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Case Report

Ruptured small cerebral aneurysm occurring at the fenestration of the A1 portion of the anterior cerebral artery, combined with accessory middle cerebral artery branching from the crus: A case report

Seigo Kimura[1], Masaki Komiyama[2], Hirokatsu Taniguchi[1], Masahiko Wanibuchi[3]

[1]Department of Neurosurgery, Kouzenkai Yagi Neurosurgical Hospital, [2]Department of Neuro-Intervention, Osaka City General Hospital, Osaka, [3]Department of Neurosurgery, Osaka Medical and Pharmaceutical University Hospital, Takatsuki, Japan.

E-mail: *Seigo Kimura - seigo.kimura@ompu.ac.jp; Masaki Komiyama - komiyama@japan-mail.com; Hirokatsu Taniguchi - taniguchi@kouzenkai.or.jp; Masahiko Wanibuchi - wanibuchi@ompu.ac.jp

***Corresponding author:**
Seigo Kimura,
Department of Neurosurgery,
Kouzenkai Yagi Neurosurgical Hospital, Osaka, Japan.

seigo.kimura@ompu.ac.jp

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ABSTRACT

Background: Cerebral aneurysms arising from fenestration of the A1 portion of the anterior cerebral artery (ACA) (A1 fenestration) with the accessory middle cerebral artery (MCA) is rare. Herein, we report a ruptured cerebral aneurysm arising from A1 fenestration combined with the accessory MCA that was successfully treated with coil embolization.

Case Description: A 51-year-old woman suddenly experienced a severe occipital headache and was admitted to our hospital. Detailed examination revealed subarachnoid hemorrhage due to a cerebral aneurysm arising from A1 fenestration combined with the accessory MCA. Hence, coil embolization was performed, and a favorable outcome was obtained.

Conclusion: Coil embolization of the cerebral aneurysm arising from the A1 fenestration of the ACA combined with the accessory MCA is considered to be useful.

Keywords: Accessory middle cerebral artery, Anterior cerebral artery, Coil embolization, Fenestration, Subarachnoid hemorrhage

INTRODUCTION

Fenestration of the A1 portion (A1 fenestration) of the anterior cerebral artery (ACA) is a variation that forms in the embryonic period,[4,5,11] and cerebral aneurysms in this region are relatively rare. The accessory middle cerebral artery (MCA) is a variation originating from the ACA that runs along the MCA.[1,2,8] Cerebral aneurysms arising from the A1 fenestration combined with the accessory MCA are also rare. Herein, we report a ruptured cerebral aneurysm arising from the A1 fenestration combined with the accessory MCA that was successfully treated with coil embolization.

CASE REPORT

A 51-year-old woman suddenly experienced an occipital headache and collapsed at home. Her family contacted emergency medical assistance, and she was admitted to our hospital. She had a history of hypertension, but her family history was insignificant. On arrival at our hospital, her Glasgow Coma Scale score was 15 (E4, V5, and M6) with no apparent paresis. However, she had a severe occipital headache. Her blood pressure level and pulse rate were 192/99 mmHg and 95/min, respectively. Head computed tomography (CT) revealed a subarachnoid hemorrhage (Fisher group 3) [Figure 1] with World Federation of Neurosurgical Societies and Hunt and Kosnik grades of I and II, respectively. Head CT angiography (CTA) revealed a right A1 fenestration with a cerebral aneurysm at the proximal end of the fenestration. A branch of the accessory MCA from the A1 fenestration was also observed. Subsequently, coil embolization was performed. A 7-Fr Roadmaster (GOODMAN CO., LTD., Aichi, Japan) was guided to the right internal carotid artery (ICA). Three-dimensional imaging was performed and revealed that the aneurysm was located at the proximal end of the A1 fenestration [Figures 2a and b]. After performing the imaging at the working angle [Figure 3a], a 4-Fr Cerulean (Medikit Co., Ltd., Tokyo, Japan) was guided into the cavernous portion of the ICA, and SL10 (Stryker, Kalamazoo, MI, USA) with a 45° steam shape at 1 mm and 3 mm from the tip, respectively, was guided into the aneurysm using Traxcess (Terumo Corporation, Tokyo, Japan) [Figure 3b]. Then, Target 360 nano (2 mm × 3 cm; Stryker, Kalamazoo, MI, USA) was implanted [Figure 3c]; as no cerebral aneurysm was observed, the procedure was completed [Figure 3d]. Head magnetic resonance imaging performed on the day after the intervention revealed no cerebral infarction or cerebral aneurysm. Postoperative imaging showed no obvious cerebral vasospasm or ventricular enlargement, and the patient was discharged home on day 21 with a modified Rankin Scale score of 0.

