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Case Report

Microsurgical clipping for anterior communicating artery aneurysm associated with the accessory anterior cerebral artery via the pterional approach

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Abstract

Background: Accessory anterior cerebral artery (ACA), a type of median artery of anomalous triplicate ACA, is not rare, but aneurysms of the anterior communicating artery (ACoA) associated with accessory ACA can be a considerable challenge to treat surgically based on the morphological features of the ACoA complex.

Case Description: A 35-year-old man was admitted to our hospital with severe headache and subsequent loss of consciousness. Initial computed tomography (CT) showed typical findings of subarachnoid hemorrhage in the basal cistern and three-dimensional CT angiography revealed an ACoA aneurysm arising from the trifurcation of the accessory ACA, the branching point of the ACoA, and the right A1 or A2 segment of the ACA. The aneurysmal fundus projected superolaterally to the right, and was treated via a right-sided pterional approach. The aneurysm was behind the ipsilateral A2 segment of the ACA and the accessory ACA was hidden behind the aneurysm. The aneurysm was successfully obliterated with clipping using a straight fenestrated Yasargil titanium clip. Complete aneurysm occlusion and patency of both the A2 segment of the ACA and the accessory ACA were confirmed intraoperatively by indocyanine green angiography.

Conclusion: In treating this aneurysm via the pterional approach, selection of approach side it is critical to preserve prevent the patency of the accessory ACA and to simultaneously perform aneurysm clipping without leaving a neck remnant. Selecting the optimal approach based on preoperative neuroimaging of which side will allow both these actions is important.

Key Words: Accessory anterior cerebral artery, aneurysm, anterior communicating artery, vascular anomaly

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INTRODUCTION

The anatomy of the anterior cerebral artery (ACA) is highly variable.[1,8] Variant anatomies of the artery consist of azygous ACA, bihemispheric ACA, crossover of branches to the contralateral hemisphere, and accessory ACA. Of particular clinical importance is the frequently encountered accessory ACA, which becomes one of the draining arteries of anterior communicating artery (ACoA) aneurysms. The presence of an accessory ACA is not particularly rare,[1,2,4-6,8] but aneurysms of the ACoA associated with accessory ACA can represent a considerable challenge to treat surgically based on the morphological features of the ACoA complex. The accessory ACA usually arises from the postero-inferior surface of the ACoA.[8] When the aneurysmal fundus projects superiorly or posteriorly, the accessory ACA is hidden behind the aneurysm. Furthermore, the aneurysm is behind the ipsilateral A2 segment of the ACA when the superolaterally projecting aneurysm is treated via the side to which the aneurysmal fundus projects. We encountered a case of ACoA aneurysm arising from the trifurcation of the accessory ACA, the branching point of the ACoA, and the right A1 or A2 segment of the ACA. The aneurysmal fundus projected superolaterally to the right. Here, we describe some unique characteristics of and surgical management for such aneurysms.

CASE DESCRIPTION

A 35-year-old man presented with severe headache and subsequent loss of consciousness and was admitted to our hospital. No focal neurological abnormalities were noted. Initial computed tomography (CT) showed findings typical of subarachnoid hemorrhage in the basal cistern. Three-dimensional CT angiography revealed an anomalous artery originating from the posterior surface of the ACoA and a saccular aneurysm arising from the trifurcation of the anomalous artery, the branching point of the ACoA with fenestration, and the right A1or A2 segment of the ACA [Figure 1a]. The aneurysmal fundus projected superolaterally to the right. The anomalous artery arose from the posterior surface of the ACoA and ran around the genu of the corpus callosum, parallel to bilateral pericallosal arteries, which distributed branches to the m edial frontal lobes [Figure 1b]. The anomalous artery was interpreted as an accessory ACA.

Right frontotemporal craniotomy was performed. Following dissection of the Sylvian fissure and interhemispheric fissure, the ACoA complex including bilateral A1 and A2 segments of the ACA, and the anterior surface of the ACoA were exposed [Figure 2a]. After partial resection of the ipsilateral gyrus rectus, the aneurysmal fundus was found behind the ipsilateral A2 segment of the ACA, which hid the accessory ACA. After gently pushing the aneurysm forward by spatula to the corner of the ACoA, the distal artery of the accessory ACA and its origin were confirmed, working between the right frontal lobe and the right A2 segment of the ACA [Figure 2b]. A straight fenestrated Yasargil titanium clip (No. FT598T; blade length 4

