other after 11 years has become disabled with a slowly progressive hemiplegia and third nerve palsy. Six cases were operated on, with one death following a useless attempt at salvage surgery in a moribund patient. Four of the five survivors are well, the last case developed a postoperative hemiplegia and third nerve palsy from temporal lobe swelling, possibly related to division of large bridging veins associated with an occipital angioma. Remarkably, there have been no postoperative visual field defects.

References


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**Fig. 5.** Drawing to depict operative exposure of distal posterior cerebral aneurysm. The overlying hippocampal gyrus has been removed and a major branch artery is being separated from the fundus.
aneurysm and arteriovenous malformations: based on 6368 cases in the cooperative study. 