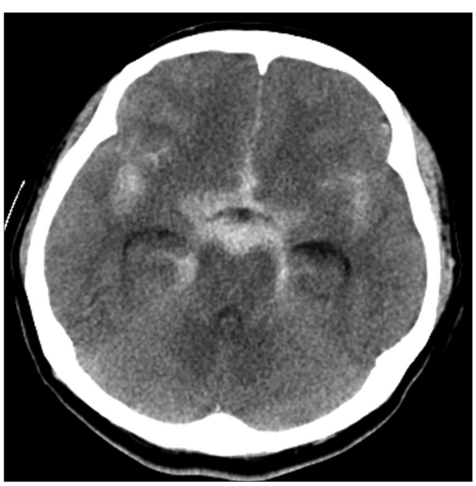

Figure 1: Head computed tomography on admission shows subarachnoid hemorrhage (Fisher group 3).

DISCUSSION

In 1905, Fawcett and Blachford reported an A1 fenestration incidence of 0.14%.[4] The bilateral ACAs from the primitive olfactory artery become plexiform in the midline.[11] This plexiform anastomosis forms an anterior communicating artery. Inagawa *et al.*[5] revealed that incomplete fusion or remnants of median plexiform vessels may cause A1 fenestration. To the best of our knowledge, 37 cerebral aneurysms occurring in the A1 fenestration have been reported so far.[10] The proximal part of A1 fenestration is prone to mesangial defects, and cerebral aneurysms

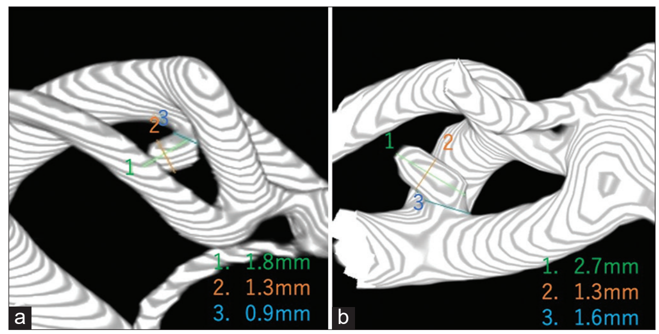

Figure 2: (a) Frontal image of the working angle. (b) The aneurysm is located at the proximal end of the A1 fenestration.

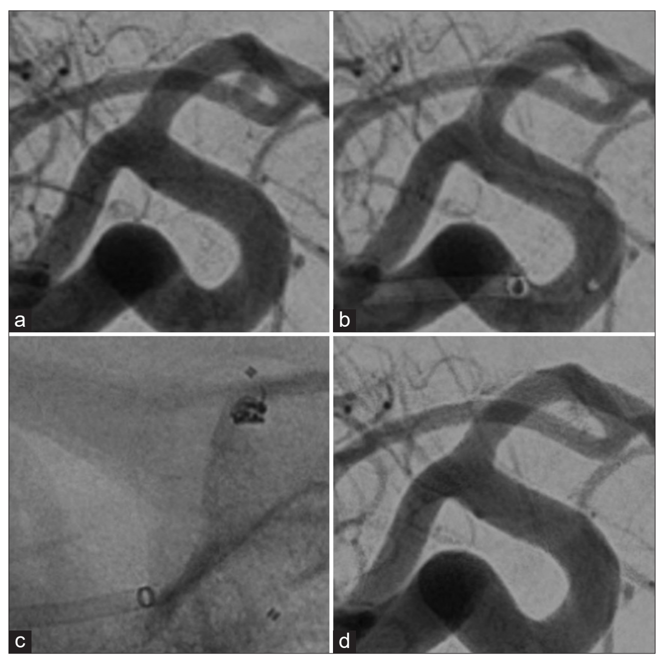

Figure 3: (a) Frontal image of the working angle. (b) Microcatheter was guided into the aneurysm. (c) Implantation of Target 360 nano into the aneurysm. (d) No cerebral aneurysm was observed.