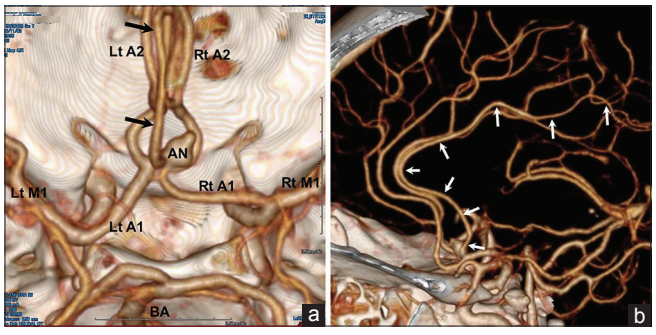

Figure 1: (a) Preoperative three-dimensional CT angiogram, superoinferior view, showing a saccular aneurysm (AN) arising from the trifurcation of the accessory ACA (black arrows), the branching point of the ACoA with fenestration, and the right A1 or A2 segment of the ACA. Aneurysmal fundus projects superolaterally to the right. Lt: left; Rt: right; BA: basilar artery. (b) Left lateral view of the three-dimensional CT angiogram, showing the accessory ACA (white arrows) arising from the posterior surface of the ACoA and running around the genu of the corpus callosum, parallel to bilateral pericallosal arteries, which distributed branches to the medial frontal lobes

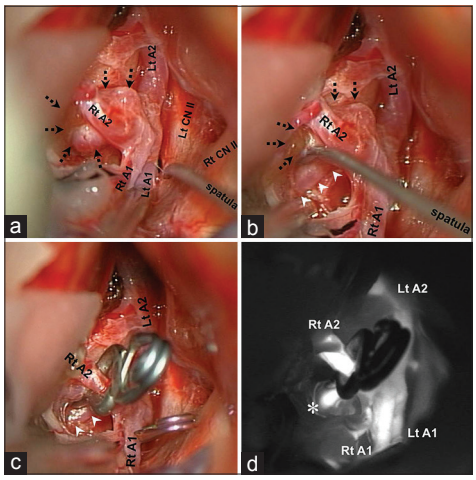

Figure 2: Intraoperative photographs showing the aneurysm (dotted arrows) and its relationship to bilateral A1 and A2 segments of the anterior cerebral artery (ACA), and the accessory ACA. (a) Partial resection of the ipsilateral gyrus rectus, allowing visualization of the aneurysm fundus behind the ipsilateral A2 segment of the ACA. (b) Gently pushing the aneurysm (dotted arrows) forward using the spatula to the corner of the ACoA, allowing visualization of the accessory ACA, working between the right frontal lobe and right A2 segment of the ACA. (c) The aneurysm is occluded by a straight fenestrated clip placed with the aperture around the ipsilateral A2 segment of the ACA, preserving the accessory ACA (white arrowheads). (d) Intraoperative indocyanine green angiogram showing patency of both the right A2 segment of the ACA and the accessory ACA (*), and disappearance of the aneurysm. Lt: left; Rt: right; CN: cranial nerve; Lt CN: left cranial nerve

mm, fenestration diameter 3.5 mm) was applied across the ipsilateral A2 segment of the ACA and toward the accessory ACA from the ACoA origin, parallel to the ACoA [Figure 2c]. The aneurysm was successfully obliterated with clipping. Complete aneurysm occlusion and patency of the ipsilateral A2 segment of the ACA and the accessory ACA were confirmed intraoper atively under indocyanine green angiography [Figure 2d]. Postoperative three-dimensional CT angiography revealed patency of both the right A2 segment of the ACA and the accessory ACA, resulting in disappearance of the aneurysm [Figure 3].

The postoperative course was uneventful, and the patient was discharged with no neurological deficits.

DISCUSSION

The presence of the accessory ACA is well described, but several terms have been used to describe this variation, including medial ACA, median artery of the corpus callosum (MACC), third A2, triple A2, and superior pericallosal artery.[8] Baptista *et al*. used the term MACC to refer to the median artery of a triplicated ACA, which supplies branches to the corpus callosum and adjacent cortex, as well as the septal nuclei, septal nuclei, septum pellucidum, and upper portion of the column of the fornix.[2] Furthermore, Baptista *et al*. classified the MACC, from which one or more of the usual cortical branches of ACA originate, thus defining a relatively large cerebral cortical area as the accessory ACA. The incidences of the accessory ACA and aneurysm in the ACoA associated with accessory ACA have been reported as 3.3–13.1% and 4.4–13.1%, respectively.[2,4-6] The presence of an accessory ACA is not so rare, but aneurysms of the ACoA associated with accessory ACA can be a considerable challenge

