Endovascular Repair of Ruptured Aneurysm Arising From Fenestration of the Horizontal Segment of the Anterior Cerebral Artery

—Case Report—

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Abstract

A 50-year-old man presented with an aneurysm arising from a fenestration of horizontal portion (A1) of the anterior cerebral artery manifesting as subarachnoid hemorrhage. Coil embolization was conducted and the aneurysm was occluded easily. Most reported cases of these types of aneurysms underwent direct surgery. Aneurysm arising from the A1 fenestration is rare, but the present case shows that coil embolization can be an effective treatment modality. Three-dimensional rotational angiography and aneurysmography were helpful to characterize this complicated vascular structure.

Key words: fenestration, anterior cerebral artery, subarachnoid hemorrhage, endovascular treatment, embolization

Introduction

Fenestration of intracranial vessels other than the anterior communicating artery and vertebrobasilar arteries is rare. Aneurysm arising from fenestration of the horizontal segment (A1) of anterior cerebral artery (ACA) is quite uncommon. Conventionally, this type of aneurysm has been treated with direct surgery.6,9,10,14,16–19,21,25,28–30) The present report describes a patient with ruptured A1 aneurysm with fenestration who was treated with an endovascular technique. Three-dimensional (3D) rotational angiography and aneurysmography were helpful to characterize this complicated vascular structure.

Case Report

A 50-year-old man experienced sudden onset of severe headache and was transferred to our hospital. On admission, he was alert, and his neurological status was assessed as World Federation of Neurosurgical Societies grade I. Computed tomography (CT) revealed subarachnoid hemorrhage (Fig. 1), and right carotid angiography showed an aneurysm (approximately 3 mm in diameter) of the A1 segment (Fig. 2). 3D rotational angiography showed tandem fenestrations of the right A1 and anterior communicating artery (Fig. 3). The aneurysm arose from the proximal end of A1 fenestration and projected inferomedially. Coil embolization was planned. Under general anesthesia, a 6-French guiding catheter was placed into the right cervical internal carotid artery, and the microcatheter was navigated into the aneurysm. The right frontal oblique view was considered appropriate as a reference (Fig. 4A). Aneurysmography clearly characterized the morphology of the aneurysm (Fig. 4B). After insertion of four detachable coils (total 15 cm), the aneurysm was occluded, with slight remnant of the aneurysm neck (Fig. 4C). Spinal drainage was performed after the embolization. The
Fig. 2 Right internal carotid angiograms, anteroposterior (A) and lateral (B) views, showing an aneurysm arising from the horizontal segment of the right anterior cerebral artery (arrow).

Fig. 3 Three-dimensional rotational angiogram (A) and schema (B) demonstrating the aneurysm and double fenestrations of the right anterior cerebral artery and the anterior communicating artery. The aneurysm arises from the proximal end of the fenestration and projects inferomedially.

Fig. 4 A, B: Digital subtraction angiograms obtained before (A) and after (B) the embolization. C: Aneurysmogram showing that the tip of microcatheter was positioned in the dome of aneurysm (arrowhead).

postoperative course was uneventful, and neurological aggravation due to vasospasm was not seen. The patient was discharged ambulatory on hospital day 20 with no neurological deficit. Postoperative digital subtraction angiography performed 3 months after embolization showed no evidence of recurrence.

Discussion

Detection of fenestrations of the intracranial vessels has been relatively rare by two-dimensional (2D) angiography. However, a recent study using CT angiography and 3D rotational angiography demonstrated that the frequency of fenestrations was much more common at 11% to 26%, with the most frequent sites of fenestration in the vertebrobasilar system and anterior communicating region.

Fenestration of the ACA is extremely rare, with a frequency of 0.1–7.2% at autopsy and a frequency of 0.17–0.2% on 2D angiography. The first autopsy case of aneurysm arising from the A1 fenestration was described in 1962. Congenital medial wall defect and hemodynamic stress are thought to be the main causes of aneurysm formation. A review of 38 cases with A1 aneurysms found that six aneurysms arose from the fenestration. Thus, fenestration is an important cause of A1 aneurysms and recognition of this unusual anomaly is important from the surgical point of view. A total of 21 detailed case reports of A1 aneurysm arising from the fenestration, including the present case, are available (Table 1). With very few exceptions fenestration tends to occur in the distal part of the A1 segment. With one exception, the origin of the aneurysm was located at the proximal end of the fenestration. No specific sex predominance was found in the incidence of these aneurysms. No accurate information was given regarding the size of these types of aneurysms, although previous angiographic studies suggest that most are small. The mean age of patients with bleeding from the aneurysm was 49 years, which is younger than that of patients with general aneurysms in the circle of Willis. Most reported cases of these types of aneurysms (except some conservative examples) underwent direct surgery. The essential points in clipping are complete dissection of the aneurysm neck and preservation of the perforators. Perforators are more abundant in the proximal half of the A1 segment than in the distal half. No previous report has described endovascular treatment of these types of aneurysms.

With the increasing adoption of endovascular surgery, aneurysms arising from the fenestration have been embolized. Because of the high degree of difficulty associated with surgical clipping, embolization was introduced early in the treatment of vertebrobasilar aneurysms. The potential of endovascular treatment for A1 aneurysms arising from the fenestration was realized, and the present case demonstrates that the endovascular procedure is feasible for the management of A1 aneurysms with fenestration. With very few exceptions, the preferred site of aneurysm origin is the proximal end of the fenestration. Thus, endovascular treatment may be possible in many cases. In contrast, sharp angulations of the A1 origin can complicate catheterization, and an aneurysm arising from the distal end of the fenestration can make navigation of the catheter problematic. Such lesions may be more suitable for clipping.

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Correct diagnosis of a complex vascular lesion is important. 3D rotational angiography is quite useful to examine the details of a complex vascular lesion from all directions. In this case, 3D rotational angiography could demonstrate the complex vascular structure with tandem fenestration. Aneurysmography is also helpful in some circumstances, every effort should be made to preserve the related artery based on detailed radiological examination. Aneurysm arising from the A1 fenestration is rare, but the present case shows that coil embolization can be an effective treatment modality.

## References


## Table 1 Summary of aneurysms arising from A1 fenestration

<table>
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<tr>
<th>Case No.</th>
<th>Author (Year)</th>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Side</th>
<th>Site of A1 fenestration</th>
<th>Origin of aneurysm</th>
<th>Ruptured or unruptured</th>
<th>Treatment</th>
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<td>Yamada et al. (1982)</td>
<td>43</td>
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