Endosaccular aneurysm occlusion with Guglielmi detachable coils for obstructive hydrocephalus caused by a large basilar tip aneurysm

Case report

Akira Watanabe, M.D., Kazuhiro Imamura, M.D., and Ryoji Ishii, M.D.

Department of Neurosurgery, Kawasaki Medical School, Okayama, Japan

The authors present the case of a 60-year-old man with obstructive hydrocephalus caused by a large basilar artery tip aneurysm, in whom direct surgical clipping of the aneurysm neck was considered hazardous. After endosaccular aneurysm occlusion, his symptoms (headache, intellectual impairment, and gait disturbance) and ventricular dilation immediately improved without placement of a ventricular shunt. To the authors' knowledge, this is the first case of its kind treated solely endovascularly.

Key Words * basilar tip aneurysm * coil embolization * obstructive hydrocephalus

Obstructive hydrocephalus caused by a large or giant aneurysm is rare.[1-4,6,11-13] In most reported cases, the aneurysm was located on the bifurcation of the basilar artery (BA) and direct surgical treatment was considered hazardous. Although there is a theoretical risk of rupture of the aneurysm because of the reduction of intracranial pressure (ICP) after ventricular shunt placement, the much simpler surgical procedure was performed in all reported cases except ours. In fact, one patient with an unruptured giant aneurysm of the BA bifurcation suffered a massive subarachnoid hemorrhage (SAH) and eventually died after a biventricular peritoneal shunt was inserted.[4] In our patient, endosaccular treatment of the aneurysm was first performed to prevent rupture of the aneurysm. Ventricular dilation also improved without placement of a ventricular shunt.

CASE REPORT

History. This 60-year-old man was referred to our hospital with complaints of a 3-month history of headaches, intellectual impairment, and gait disturbance. Following a traffic accident 3 years earlier, magnetic resonance (MR) imaging and MR angiography had revealed occlusion of the left internal carotid artery (ICA) but normal configuration of the bifurcation of the BA (Fig. 1). Follow-up MR imaging and MR angiography performed 2 years later disclosed an aneurysm dilating the bifurcation of the BA.
Examination. A neurological examination revealed intellectual impairment; namely, a score of 16 of 30 on the revised version of Hasegawa's Dementia Scale,[7] which is a Japanese screening test for dementia in which verbal memory is assessed, with a score range of 0 to 30. The patient's upward gaze was slightly restricted, and his gait was slightly slow and unsteady. On MR imaging a large aneurysm was revealed on the bifurcation of the elongated BA, and bilateral ventricular dilation with abnormal intensity in the periventricular white matter was observed (Fig. 2).

The large aneurysm occupied the third ventricle and caused obstructive hydrocephalus. On angiographic studies complete occlusion of the left ICA and a large aneurysm on the bifurcation of the BA were demonstrated (Fig. 3). Collateral circulation via the left enlarged posterior communicating artery (PCoA)
and the posterior cerebral artery (PCA) to the left middle cerebral artery (MCA) was identified. The aneurysm was 12 X 12 X 12 mm in size, and its neck involved bilateral PCAs. The origin of the left PCA, arising from a lateral wall of the aneurysm, was conical. The patient was scheduled to be treated using the endovascular approach before ventricular shunt placement because direct surgical clipping of the aneurysm neck was considered to be hazardous and difficult, and there was a theoretical risk of rupture of the aneurysm because of the reduction of ICP after ventricular shunt insertion.

![Image](image.png)

**Fig. 3.** Left VA angiogram demonstrating a large aneurysm on the bifurcation of the elongated BA and the collateral circulation via the left enlarged PCoA and the PCA to the left MCA. The neck of the aneurysm involved the bilateral PCAs. The origin of the left PCA, arising from a lateral wall of the aneurysm, was conical.

