Online September 9, 2020
Journal of Neuroendovascular Therapy 2021; 15: 120–123
DOI: 10.5797/jnet.cr.2020-0095

Case Report

A Case of Ruptured Cerebral Aneurysm with Asymmetric Fusion of Basilar Apex

Toshinari Meguro, Miki Taniguchi, Shuji Hamauchi, Manabu Onishi, Toru Fukuhara, Yasuyuki Miyoshi, and Shigeki Ono

Objective: We report a case of a ruptured cerebral aneurysm in which a bifurcation pattern at the tip of the basilar artery was asymmetric fusion type and the superior cerebellar artery (SCA) branched from the posterior cerebral artery (PCA) on the caudal fusion type side.

Case Presentation: A 45-year-old woman presented with a subarachnoid hemorrhage with a headache. Cerebral angiography revealed that the right SCA diverged from the PCA and a small cerebral aneurysm had developed at this site. This cerebral aneurysm was successfully treated by coil embolization.

Conclusion: There have been no previous reports on cerebral aneurysms at the site of this normal variation.

Keywords ▶ superior cerebellar artery, cerebral aneurysm, asymmetric fusion type

Introduction

At the tip of the basilar artery (BA), the superior cerebellar artery (SCA) normally branches directly from the BA. However, it is well known that the SCA may branch from the posterior cerebral artery (PCA) embryologically.[1)]

We present a case in which a cerebral aneurysm occurred at the site where the SCA branched from the PCA due to a normal variation in the bifurcation pattern of the BA, leading to rupture and subarachnoid hemorrhage (SAH).

Case Presentation

A 45-year-old woman had a sudden onset of severe headache. She was immediately admitted to our hospital, and CT showed Fisher group 2 SAH (**Fig. 1**). SAH was diagnosed as Hunt and Hess grade II and World Federation of Neurological Surgeons grade I. Cerebral angiography was performed under general anesthesia on the day of onset. Vertebral arteriography revealed that the shape of the BA tip was asymmetrical fusion type. That is, at the tip of BA, the left SCA diverged directly from BA, while the

Fig. 1 Initial head CT scan showed a diffuse SAH. SAH: subarachnoid hemorrhage

Department of Neurosurgery 2, Kawasaki Medical School, Okayama, Okayama, Japan

Received: May 22, 2020; Accepted: July 10, 2020
Corresponding author: Toshinari Meguro. Department of Neurosurgery 2, Kawasaki Medical School, 2-6-1 Nakasange, Kita-ku, Okayama, Okayama 700-8505, Japan
Email: tmeguron@hotmail.com

