A giant anterior communicating artery aneurysm associated with hypoplasia of the unilateral internal carotid artery

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Abstract

Objective: There have been few reports on the association of large or giant aneurysms with congenital absence or hypoplasia of the internal carotid artery (ICA). We present a case of a giant anterior communicating artery aneurysm associated with hypoplasia of the unilateral ICA with secondary occlusion.

Case presentation: A 62-year-old man was diagnosed with a giant anterior communicating artery aneurysm (10×12×28 mm) associated with hypoplasia of the unilateral ICA. A left common carotid angiogram revealed occlusion of the cervical portion of the left ICA. A right internal carotid arteriogram showed the aneurysm. Both the left anterior cerebral artery and left middle cerebral artery were filled from the right ICA via the anterior communicating artery. Due to the complicated morphology and calcified wall of the aneurysm, we performed endovascular treatment using a combination of 18- and 10-series microcatheters to make separate coil frames in the aneurysmal sac. Twenty-seven Guglielmi detachable coils with a total length of 419 cm were placed in the aneurysm, which resulted in satisfactory occlusion. The patient was discharged without complications, and there was no evidence of aneurysmal recurrence for three years.

Conclusion: Large or giant aneurysms associated with congenital absence or hypoplasia of the ICA are rare. In their treatment, it is important to avoid a decrease in collateral blood flow. The endovascular procedure is a reasonable therapeutic option.

Key Words

agnesia, embolization, giant aneurysm, hypoplasia, internal carotid artery

Introduction

Congenital anomalies of the internal carotid artery (ICA) classified as agenesis, aplasia, and hypoplasia by Lie2) are rare. However, the associated incidence of intracranial aneurysms is quite high. Its incidence has been reported as 25–67%3,4,19,31,33,38.

The current literature on these complicated aneurysms does not discuss aneurysmal size or treatment, and there have been only a few reports on large or giant aneurysms associated with these anomalies of the ICA. We present a case of a giant, irregularly shaped aneurysm of the anterior communicating artery associated with hypoplasia of the unilateral ICA with secondary occlusion, and review the literature.

Case Presentation

A 62-year-old man presented with complaints of a continual severe headache and was admitted to our hospital. There was no evidence of subarachnoid hemorrhage based on computed tomography (CT). However, CT revealed a large, irregularly shaped lesion with rim calcification in the suprasellar cistern (Fig. 1). Three-dimensional CT angiography (3D-CTA) showed an irregularly shaped aneurysm of the anterior communicating artery. The intracranial portion of the left ICA was not delineated (Fig. 2A, B). A right ICA arteriogram revealed the irregularly shaped aneurysm of the anterior communicating artery (10×12×28 mm), in which both the left anterior cerebral artery (ACA) and left middle cerebral artery (MCA) were filled by the right ICA via the anterior communicating artery (Fig. 3A). A left common carotid angiogram revealed occlusion of the cervical portion

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of the left ICA with a stump at the bifurcation (Fig. 3B). Left vertebral angiography showed normal anatomy, with filling of both the posterior cerebral artery territory and the posterior fossa. CT at the level of the skull base showed hypoplasia of the left carotid canal (Fig. 4).

Resting cerebral blood flow (CBF) and vascular reactivity to acetazolamide were calculated by single photon emission CT. No global or focal reduction of the CBF was detected in
Fig. 3
A: Right internal carotid angiogram (anteroposterior view) showing that the left anterior and middle cerebral arteries are supplied by the right internal carotid artery via the anterior communicating artery, and the presence of a large, irregularly shaped aneurysm of the anterior communicating artery.
B: Left common carotid arteriogram (lateral view) shows occlusion of the cervical portion of the left internal carotid artery with a stump.

calculated wall, aneurysmal clipping was considered difficult, and we decided to perform endovascular treatment. Due to the difficulty in making a frame with a single coil for this irregularly shaped aneurysm, we used a combination of 18- and 10-series microcatheters to make separate frames in the intrasellar and suprasellar portions of the aneurysm. The first 18-microcatheter (Excelsior 1018, Boston Scientific, Natick, MA, USA) was positioned within the intrasellar portion, and the second 10-microcatheter (pre-shaped Prowler-10, J-type, Cordis, Miami, FL) was introduced within the suprasellar portion (Fig. 5A, B). A Guglielmi detachable coil (GDC-18, 9-mm 2D helix×30-cm, Boston Scientific, Natick, MA) was initially deployed from the Excelsior 1018 catheter, which was stable across the aneurysmal neck without compromising the flow in the parent artery (Fig. 5C). Then, the second coil (GDC-10, 3D 10-mm ×30-cm) was deposited via the Prowler-10 catheter, and a stable coil frame was formed in the suprasellar portion of the aneurysm (Fig. 5D). The residual aneurysmal sac was filled with small coils from the distal sac of the aneurysm in piecemeal fashion, aiming at the neck through both catheters. Twenty-seven coils with a total length of 419 cm were placed in the aneurysm, resulting in satisfactory occlusion (Fig. 5E).
A: The right carotid arteriogram (oblique view) shows a large, irregularly shaped aneurysm of the anterior communicating artery.

B: The tip of the Excelsior 1018 microcather (arrow) is seen in the intrasellar portion of the aneurysmal sac, and that of the Prowler-10 microcather (arrowhead) in the suprasellar portion.

