Differentiation of Aneurism from Infundibulum of the Posterior Communicating Artery

JOHN L. FOX, M.D., THEODORE C. BAIZ, M.D., AND RUTH KERR JAKOBY, M.D.

Neurosurgery Department, District of Columbia General Hospital, George Washington University School of Medicine, and Georgetown University School of Medicine, Washington, D.C.

An arteriographic demonstration of aneurisms encountered in the lower portion of the C1 segment of the internal carotid artery, below the origin of the anterior choroidal artery and at, or near, the junction with the posterior communicating artery, has remained a vexatious problem because of the danger of interpreting a benign projection of contrast material as representing an aneurismal dilatation. The subject has received little attention although discussions with colleagues reveal an acute awareness of the problem gained, in part, at the expense of negative surgical explorations. The radiographic anatomy of this site has been discussed by Saltzman in noting that the posterior communicating artery is often dilated and funnel-shaped at its point of origin at the carotid siphon, an area which may be termed the infundibulum. Although the infundibulum can fill with contrast material from the carotid artery, the subsequent course of a posterior communicating artery with a small lumen may not be visualized because of failure to fill or because of the low density of contrast material in the small-caliber vessel. The resultant saccular projection of contrast material arising from the supraclinoid internal carotid artery may be readily confused with an aneurism.

Five cases are presented in which the apparent aneurism was actually the infundibulum of the posterior communicating artery. The problems encountered in differentiating between the two alternatives are noted and suggestions are offered for establishing the correct diagnosis.

Case Reports

Case 1. A 37-year-old woman was admitted with severe frontal headaches and in a confused state. She had a history of hypertension and was found to have a blood pressure of 240/140. A lumbar puncture revealed sanguinous cerebrospinal fluid and, during the ensuing 24 hours, nuchal rigidity became evident. Bilateral carotid and right vertebral arteriograms* revealed grossly reduced circulation time, vascular tortuosity, elevation of the right carotid siphon, and an aneurismal projection from the supraclinoid portion of the right internal carotid artery.

Twenty-one days later, after medical control of her blood pressure was obtained, a low right frontotemporal craniotomy was performed utilizing intravenous tris(hydroxymethyl)aminomethane under normothermic conditions and resulting in good exposure of the vasculature in question.

Under direct observation, there was no evidence of local subarachnoid hemorrhage or of an aneurism. Tortuosity of atherosclerotic vessels, rather than hematoma, accounted for elevation of the carotid siphon. A large funnel-shaped junction of the posterior communicating artery with the internal carotid was observed; after leaving the infundibulum, the narrow posterior communicating artery angled sharply posteriorly and upwards.

Demonstration of continuity between infundibulum and posterior communicating artery might have been expected if either the carotid or vertebral arteries had been compressed during vertebral or carotid injection, respectively (cf. Case 5). The preoperative diagnosis of aneurism was enhanced by the ragged appearance of the terminal portion of the infundibular projection. In retrospect the ragged outline appears to be caused by the juxtaposition of the projection to the clinoid process.

Case 2. A 54-year-old male was admitted in coma with a history of good recovery from a "stroke" involving the left side of the body 2 years previously. The present incident began with the sudden onset of severe frontal headache followed by collapse and, subsequently, a convulsive episode. Pertinent findings include blood pressure

* Although these films have been submitted, they are not included in the publication of this report because of the large number of illustrations involved.
of 160/100, left hemiplegia, left homonymous hemianopia, and left hemihypesthesia which gradually improved. Spinal fluid was entirely normal. Bilateral carotid angiograms revealed a backward and downward projection of contrast material from the lower C1 portion of the right internal carotid artery (Fig. 1).

Nine days after admission these findings led to a low right frontotemporal craniotomy performed under the same conditions as in Case 1.

Under direct observation, the above noted projection was found to be caused by a bulging infundibulum of the posterior communicating artery at its junction with the lower end of C1 portion of the internal carotid artery.

Case 3. A 56-year-old woman was admitted in coma with a history of hypertension. Her blood pressure stabilized at 150/100. There were no focal neurological findings but nuchal rigidity was present. On lumbar puncture, sanguineous cerebrospinal fluid was obtained. Bilateral carotid and right vertebral angiography demonstrated an aneurismal projection at the origin of the right posterior communicating artery (Fig. 2).

Nine days following subarachnoid hemorrhage the patient was subjected to a low, right, frontotemporal craniotomy under automatic controlled passive hyperventilation.

