Splitting of the Oculomotor Nerve by the Posterior Communicating Artery

—Case Report—

Sung-Pil JOO, Tae-Sun KIM, and Bo-Ra SEO

Department of Neurosurgery, Chonnam National University
Hospital & Medical School, Gwangju, R.O.K.

Abstract

A 62-year-old woman presented with subarachnoid hemorrhage manifesting as sudden onset of headache, but without visual symptoms or extraocular movement disturbances. Computed tomography angiography showed a 7-mm size aneurysm originating from the internal carotid-posterior communicating artery (PcomA). After the neck of the aneurysm was clipped, the PcomA was confirmed to have split the oculomotor nerve. Splitting of the oculomotor nerve by the PcomA was probably caused by arterial blood pulsation in the tortuous PcomA.

Key words: splitting, oculomotor nerve, posterior communicating artery, aneurysm

Introduction

Cranial nerve penetration by an intracranial aneurysm is rare, with six cases of optic nerve penetration,^{1-3,5-7)} and two cases of oculomotor nerve penetration.^{4,8)} Several mechanisms of nerve penetration/splitting by an aneurysm have been proposed including: Development of an aneurysm on the perforating fetal vessels supplying the cranial nerve⁷⁾; growth of an aneurysm between tandem bundles of the penetrated cranial nerve during development^{4,5)}; herniation through a newly created gap between the fibers of a cranial nerve related to overt subarachnoid hemorrhage (SAH)²⁾; and rapid expansion of an unruptured aneurysm pushing through the tightly bound fibers of the cranial nerve.³⁾

We describe a case of oculomotor nerve splitting caused by a tortuous posterior communicating artery (PcomA) detected during investigation for aneurysmal SAH.

Case Report

A 62-year-old woman presented with sudden onset of headache. Her level of consciousness was not changed. Neurological examination detected no visual symptoms or extraocular movement disturbances. Computed tomography (CT) revealed diffuse SAH (Fig. 1A), and three-dimensional CT angiography revealed a medium-sized aneurysm arising from the PcomA (Fig. 1B).

After right conventional pterional craniotomy, the sylvian fissure was widely opened, and the right frontal lobe was carefully elevated to expose the right internal carotid artery (ICA). The left ICA was slightly elongated and C-

shaped in form. The atherosclerotic superior wall was indented, and the aneurysm originated from the IC-PcomA and protruded posterolaterally (Fig. 2A). Further dissection of the aneurysm neck exposed a broad neck and yellowish aneurysm mass, approximately 8 × 6 mm (height × width), buried in the temporal lobe. The neck of the aneurysm was clipped. Further investigation found that the oculomotor nerve was divided into two segments at the entry of the superior orbital fissure, and appeared to be very thin and faint. The very tortuous PcomA, not an aneurysm, was confirmed to project through the fibers and split the oculomotor nerve (Fig. 2B, C). The patient underwent successful aneurysm clipping after temporary ICA control was obtained. The dome of the aneurysm was punctured with a fine needle, and the oculomotor nerve was decompressed.

The postoperative course was uneventful. Postoperative cerebral angiography showed complete clipping of the aneurysm. Her visual acuity and field were unchanged. At the 18-month follow-up examination, she was completely independent and free of neurological deficits.

Discussion

In the present case, the oculomotor nerve was split by a tortuous proximal PcomA rather than an aneurysm. The exact mechanism of oculomotor nerve splitting is difficult to conclusively prove, but we thought that the gap created by hemorrhage or rapid expansion of the aneurysm did not contribute to the penetration of the oculomotor nerve because the patient had no visual symptoms.

Our case is interesting in two respects. First, the presence of congenital splitting of the oculomotor nerve, and the PcomA growth into the nerve bundle during de-

velopment. However, the PcomA was very tortuous, with an acute arterial curvature that was different from typical PcomA. Second, we could propose an alternative explanation. The aneurysm might have grown slowly with time and herniated the PcomA, which was then gradually displaced downward to the lateral aspect of the sella turcica. Hemodynamic flow pressure generated the acute arterial curvatures so that the bloodstream produced by arterial pulsation chiseled through the oculomotor nerve, creating the gap between the fibers. Based on the findings in our case, the possibility of oculomotor nerve splitting is important to consider during surgery for this condition.

Fig. 1 (A) Computed tomography (CT) scan demonstrating diffuse thick subarachnoid hemorrhage. (B) Three-dimensional CT angiogram showing that the aneurysm appears to originate from the internal carotid-posterior communicating artery.

References

- 1) Beatty RA: Splitting of the optic nerve by a carotid-ophthalmic artery aneurysm. Case report. *J Neurosurg* 65: 560-562, 1986
- 2) Date I, Akioka T, Ohmoto T: Penetration of the optic chiasm by a ruptured anterior communicating artery aneurysm. Case report. *J Neurosurg* 87: 324-326, 1997
- 3) Fujita A, Tamaki N, Yasuo K, Nagashima T, Ehara K: Complete penetration of the optic chiasm by an unruptured aneurysm of the ophthalmic segment: case report. *Surg Neurol* 57: 130-134, 2002
- 4) Horiuchi T, Kyoshima K, Oya F, Kobayashi S: Fenestrated oculomotor nerve caused by internal carotid-posterior communicating artery aneurysm: case report. *Neurosurgery* 40: 397-399, 1997
- 5) Jea A, Baskaya MK, Morcos JJ: Penetration of the optic nerve by an internal carotid artery-ophthalmic artery aneurysm: case report and literature review. *Neurosurgery* 53: 996-1000, 2003
- 6) Joo SP, Kim TS: Splitting of the optic nerve associated with ruptured anterior communicating artery aneurysm. *Neurol Med Chir (Tokyo)* 47: 501-502, 2007
- 7) Kanamaru K, Ishida F, Taki W: Splitting and penetration of the optic nerve by an aneurysm arising from the anterior wall of internal carotid artery: case report. *J Neurol Neurosurg Psychiatry* 71: 525-527, 2001
- 8) Yasargil MG: *Microneurosurgery*. Stuttgart, Georg Thieme Verlag, 1984, vol 2, pp 71-90

Address reprint requests to: Tae-Sun Kim, M.D., Department of Neurosurgery, Chonnam National University Hospital and Medical School, 8 HakDong, Dong-Gu, Gwangju 501-757, R.O.K.
e-mail: taesun1963@yahoo.co.kr

Fig. 2 Intraoperative photograph (A) showing a 7-mm size aneurysm protruding laterally. Intraoperative photograph (B) and drawing (C) illustrating the splitting of the oculomotor nerve (arrowheads) and the posterior communicating artery (arrow) after the neck of the aneurysm was clipped and retracted upward. An: aneurysm, ICA: internal carotid artery, ON: oculomotor nerve, PcomA: posterior communicating artery.