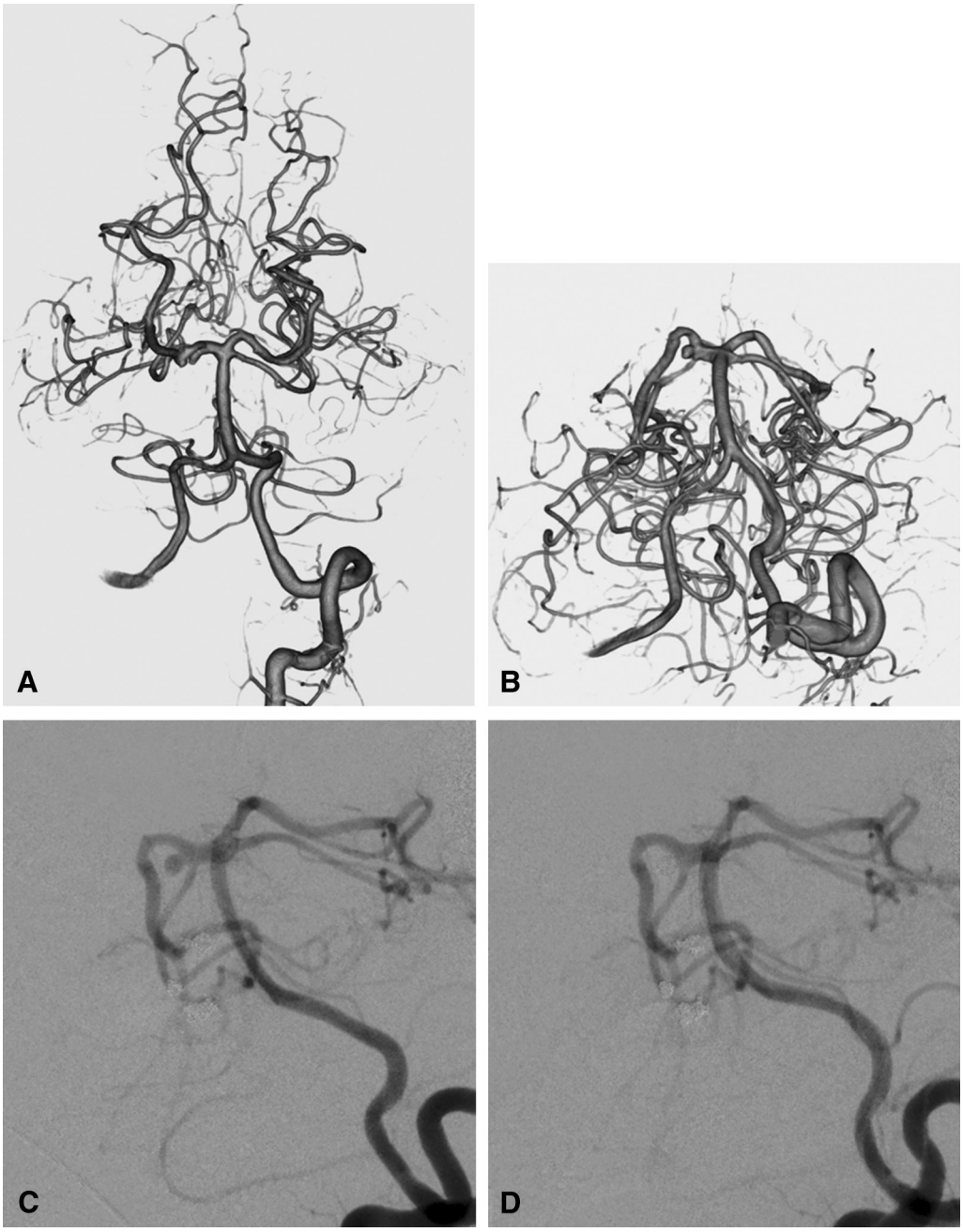

Fig. 2 Intraoperative angiography. The right SCA branches from the right PCA, and a small aneurysm was observed at that location (**A**–**C**). The left SCA branched from the tip of the BA. Final angiography confirmed complete occlusion of the aneurysm (**D**). BA: basilar artery; PCA: posterior cerebral artery; SCA: superior cerebellar artery

right SCA diverged from the P1 segment of 4.5 mm where the right PCA diverged from the tip of BA (**Fig. 2A** and **2B**). The posterior communicating arteries on both sides were not visualized by internal carotid arteriography. A 3.1 mm × 3.3 mm cerebral aneurysm was found in the portion of the right SCA branching from the right PCA. Subsequently, cerebral aneurysm coil embolization was performed with general anesthesia. An ASAHI FUBUKI guiding sheath (4 Fr, 90 cm; Asahi Intecc, Aichi, Japan) was inserted into the right femoral artery and advanced to and placed in the left vertebral artery; then, Excelsior SL-10 (Stryker, Kalamazoo, MI, USA) was introduced into the aneurysm. The first coil (GALAXY G3 XSFT 3 mm × 4 cm; Cerenovus, New Brunswick, NJ, USA) was positioned and detached from the aneurysm. Two more coils (GALAXY G3 MINI 2.5 mm × 4.5 cm, GALAXY

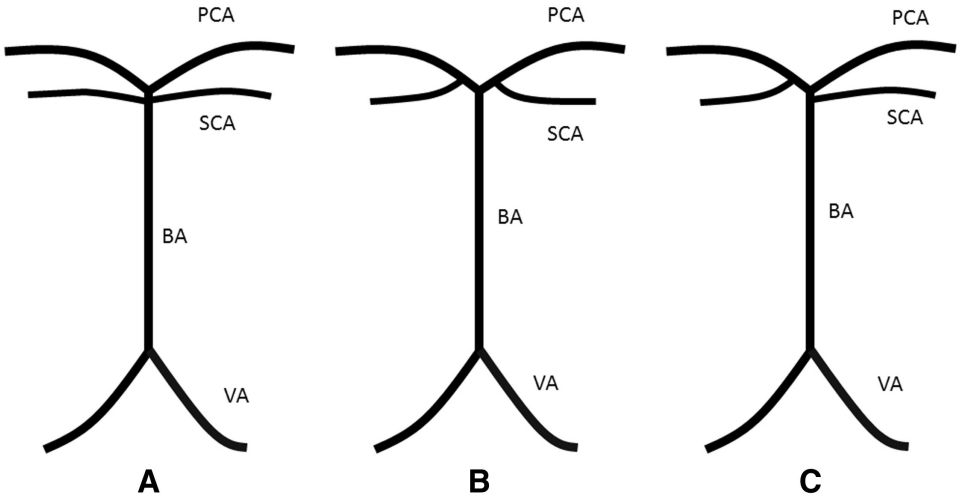

Fig. 3 Anatomical variations of the tip of the BA. (**A**) Symmetrical cranial fusion type. (**B**) Symmetrical caudal fusion type. (**C**) Asymmetrical fusion type. BA: basilar artery

G3 MINI 2 mm × 4 cm) were plugged into the aneurysm. Final angiography confirmed complete occlusion of the aneurysm (**Fig. 2D**). No neurological deficits developed during the peri- or postoperative periods, and the patient was discharged without neurological deficits 18 days after treatment.

