Subarachnoid Hemorrhage Caused by Ruptured Posterior Inferior Cerebellar Artery Aneurysm Arising From the Extracranial Portion of an Anomalous Vertebral Artery

—Case Report—

Makoto KATSUNO,1 Rokuya TANIKAWA,1 Nakao OTA,1 Naoto IZUMI,1 and Masaaki HASHIMOTO1

1Abashiri Neurosurgical Rehabilitation Hospital, Abashiri, Hokkaido

Abstract

A 42-year-old woman presented with subarachnoid hemorrhage caused by a ruptured posterior inferior cerebellar artery aneurysm arising from the extracranial portion of an anomalous vertebral artery. We speculated that the aneurysm formed by dissection of the media because of its shape and location. Therefore, the aneurysm was isolated by trapping and excised, with occipital artery to posterior inferior cerebellar artery bypass. Histological examination showed a typical true aneurysm without evidence of dissection. This case suggests that an aneurysm of an anomalous artery is caused by hemodynamic stress and is a true aneurysm, not a dissection.

Key words: subarachnoid hemorrhage, posterior inferior cerebellar artery, aneurysm, etiology, anomaly

Introduction

Aneurysms of the distal portion of the posterior inferior cerebellar artery (PICA) are uncommon, representing 0.5% to 3% of all intracranial aneurysms.2 Cadaveric and angiographic studies have shown that the PICA arises from the extracranial portion of the vertebral artery (VA) in only 17–18% of the cases.3,4 Some PICA aneurysms have an intradural cervical origin and are usually located in the intracranial portion. However, extracranial PICA aneurysms are extremely rare. We present a case of an aneurysm of the extracranial PICA associated with anomalous course of the extracranial portion of the VA.

Case Report

A 42-year-old woman with no history of hypertension or trauma suffered sudden onset of severe headache and was brought to our hospital. Her Glasgow Coma Scale score was 14 and neurological examination revealed no deficits. Computed tomography (CT) showed subarachnoid hemorrhage predominantly in the posterior fossa. Three-dimensional (3D) CT demonstrated a saccular aneurysm of the left PICA that originated extracranially from the left VA, which was located between the foramen magnum and the posterior C1 arch, and had an anomalous course (Fig. 1). The left VA passed through the C2 foramen transversarium, not that of C1, and passed into the dura between C1 and C2. The contralateral VA took a normal course through the C1 foramen transversarium (Fig. 2). The PICA aneurysm was intradural but extracranial, affected the hairpin turn segment of the artery, and did not include a bifurcation (Fig. 3).

The patient was placed in the park bench position under general anesthesia, and the occipital artery (OA) was prepared for bypass following the transcondylar approach. The dura mater was opened, and following removal of the clot along the left PICA, the dome of the aneurysm was exposed at the level of the cranio-cervical junction. Although the external appearance of the aneurysm was that of a
Fig. 2 Three-dimensional computed tomography scan showing left vertebral artery (VA) passed through the foramen transversarium of C2 and passed into the dura between C1 and C2. The contralateral VA took a normal course through the C1 foramen transversarium.

Fig. 3 Three-dimensional computed tomography angiogram showing the posterior inferior cerebellar artery aneurysm was irregular, affected the hairpin turn segment of the artery, and did not include a bifurcation.

Fig. 4 Postoperative three-dimensional computed tomography angiogram showing the aneurysm had disappeared after trapping and good patency of the bypass.

Fig. 5 Photomicrograph demonstrating the rupture point with fibrous thickening without evidence of dissection (arrow), and absence of tunica media and hypoplastic internal elastic lamina. Hematoxylin and eosin stain, original magnification ×2.

Discussion

Only three cases of extracranial distal PICA aneurysms arising from an extracranial VA have been reported.1,3,6) These aneurysms were located at the top of the posterior C1 arch in all cases, and direct clipping was performed in two cases1,6) and trapping in one.6) Direct surgery was employed in all cases to preserve the brain stem perforators from the PICA. The etiology of the aneurysm was not described in one case,6) but another case had been caused by dissection as a result of chronic neck rotation or flexion/extension stress, which was confirmed by pathological diagnosis.5) In the third patient with an anatomy similar to that of our patient, the aneurysm was speculated to have resulted from hemodynamic stress due to the complicated anomalous course of the VA that passed beneath the posterior arch of C1.1) In general, a ruptured aneurysm in
the distal or in the nonbranching segment of the cerebral artery is caused by mycotic infection, or traumatic or arteriosclerotic dissection.

In the present case, histological examination demonstrated fibrous thickening and hypoplastic tunica media as well as hypoplastic internal elastic lamina, characteristic of a typical, true aneurysm, without any evidence of infection or dissection. We speculate that this true aneurysm was caused by hemodynamic stress, based on its location and the anomalous course of the VA. The unusual course of the VA caused the hemodynamic stress, in the same way as vascular anomalies such as azygos vessels or fenestrations are commonly associated with aneurysm.1) Moreover, the hemodynamic stress theory posits that aneurysms tend to form in areas of high or abnormal hemodynamic forces (for example, branch points or hairpin turns). The histological analysis confirmed that the unusual course of the VA led to hemodynamic stress predisposing the vessel to the formation of an aneurysm at a hairpin turn segment of the distal PICA.

The present case suggests that the etiology of an aneurysm located in a nonbranching segment and associated with an anomaly of the parent artery is most probably hemodynamic stress and not dissection. However, we recommend that the OA be prepared for bypass at surgery for a distal PICA aneurysm, because it is difficult to diagnose a priori whether a distal PICA aneurysm is a dissection or a true aneurysm.

References


Address reprint requests to: Makoto Katsuno, MD, Abashiri Neurosurgical Rehabilitation Hospital, 4–1–7 Katsura-machi, Abashiri, Hokkaido 093–0041, Japan.