**Operation.** The goal of our intraaneurysm coil embolization was to occlude the upper two thirds of the aneurysm to preserve the patency of the bilateral PCAs. The patient received a general anesthetic and systemic heparinization throughout the procedure. A No. 6 French catheter was guided into the left vertebral artery (VA) through the right femoral artery, and then a Tracker-18 microcatheter (Target Therapeutics/Boston Scientific, Fremont, CA) was introduced coaxially and its tip was gently positioned in the sac of the aneurysm. The tip of the microcatheter was curved on a horizontal plane to its axis, because we were able to hold a Guglielmi detachable coil (GDC) protruding from the tip of the microcatheter to the upper part of the aneurysm (Fig. 4).
A two-dimensional No. 18 GDC (12 mm diameter X 30 cm long) was first advanced into the aneurysm, followed slowly by a 9 mm X 15-cm No. 18 GDC (Fig. 5). Then the microcatheter was retracted, and its tip was shaped into a simple angle so that we could introduce and/or retrieve it easily. The microcatheter was reinserted into the aneurysm, and three No. 18 GDCs and five soft No. 18 GDCs were introduced. In all, 10 No. 18 GDCs with a total length of 156 cm were placed in the aneurysm (Fig. 6). The patient did not receive steroid medications during his treatment.
Fig. 6. Postoperative left VA angiogram demonstrating an occlusion of the upper two thirds of the lesion. Ten No. 18 GDCs with a total length of 156 cm were placed in the aneurysm.

**Postoperative Course.** After the intraaneurysm coil embolization, the patient's headache immediately disappeared. His intellectual impairment and gait disturbance also improved a few days later. His score on the revised Hasegawa’s Dementia Scale was 30/30. Magnetic resonance imaging performed 12 days postoperatively demonstrated a decrease in both the ventricular dilation and the abnormal intensity in the periventricular white matter, because a narrow space between the roof of the third ventricle and the tip of the aneurysm dome had clearly opened (Fig. 7). Approximately 1 month later the patient was discharged home after follow-up angiographic studies revealed no coil compaction or stenosis in the bilateral PCAs. Four months later, he continued to be healthy and had returned to work.

Fig. 7. Left: Coronal T2-weighted MR image obtained at the same location as in Fig. 2, demonstrating reduction of the ventricular dilation and the hyperintense lesion in the periventricular white matter. The space between the roof of the third ventricle and the tip of the aneurysm dome is opened (curved arrows). The floor of the third ventricle is elevated by the aneurysm dome (white arrows). Right: Axial fluid-attenuated inversion-recovery MR image demonstrating enlargement of sulci and sylvian fissures.
DISCUSSION

Obstructive hydrocephalus caused by a large or giant aneurysm is rare. To the best of our knowledge, only 10 such cases (including ours) have been reported in the last 20 years (Table 1).[1-4,6,11-13] In most of these cases, the aneurysm was located on the bifurcation of the BA, and direct surgical treatment was considered hazardous. A ventriculoperitoneal (VP) shunt was inserted to decompress the obstructive hydrocephalus in all cases except ours. Of three patients who underwent direct surgery after VP shunt placement, two died of complications related to the surgery.[1,3] One patient with an unruptured giant aneurysm of the BA bifurcation suffered a massive SAH after VP shunt placement and that patient died.[4] Because there is a theoretical risk of rupture of an aneurysm because of the reduction in ICP after VP shunt placement, the patient needs protection against rupture of the aneurysm before the VP shunt is inserted. Our patient underwent endosaccular aneurysm occlusion with GDCs to prevent such a rupture. As a result, the ventricular dilation improved immediately without a VP shunt being necessary.