Under direct observation no aneurism was seen. The “lesion” noted on angiography appeared to be caused by a funnel-shaped junction of the posterior communicating artery with the internal carotid. At the lower end of this infundibulum, the posterior communicating artery abruptly narrowed and turned posteriorly. Many atherosclerotic plaques were observed. Throughout the subarachnoid space of the region explored, numerous adhesions were encountered and the brain was stained yellow-green, consistent with the recent subarachnoid hemorrhage. The course of the posterior communicating artery was demonstrated as arising directly from the aneurismal projection which proved to be the infundibulum.

Case 4. A 60-year-old male was admitted with left-sided weakness and severe right temporal headache of 1 day’s duration. Spinal fluid was entirely normal. Right carotid arteriography demonstrated an aneurismal projection of contrast material from the lower end of the C1 portion of the internal carotid artery. Subsequent injections resulted in films (Fig. 3) which prove that the projection represents a large descending infundibulum from which the posterior communicating artery arises and continues abruptly upward and backward over the tentorial edge. This patient was not operated on.

Comment. Attention is directed to Figs. 3 and 4A which allow comparison with a proven internal carotid aneurism near the junction of the internal carotid and posterior communicating arteries. Fig. 4B is an orbital

Fig. 1. Case 2. Carotid arteriogram demonstrating the bulging infundibulum.

Fig. 2. Case 3. Carotid arteriogram revealing a dilated infundibulum of the posterior communicating artery.

Fig. 3. Case 4. Lateral view following carotid injection revealing a dilated infundibulum leading into the posterior communicating artery.
view which demonstrates the proven aneurism arising from the internal carotid artery proximal and medial to a dilated infundibulum of the posterior communicating artery. Without the oblique view it would not have been known that the contrast projection from the internal carotid artery in Fig. 4A was in fact a superimposition of an aneurism on a more lateral and distal bulging posterior communicating infundibulum from the same carotid artery. Here the aneurism is more bulbous and ragged in appearance than the tapering and smooth-walled “lesion” of Case 4 but identical to the infundibulum adjacent to it.

Case 5. Following a head injury 6 days prior to admission, a 39-year-old male was evaluated because of convulsive seizures, left hemiparesis, and sanguineous cerebrospinal fluid. Bilateral carotid arteriography revealed a prominent aneurismal projection from the lower end of the C1 portion of the left internal carotid artery (Fig. 5A). A left vertebral arteriogram (Fig. 5B) with left carotid compression demonstrated retrograde filling of the left infundibulum, the C1 segment of the internal carotid artery, and both anterior cerebral vessels. This was confirmed on an anteroposterior view. Superimposition of the lateral views obtained by carotid and vertebral injection, respectively, demonstrates that the aneurismal projection noted on carotid injection is the infundibulum of the posterior communicating artery. Surgery was not performed.

Discussion

The radiologic appearance of a dilated infundibulum of the posterior communicating artery has been described by Saltzman as occurring in approximately 7 per cent of angiograms reviewed and increasing in incidence with age. As detailed here, the danger of interpreting such infundibular projections as aneurisms of the C1 portion of the internal carotid artery may be considerable. In differentiating these two entities angiographically we now also require a vertebral arteriogram under conditions of digital compression of the carotid artery on the side of interest. Superimposition of the vertebral arteriogram obtained in this manner with projections following carotid injection yields the diagnosis as illustrated by Case 5. Although vertebral compression during carotid injection may be somewhat more difficult to achieve successfully, it represents an alternative procedure. Performance of the procedures of arterial compression obviates dependence upon relatively minor points of difference which include the tapering, funnel-shape of the large infundibulum and its relatively smooth vascular wall, as well as reliance upon the lack of vascular spasm or displacement in the area. Thirdly, subclavian or brachial injection of contrast material may fill the
carotid and vertebral arteries at the same time on the right side.

In reviewing possible mechanisms with regard to the development of intracranial berry aneurisms, congenital and acquired theories are advanced. Since the identical changes seen histologically in the walls of aneurisms are often found in the wall of the enlarged posterior communicating infundibulum, there is a question as to whether the dilated infundibulum of the posterior communicating artery is an incidental anomaly or actually represents an aneurism (or pre-aneurism) subject to rupture and subarachnoid hemorrhage.

Summary

Five cases are presented to demonstrate the difficulties encountered in angiographically differentiating aneurism from infundibulum of the posterior communicating artery. Methods to aid in solving this problem are described.

References