occur due to hemodynamic stress.[3] The accessory MCA originates from the ACA and runs along the MCA; it has been detected in 0.3–2.7% of autopsy cases and 0.24–0.34% of cerebral angiography cases.[1,8] The accessory MCA is a variation in which the primitive MCA branches into the cerebral hemispheres.[2] To the best of our knowledge, only three reports have described A1 fenestration combined with the accessory MCA to date,[2,8,10] and cerebral aneurysms from A1 fenestration have been reported in only two of them.[8,10] In addition to hemodynamic stress, the involvement of developmental abnormalities that develop simultaneously in the primitive arteries has been postulated as a mechanism of cerebral aneurysm development in patients with A1 fenestration combined with the accessory MCA.[10] Phylogenetically, the MCA develops after the ACA. Further, the accessory MCA is believed to be an anomalously early ramification of the MCA branch, which originates from the A1 portion of the ACA.[7] Thus, the accessory MCA in our case may have branched from A1 fenestration.

Surgical treatment for cerebral aneurysms associated with A1 fenestration includes clipping and coil embolization. For cerebral aneurysms associated with A1 fenestration, 25 cases of clipping and ten cases of coil embolization have been reported in previous studies; furthermore, reports of coil embolization are increasing.[10] In some cases, due to the shape of the cerebral aneurysm or strong adhesion to the perforating artery, it is necessary to occlude one side of the trunk with the cerebral aneurysm through clipping or coiling. Therefore, some patients may remain asymptomatic,[6,13] whereas others may experience postoperative complications, such as impaired consciousness.[10] These complications may be caused by the presence of numerous perforating arteries in the horizontal portion of A1, especially in A1 fenestration, where the perforating arteries branch through complex mechanisms.[3,10]

A1 fenestration tends to cause tunica media defects at the proximal end. Therefore, it has been reported that the majority of cerebral aneurysms that occur in the A1 fenestration occur at the proximal end of the fenestration due to hemodynamic stress.[10] In our case, not only hemodynamic stress toward ACA but also accessory MCA may have added to the tunica media defect of the proximal end of the A1 fenestration, which may have further influenced the occurrence of cerebral aneurysm. Due to the rare location of the aneurysm, its complex structure, and the fact that the aneurysm was small, the location of the aneurysm was not clear at first. Furthermore, a more detailed evaluation of CTA and three-dimensional imaging by cerebral angiography could identify the exact vascular structure and location of the cerebral aneurysm. Subarachnoid hemorrhage requires immediate attention, but in the case of a complex vascular structure and rare cerebral aneurysm such as this case, more careful image evaluation was considered necessary.

In the present case, the vascular structure around the cerebral aneurysm was complex, and clipping was thought to be difficult. In addition, the diameter of the cerebral aneurysm was small and the risk of hemorrhagic complications from coil embolization was high.[9] However, as the cerebral aneurysm was located at the proximal end of the fenestration, we assumed that microcatheter guidance and coil embolization are feasible with careful manipulation. Hence, in this case, coil embolization was selected as a minimally invasive treatment. Some innovations in coil embolization of microaneurysms are as follows: guiding catheters as distally as possible to improve the maneuverability of microcatheters,[14] using distal access catheters to stabilize catheter manipulation,[12] shaping the tip of the microcatheter to obtain catheter stability,[14] and using soft coils with short coil junction.[15] In particular, the present cerebral aneurysm had a steep bifurcation angle to the A1 and fenestration; hence, it was necessary to shape the tip of the microcatheter appropriately. In the present treatment, the cerebral aneurysm was successfully embolized based on the above-mentioned measures, and the patient recovered with no apparent complications.

CONCLUSION

Herein, we report a ruptured cerebral aneurysm arising from the A1 fenestration combined with the accessory MCA that was successfully treated with coil embolization. Hemodynamic stress toward ACA and accessory MCA may have added to the tunica media defect of the proximal end of the A1 fenestration, which may have influenced the occurrence of a cerebral aneurysm. Although the vascular structure was complex and the cerebral aneurysm was small, detailed imaging evaluation, and careful manipulation of the coil embolization resulted in a good outcome.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author(s) confirms that there was no use of Artificial Intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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