Splitting of the Optic Nerve Associated With Ruptured Anterior Communicating Artery Aneurysm
—Case Report—

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Abstract
A 52-year-old man presented with an anterior communicating artery aneurysm associated with splitting, penetration, and visual symptoms of the optic nerve and manifesting as sudden onset of severe headache. Angiography disclosed a 10-mm anterior communicating artery aneurysm projecting supero-posteriorly, and operative findings revealed unexpected splitting of the optic nerve. Moreover, the optic nerve was not in direct contact with the aneurysm fundus. Splitting of the optic nerve without the presence of a penetrating aneurysm is extremely rare. The pathogenesis of optic nerve penetration may involve congenital fenestration of the optic nerve.

Key words: splitting of the optic nerve, aneurysm, congenital abnormality

Introduction
Fenestration of the optic nerve or chiasm associated with aneurysm of the internal carotid artery (ICA) is rare. Recent review of six cases included three with ICA-ophthalmic artery aneurysms, one with anterior communicating artery (AcomA) aneurysm, one with ICA anterior wall aneurysm, and one with multiple left middle cerebral artery and right posterior communicating artery aneurysms. Only one case of splitting of the optic nerve by AcomA aneurysm is known. Here we describe a case of ruptured AcomA aneurysm associated with splitting of the optic nerve.

Case Report
A 52-year-old man suffered sudden onset of headache and vomiting. He was initially transported to a local hospital and later referred to our hospital for further management of subarachnoid hemorrhage (SAH). On admission, his neurological symptoms were unremarkable, except for drowsiness. He exhibited no decreased visual acuity and had intact extraocular movements. His condition was graded as Hunt and Hess grade III. Computed tomography (CT) showed thick but diffuse SAH in the basal cistern and sylvian fissure that was slightly more prominent on the left (Fig. 1A). CT angiography demonstrated a broad-based AcomA aneurysm projecting supero-posteriorly (Fig. 1B).

On the day of admission, a right pterional craniotomy was performed and a small amount of subarachnoid clotted blood was observed in the region of the optic chiasm. During surgery to clip the AcomA aneurysm, an abnormality of the medial left optic nerve and chiasm was identified (Fig. 2). The medial portion of the optic nerve was dissected free of the adhered arachnoid and was identified coursing between the right and the left optic nerves. The distal end of the medial optic nerve ran anterior-
Intraoperative photograph showing the left optic nerve (LON), the right optic nerve (RON), and the optic chiasm (C). A third component (arrow) was observed at the optic chiasm. The tip of this nerve seemed to be rudimentary and was attached to the edge of the anterior tuberculum sellae. The penetrating artery passed across from the medial portion to anterior of the lateral portion of the left optic nerve (arrowhead). No duplicated optic canal was identified.

Diagram of operative findings showing the entire configuration. Splitting of the optic nerve had no apparent relationship with the aneurysmal dilatation. An indicates aneurysm; LON, left optic nerve; PA, penetrating artery; RA1 and RA2, proximal and distal segments of the anterior cerebral artery; RICA, right internal carotid artery; RON, right optic nerve.

Discussion

Several mechanisms have been proposed to explain splitting of the optic nerve by an enlarging aneurysm. One mechanism of optic nerve penetration involves the development of a fenestration in the optic nerve. This normal variant allows a mass like an aneurysm to pass between the tandem bundles of the optic nerve, and might be closely associated with an embryological vascular remnant penetrating the optic nerve and allowing the development of fenestration in bundles of nerve fibers. The second mechanism involves congenital optic nerve duplication, and indeed duplications of optic canals have been identified in cadaveric specimens. However, this explanation of optic nerve penetration/splitting/fenestration is difficult to convincingly apply in the reported cases. Therefore, we think that the most likely explanation is congenital optic nerve duplication. The present case shows that anomaly of optic nerve may be encountered during surgical treatment for aneurysms, and the relationship with the aneurysm should be considered.

References


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