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Clinical Presentation</th>
<th>Location</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Babu &amp; Eisen, 1979</td>
<td>52</td>
<td>F</td>
<td>insomnia, memory loss, headache, unsteadiness on feet, urinary incontinence</td>
<td>A CoA</td>
<td>VP shunt↑</td>
<td>died during op postop</td>
</tr>
<tr>
<td>Bose, et al., 1983</td>
<td>55</td>
<td>F</td>
<td></td>
<td>BA tip</td>
<td>VP shunt↑</td>
<td>died 5 days postop</td>
</tr>
<tr>
<td>Piek, et al., 1983</td>
<td>60</td>
<td>F</td>
<td>instability on moving, intellectual impairment</td>
<td>BA tip</td>
<td>VP shunt</td>
<td>recovered</td>
</tr>
<tr>
<td>Borrie, et al., 1985</td>
<td>70</td>
<td>M</td>
<td>intellectual impairment, gait disturbance, urinary incontinence</td>
<td>rt MCA</td>
<td>VP shunt</td>
<td>recovered</td>
</tr>
<tr>
<td></td>
<td>72</td>
<td>F</td>
<td>unsteadiness on feet, short-term memory loss, urinary bowel incontinence</td>
<td>BA tip</td>
<td>VP shunt</td>
<td>recovered</td>
</tr>
<tr>
<td>Morota, et al., 1988</td>
<td>69</td>
<td>F</td>
<td>gait disturbance, urinary incontinence</td>
<td>rt ICA bif</td>
<td>VP shunt</td>
<td>recovered</td>
</tr>
<tr>
<td>Goetz, et al., 1990</td>
<td>62</td>
<td>M</td>
<td>headache, progressive neurological deterioration</td>
<td>BA tip</td>
<td>VP shunt</td>
<td>died of SAH 3 wks later</td>
</tr>
<tr>
<td>Ishibashi, et al., 1993</td>
<td>63</td>
<td>M</td>
<td>lethargy, mild right hemiparesis</td>
<td>BA tip</td>
<td>VP shunt</td>
<td>recovered</td>
</tr>
<tr>
<td>Smith, et al., 1994</td>
<td>60</td>
<td>F</td>
<td>headache, nausea, confusion</td>
<td>rt P CoA</td>
<td>VP shunt↑</td>
<td>recovered</td>
</tr>
<tr>
<td>present study</td>
<td>60</td>
<td>M</td>
<td>headache, intellectual impairment, gait disturbance</td>
<td>BA tip</td>
<td>coil embolization</td>
<td>recovered</td>
</tr>
</tbody>
</table>

* A CoA = anterior communicating artery; bif = bifurcation.
† Shunt insertion was performed following direct surgery.

Endosaccular aneurysm occlusion has led to improvement of mass effect symptoms according to several reports. Halbach, et al.,[5] reported the efficacy of endosaccular aneurysm occlusion with detachable silicone balloons in alleviating neurological deficits produced by mass effect. Malisch, et al.,[9] evaluated the response to endosaccular GDC treatment of unruptured intracranial aneurysms in 19 patients with cranial nerve deficits. The outcomes were complete resolution of symptoms in six patients (32%), improvement in eight (42%), no change in four (21%), and symptom worsening in one (5%).
These authors concluded that patients with mass effect symptoms (cranial nerve deficits) generally responded favorably to endosaccular GDC treatment. In our patient, MR images obtained after the endosaccular aneurysm occlusion demonstrated a narrow space between the roof of the third ventricle and the tip of the aneurysm dome opening. This was believed to have decreased the direct arterial pressure to the wall of the aneurysm sac after the intraaneurysm coil embolization.

A balloon-assisted technique has been used for the endosaccular treatment of broad-necked aneurysms, as was found in our case.[8,10] However, we did not think that our patient would be able to tolerate balloon occlusion of the parent artery that supplied blood flow to the left PCA and MCA. We overcame the problem by means of a special microcatheter. Its tip was curved on a horizontal plane to its axis, because we were able to hold the GDCs protruding from the tip of the device to the upper part of the aneurysm. If the GDCs had been placed in the aneurysm on a vertical plane, the broad neck of the lesion would have been occupied by the GDCs. We were able to continue placing GDCs into the residual space by the conventional method after the formation of a basket with the first two coils. It is important to withdraw the curved microcatheter in the early stage of coil deployment to avoid catching and pulling down on the tip of the curved microcatheter the GDCs, already placed in the aneurysm dome.

To our knowledge, this is the first case of obstructive hydrocephalus caused by a large BA tip aneurysm that was treated only endovascularly.

References


Manuscript received March 2, 1999.

Accepted in final form May 19, 1999.

Address reprint requests to: Akira Watanabe, M.D., Department of Neurosurgery, Kawasaki Medical School, 577 Matsushima, Kurashiki, Okayama, 701-0192 Japan. email: akira7wa@med.kawasaki-m.ac.jp.