Discussion

Generally, the morphology of vascular bifurcation at the tip of the BA is as follows: First, when the SCA directly branches from the BA (cranial fusion type) and from the PCA (caudal fusion type), it is usually classified into three patterns: symmetric cranial fusion type (**Fig. 3A**), symmetric caudal fusion type (**Fig. 3B**), and asymmetric fusion type (**Fig. 3C**).[1–3] The BA is embryologically formed because a pair of ventral longitudinal artery coalesces in the craniocaudal direction on the ventral side of the brain stem, and the extent of the coalescence is determined by the timing of primitive trigeminal artery regression. When the primitive trigeminal nerve artery regresses later, the internal carotid artery system becomes dominant over the vertebral artery system, and the fusion of ventral longitudinal artery does not proceed and becomes a caudal fusion type. In the opposite case, it will be a cranial fusion type. In this way, it is considered that the branching pattern of the basilar tip is determined by the degree of fusion of ventral longitudinal artery.[1,2]

Of the three patterns of bifurcation of the BA, the SCA actually has a high frequency of direct bifurcation from the BA. Moreover, symmetric cranial fusion type is the most common. The frequency of caudal fusion type was low, and in previous studies, the rate of branching of the SCA from the PCA was 1%–22%.[2–7] One of the causes of the variation in frequency in the reports is the difference in the confirmation method and inspection equipment (confirmation by whether autopsy or angiography/CTA/MRA). Moreover, another cause is that the bifurcation pattern at the BA tip is embryologically determined by the degree of fusion of the ventral longitudinal artery; thus, if the SCA and PCA bifurcations in BA are clearly separated, it can be easily classified as a cranial fusion type. Cases in which the SCA clearly diverges from P1 of PCA, as in this case, can be easily classified as caudal fusion type. However, it may depend on the decision of each researcher on which fusion type the PCA and SCA branching points at the tip of the BA are in contact with.

No cerebral aneurysm at the bifurcation of the SCA and PCA has been previously reported, as long as we could intervene. Originally, SCA aneurysms occurred in <2% of cerebral aneurysms,[8–10] and the frequency of SCA divergence from P1 in PCA was also low. Therefore, cerebral aneurysms occurring at this site are extremely infrequent and may not have been noted and simply classified as BA–SCA aneurysms. It was simply a low-frequency cerebral aneurysm, which was interesting from an embryological point of view.

Conclusion

We report a case of a ruptured cerebral aneurysm in which a bifurcation pattern at the tip of the BA was asymmetric

fusion type and the SCA branched from the PCA on the caudal fusion type side. There have been no previous reports on cerebral aneurysms at the site of this normal variation.

Disclosure Statement

The authors declare that they have no competing interest.

References

1) Komiyama M: Functional Anatomy of the Brain and Spinal Vessels. Osaka, Japan: MEDICUS SHUPPAN, Publishers Co., Ltd., 2007; 203–210. (in Japanese)
2) Lasjaunias P, Berenstein A, Ter Brugge K: Surgical Neuroangiography 1. Springer. Berlin, Germany, 2001; 526–540.
3) Caruso G, Vincentelli F, Rabehanta P, et al: Anomalies of the P1 segment of the posterior cerebral artery: early bifurcation or duplication, fenestration, common trunk with the superior cerebellar artery. *Acta Neurochir (Wien)* 1991; 109: 66–71.
4) Hardy DG, Peace DA, Rhoton AL: Microsurgical anatomy of the superior cerebellar artery. *Neurosurgery* 1980; 6: 10–28.
5) Uchino A, Sawada A, Takase Y, et al: Variations of the superior cerebellar artery: MR angiographic demonstration. *Radiat Med* 2003; 21: 235–238.
6) Pekcevik Y, Pekcevik R: Variations of the cerebellar arteries at CT angiography. *Surg Radiol Anat* 2014; 36: 455–461.
7) Songur A, Gonul Y, Ozen OA, et al: Variations in the intracranial vertebrobasilar system. *Surg Radiol Anat* 2008; 30: 257–264.
8) Pandey AS, Koebbe C, Rosenwasser RH, et al: Endovascular coil embolization of ruptured and unruptured posterior circulation aneurysms: review of a 10-year experience. *Neurosurgery* 2007; 60: 626–636; discussion 636–637.
9) Peluso JP, van Rooij WJ, Sluzewski M, et al: Superior cerebellar artery aneurysms: incidence, clinical presentation and midterm outcome of endovascular treatment. *Neuroradiology* 2007; 49: 747–751.
10) Kim CH, Cho YD, Jung SC, et al: Endovascular treatment for superior cerebellar artery aneurysms: morphological features, technique, and outcome. *Neuroradiology* 2014; 56: 647–654.