Ruptured Aneurysm Arising from the Anomalous Anterior Cerebral Artery

—Case Report—

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Abstract

A 64-year-old male presenting with subarachnoid hemorrhage had a saccular aneurysm arising from the anomalous anterior cerebral artery. The aneurysm was located on the curved mid-portion of the anomalous artery and extended underneath the right optic nerve. The aneurysm was clipped without unroofing the right optic canal. Postoperatively, he suffered from temporary mild deterioration of the right visual acuity. Hemodynamic stress may be important in the development of such aneurysms.

Key words: vascular anomaly, anterior cerebral artery, internal carotid artery, aneurysm, optic nerve

Introduction

Anomalous anterior cerebral artery (ACA) is rare, with only 34 reported cases. An aneurysm arising from the anomalous ACA is even rarer, as only three cases have been reported. We describe a case of ruptured aneurysm arising from the anomalous ACA, and review the clinical features.

Case Report

A 64-year-old male suffered sudden onset of severe headache on April 20, 1991, and was admitted to a nearby hospital on April 27. A lumbar puncture 10 days after the onset revealed bloody cerebrospinal fluid (CSF).

He was transferred to our hospital on May 1, 1991. On admission, he was alert with no visual defects, but marked neck stiffness, headache, and high fever.

Precontrast computed tomographic (CT) scans showed no hemorrhage in the subarachnoid space, but an isodense oval mass in the suprasellar cistern (Fig. 1). No postcontrast CT was performed.

Fig. 1 Precontrast CT scan, showing an isodense oval mass (arrow) in the suprasellar cistern.

Four-vessel angiography was performed on the 1st day of admission. Right common carotid angiograms showed the anomalous ACA arising from the intracranial origin of the right carotid siphon just proximal to the origin of the ophthalmic artery, running medially and superiorly, and supply-
ing bilateral ACA territories. The saccular aneurysm arose from the curved mid-portion of the anomalous ACA. The normal right A\textsubscript{1} segment was not identified (Fig. 2). Left common carotid angiograms demonstrated duplication of the middle cerebral artery and nonfilling of the left A\textsubscript{1} segment (Fig. 3). Bilateral vertebral angiograms found no abnormality of the vertebrobasilar system.

A right frontotemporal craniotomy was performed on the same day. Xanthochromic CSF was seen in the subarachnoid spaces including the suprasellar and the right Sylvian cisterns. The anomalous ACA ran medially below the right optic nerve and ascended superomedially to the prechiasmatic cistern. The saccular aneurysm arising from the curved mid-portion of the anomalous ACA protruded superolaterally and extended underneath the right optic nerve (Fig. 4). There was no branch from the anomalous ACA proximal to the aneurysmal neck. The aneurysm surrounded by a blood clot adhered to the optic nerve, suggesting prior bleeding. The aneurysmal neck was dissected free and clipped with a Sugita curved clip (#14) during retraction of the right optic nerve medially. The normal A\textsubscript{1} segment was not identified bilaterally.

Postoperatively, temporary mild deterioration of visual acuity developed on the right, but disappeared within 1 week. Eighty days after clipping of the aneurysm, he underwent a ventriculocisternostomy for symptomatic normal pressure hydrocephalus. His neurological deficits improved gradually. Postoperative right internal carotid angiograms revealed

Fig. 2 Right common carotid angiograms, oblique (left) and lateral (right) views, showing the anomalous ACA (arrow) arising from the intracranial origin of the right carotid siphon just proximal to the origin of the ophthalmic artery (double arrow), running medially and superiorly, and supplying bilateral ACA territories. The saccular aneurysm (arrowhead) arises from the curved mid-portion of the anomalous ACA.

Fig. 3 Left common carotid angiogram, anteroposterior view, showing duplication of the middle cerebral artery and nonfilling of the left A\textsubscript{1} segment.

Fig. 4 upper: Intraoperative photograph, demonstrating the saccular aneurysm arising from the anomalous ACA and extending underneath the right optic nerve. lower: Schematic drawing of the operative view. An: aneurysm, ON: optic nerve.
successful clipping of the aneurysm (Fig. 5).