C: A Guglielmi detachable coil (GDC-18 2D 9-mm × 30-cm) is inserted via the Excelsior 1018 catheter, and is positioned near the neck without compromising the parent vessel or anterior communicating artery by the coil loops.

D: An additional GDC-10 coil (GDC-10 3D 10-mm × 30-cm) is inserted via the Prowler-10 catheter.

E: Post-embolization angiogram shows complete occlusion of the aneurysm with patency of the anterior communicating artery.

F: Post-embolization left vertebral angiography, lateral view. The left ophthalmic artery is supplied via the posterior communicating artery.

G: At the three-year follow up, a right internal carotid artery angiogram reveals no recurrence of the aneurysm.

Post-operative left vertebral angiography revealed the left ophthalmic artery supplied via the posterior communicating artery (Fig. 5F). The patient was discharged the following day without complications, and a 3 year-follow up angiogram of the right ICA revealed no recurrence of the aneurysm (Fig. 5G).

Discussion

Hyoplasia of the ICA generally refers to incomplete development of an ICA and a hypoplastic bony carotid canal can be detected by thin slice bone CT. In our case, we recognized a left ICA occlusion with a large carotid stump in the neck. The ipsilateral ACA and MCA were supplied by the contralateral ICA through the anterior communicating artery (Fig. 2). However, CT of the skull base showed the left carotid canal to be hypoplastic (Fig. 3). Based on these findings, we diagnosed hypoplasia of the unilateral ICA with secondary occlusion. Possible reasons for occlusion of the hypoplastic ICA may include atherosclerosis, dissection, embolic phenomena or vasculitis[1,2].

There are many reports of intracranial aneurysms associated with congenital absence or hypoplasia of the I
CA in the majority of these reports, the size and shape of the associated aneurysms have not been provided in detail. Therefore, we estimated the aneurysmal morphology by referring to published figures. Most of the associated aneurysms were 10 mm or less in size, and there were no distinctive characteristics of the aneurysmal shape compared with the usual aneurysm population. Including our case, nine of 49 (18.4%) reported aneurysms were at least 10 mm in the greatest dimension (Table 1). Only 2 aneurysms (2/49, 4.1%) among them were giant aneurysms, 25 mm or more in the greatest diameter. The greatest diameter of aneurysm in our case was 28 mm, the other basilar aneurysm measuring 66 mm. These 9 aneurysms occurred in various locations of the cerebrovasculature and did not have any distinctive topographical features. Therefore, etiological factors may include not only the hemodynamic forces, but also congenital factors related to developmental failure of the ICA.

<table>
<thead>
<tr>
<th>Authors (year)</th>
<th>Age / Sex</th>
<th>Carotid agenesis</th>
<th>Aneurysm location</th>
<th>Aneurysm size (mm)</th>
<th>Initial symptom</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moyes et al. (1969)</td>
<td>37 / F</td>
<td>lt. agenesis</td>
<td>BA tip</td>
<td>15 × 20</td>
<td>SAH</td>
<td>clipping</td>
</tr>
<tr>
<td>Tangchai et al. (1970)</td>
<td>30 / F</td>
<td>lt. agenesis</td>
<td>rt. MCA</td>
<td>12</td>
<td>SAH</td>
<td>none</td>
</tr>
<tr>
<td>Handa et al. (1971)</td>
<td>28 / F</td>
<td>bil. hypoplasia</td>
<td>rt. IC-Oph</td>
<td>15 × 15 × 20</td>
<td>SAH</td>
<td>none</td>
</tr>
<tr>
<td>Servo et al. (1977)</td>
<td>48 / M</td>
<td>lt. agenesis</td>
<td>rt. carotid syphon</td>
<td>17 × 22, 12 × 19</td>
<td>SAH</td>
<td>conservative</td>
</tr>
<tr>
<td>Katakura et al. (1979)</td>
<td>41 / F</td>
<td>lt. agenesis</td>
<td>BA</td>
<td>66</td>
<td>disorientation</td>
<td>conservative</td>
</tr>
<tr>
<td>Afifi et al. (1987)</td>
<td>4m' / F</td>
<td>lt. hypoplasia</td>
<td>rt. A1-A2</td>
<td>15 × 15 × 10</td>
<td>seizure</td>
<td>clipping</td>
</tr>
<tr>
<td>Anegeawa et al. (1987)</td>
<td>52 / F</td>
<td>bil. agenesis</td>
<td>lt. PCA</td>
<td>15 × 15</td>
<td>ICH</td>
<td>clipping</td>
</tr>
<tr>
<td>Sugurua et al. (1997)</td>
<td>67 / F</td>
<td>rt. agenesis</td>
<td>BA trunk</td>
<td>21</td>
<td>mass effect</td>
<td>coiling</td>
</tr>
<tr>
<td>Present case</td>
<td>62 / M</td>
<td>lt. hypoplasia</td>
<td>Acom</td>
<td>10 × 12 × 28</td>
<td>headache</td>
<td>coiling</td>
</tr>
</tbody>
</table>

Abbreviations: Acom; anterior communicating artery, A1 and A2; the segments of anterior cerebral artery, BA; basilar artery, F; female, 4m'; 4-month, IC; internal cerebral artery, ICH; intracerebral hemorrhage, M; male, MCA; middle cerebral artery, Oph; ophthalmic artery, PCA; posterior cerebral artery, SAH; subarachnoid hemorrhage

References
36) Sugiuara Y, Miyamoto T, Takehara S, et al: Basilar artery