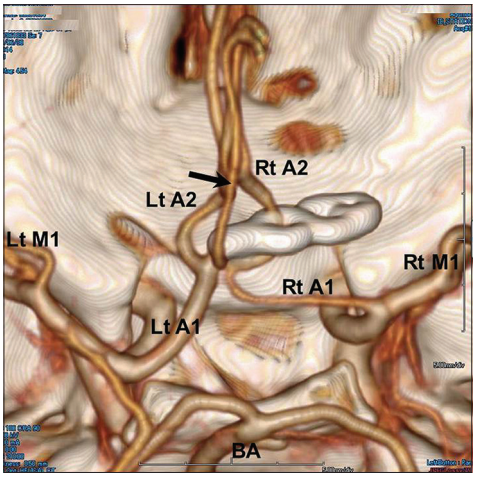

Figure 3: Postoperative three-dimensional computed tomography angiography (superoinferior view) showing patency of both the right A2 segment of the ACA and the accessory ACA (black arrow), resulting in disappearance of the aneurysm. Lt: left; Rt: right, BA: basilar artery

to treat surgically, given the variations in the anatomy and morphological features of the ACoA complex. The accessory ACA usually arises from the postero-inferior surface of the ACoA.[8] When the fundus of the aneurysm projects superiorly or posteriorly, the accessory ACA is hidden behind the aneurysm. Gibbons *et al*. reported two cases of ACoA aneurysm with poor operative outcomes due to inadvertent clip occlusion of an accessory ACA under treatment using a pterional approach.[3]

The two basic surgical approaches used for aneurysm of the ACoA are the interhemispheric approach and the pterional approach. We use a pterional approach for the ACoA aneurysm, except for giant, thrombosed, or extremely high-positioned ACoA aneurysms. Our criteria in selecting the side of the pterional approach are as follows: inferiorly projecting aneurysms are treated from the dominant A1 side to avoid hazardous bleeding, whereas superiorly projecting aneurysms are treated from the side of aneurysm fundus projection for easy dissection of the neck.[7] In the present case, the ACoA aneurysm arose from the trifurcation of the accessory ACA, the branching point of the ACoA, and the right A1 or A2 segment of the ACA. The aneurysmal fundus projected superolaterally to the right and was therefore treated via a right-sided pterional approach. The disadvantages of this right-sided approach were as follows. First, the aneurysm was behind the ipsilateral A2 segment of the ACA. Thus, the ipsilateral A2 segment of the ACA impeded clip placement across the aneurysm neck. Second, the accessory ACA was hidden behind the fundus of the aneurysms. Gyrus rectus resection was, therefore, helpful to visualize the accessory ACA, and surgical clipping of the ACoA aneurysm was achieved using a straight fenestrated clip placed with the aperture around the ipsilateral A2 segment of the ACA. If the aneurysm had been treated via a left-sided pterional approach, bilateral ACAs, and the accessory ACA would have been easily visualized, however, adequate visualization of the aneurysm neck might have been difficult and neck clipping for the ACoA aneurysm using a standard straight, angled, or curved clip might have resulted in a remnant aneurysmal neck.

When possible, placement of a straight or angled nonfenestrated clip across the aneurysm neck under direct visual observation remains the safest, simplest method of surgical aneurysm ligation. However, due to variations in the direction of ACoA aneurysms and the regional microvasculature, placement of a straight clip may be impeded by structures traversing the operative trajectory. Zada *et al*. reported that fenestrated clips were helpful in such situations and were used in 20 of 199 patients who underwent surgical treatment of ACoA aneurysms.[9] Use of a fenestrated clip might allow the surgeon to limit dissection of adherent branch vessels while maintaining the integrity of structures placed within the fenestration.

In treating this an eurysm via a pterional approach, simultaneously preserving preventing patency of the accessory ACA and achieving aneurysm clipping without a neck remnant is critical. Thus, selecting the optimal approach side to achieve both these actions based on preoperative neuroimaging is important. If these actions are expected to be difficult via a pterional approach, even with use of a fenestrated clip, an interhemispheric approach or coil embolization should be considered. Ogawa *et al*. reported 27 patients with ACoA aneurysms associated with accessory ACA who underwent microsurgical clipping via the bifrontal interhemispheric approach. This approach offers the advantage of allowing a wide operative field and attainment of a good understanding of the vascular structures near the ACoA. It is particularly useful in cases of vascular anomaly in this region.

Recognizing and reporting this variant could be helpful in preventing complications of surgery. Although injury to the accessory ACA itself is unlikely to result in clinical deficits, precise knowledge of the vascular anatomy, including such variants, is essential to help minimize the risk of complications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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