**Discussion**

The ACA normally arises below the anterior perforated substance as the smaller of two terminal branches of the internal carotid artery (ICA), passes over the optic nerve and chiasm, and courses anteromedially to the interhemispheric fissure. In contrast, the anomalous ACA with a proximal origin on the ICA passes medially below the ipsilateral optic nerve. This anomalous ACA is rare, so we will discuss the 34 previous cases\(^1\)-\(^{19},21-29\) and ours together.

Sixteen of the 35 patients were males, 15 were females, and four unknown. The anomalous vessel occurred on the right in 25 cases, on the left in four, and bilaterally in six. The \(A_1\) segment was absent or hypoplastic ipsilaterally in 26 cases and contralaterally in 23. The bilateral \(A_1\) segments were absent or hypoplastic in 18 cases.

The embryogenesis of this anomalous vessel is obscure. There are three possible explanations based on the development of the cranial arteries in the human embryo\(^20\): 1) developmental failure of the anastomotic loop between the primitive dorsal ophthalmic and the primitive ventral ophthalmic arteries\(^11,23\); 2) developmental failure of the prechiasmal arterial networks\(^6\) supplied from the prechiasmal branch of the ophthalmic artery, the superior hypophyseal branch of the ICA, and the chiasmal branch of the ACA\(^8,11,23\); and 3) developmental failure of the potential anastomosis between the primitive olfactory and the primitive maxillary arteries, both supplying the prosencephalon.\(^9\) The latter hypothesis seems to be more attractive. In the present case, the anomalous vessel arose from the ICA proximal to the origin of the ophthalmic artery. The primitive maxillary artery can be considered the precursor of this anomalous vessel, because the primitive maxillary artery is located caudal to the primitive dorsal ophthalmic artery.

There is a high incidence of aneurysms associated with this anomaly. Twenty-two aneurysms occurred in 19 of the 35 cases. Eighteen of 19 cases developed subarachnoid hemorrhage. Thirteen of the 22 aneurysms were located in the region of the anterior communicating artery (ACoA). In 10 of the 13 cases associated with ACoA aneurysms, the bilateral \(A_1\) segments were absent or hypoplastic. Odake\(^19\) proposed that double hemodynamic stress at the apex of this anomalous vessel, supplying most of the

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**Table 1** Summary of four reported aneurysms arising from the anomalous ACA

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Author (Year)</th>
<th>Age/ Sex</th>
<th>Presenting symptoms</th>
<th>Side</th>
<th>Location of anomalous ACA aneurysm</th>
<th>Other aneurysm</th>
<th>(A_1) segment</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Klein <em>et al.</em> (1987)(^3)</td>
<td>43/F</td>
<td>SAH</td>
<td>rt</td>
<td>curved mid-portion proximal end of duplication(^*)</td>
<td>ACoA(^*)</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>2</td>
<td>Ban <em>et al.</em> (1990)(^1)</td>
<td>47/F</td>
<td>SAH</td>
<td>rt</td>
<td>curved mid-portion(^*)</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Present case</td>
<td>56/M</td>
<td>SAH</td>
<td>rt</td>
<td>curved mid-portion(^*)</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>64/M</td>
<td>SAH</td>
<td>rt</td>
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</tr>
</tbody>
</table>

\(^*\)Ruptured aneurysm.  MCA: middle cerebral artery, ND: not described, SAH: subarachnoid hemorrhage.
bilateral A2 territories, correlates with the high incidence of ACoA aneurysms. In contrast, the aneurysm was located on the proximal bifurcation of the duplicated anomalous ACAs in one case and on the curved mid-portion of the vessel in three. This aneurysm does not originate from the arterial junction, as with aneurysms arising from the A1 segment.30) In the present case, there were no characteristic angiographic findings of dissecting aneurysms, such as “pearl and string sign” and “double lumen sign.” The aneurysm may be associated with congenital weakness in the arterial wall. The anomalous vessel supplied bilateral ACA territories, and a resultant compensatory increase in blood flow might be responsible for the aneurysm formation. We suggest that hemodynamic stress is important in the development of aneurysms on the curved mid-portion of the anomalous vessel.

Our patient suffered from a temporary mild deterioration of right visual acuity after clipping of the aneurysm. Retraction of the optic nerve during surgery was probably the cause. Removal of the anterior clinoid process and unroofing of the optic canal might facilitate manipulation of the optic nerve.

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References


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