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# Treatment of Giant Anterior Communicating Artery Aneurysm via an Endovascular Approach Using Detachable Balloons and Occlusive Coils

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Endovascular approaches have been used to treat cerebrovascular disease since the extensive work of Serbinenko [1], and their efficacy has been increased by the improvement of such techniques and instruments as microcatheters, embolic materials [2–7], and digital subtraction angiography systems. For cerebral aneurysms, embolization utilizing detachable balloons has been performed successfully when the artery was difficult to clip or in high-risk cases [8–17]. In this report, we describe a giant anterior communicating artery aneurysm embolized by successful use of a combination of detachable balloons and occlusive coils. The technical aspects, usefulness, and problems of this procedure are discussed.

## Case Report

A month before admission, a 33-year-old man presented with blurred vision in his left eye, first noticed during a baseball game. The visual disturbance was progressive, and a CT scan revealed a large suprasellar mass. On admission, ophthalmologic examination showed only light perception in his left eye, while visual acuity of the right eye was normal. The patient was otherwise normal on neurologic examination. MR imaging showed a large mass with heterogeneous signal intensity in the suprasellar region extending to the left (Fig. 1A). Cerebral angiography showed a giant anterior communicating artery aneurysm arising between the pre- and postcommunicating segment of the right anterior cerebral artery (Fig. 1B). The anterior communicating artery was hypoplastic, and a compression study revealed poor cross-circulation. MR imaging and cerebral angiography showed the aneurysm to have a large, partially thrombosed dome, making the operative field narrow and limited. Therefore, direct surgery was considered risky, and endovascular treatment was planned.

Because of poor collateral circulation and the narrow neck of the aneurysm, we planned to obliterate the aneurysmal lumen. An 8-French introducing catheter was positioned at the level of the C2 vertebral body in the right internal carotid artery through a sheath introducer placed in the right femoral artery. An electrodetachable latex balloon catheter (Dow Corning, Kanagawa, Japan) was passed through the introducing catheter and up to the right precommunicating segment. The balloon was then navigated into the lumen of the aneurysm in a flow-guided manner. The lumen was so large that several balloons seemed to be necessary. Thus, a first balloon was

filled with a fast-solidifying HEMA mixture and detached after solidification. Subsequently, a second detachable balloon catheter was passed up to the neck of the aneurysm. Repeated attempts to insert a second balloon into the lumen of the aneurysm were unsuccessful because the first balloon acted like an obstruction at the neck of the aneurysm and blocked the entrance of the second balloon. Ultimately, the detachable balloon strategy was abandoned, and a Tracker-18 catheter (Target Therapeutics, San Jose, CA) with a steerable guide-wire (Target Therapeutics) was successfully inserted into the aneurysmal lumen past the first balloon. Through this catheter, 16 platinum flower coils (nine pieces: length in introducer, 6 cm; unrestrained outside diameter, 3.0 mm; seven pieces: length in introducer, 6 cm; unrestrained outside diameter 4.0 mm; Target Therapeutics) were packed into the lumen. Eventually, the lumen beyond the balloon was occluded. After an additional coil was placed superior to the balloon (Fig. 1C), further embolization was given up for fear of migration of the coil to the parent artery. A small remnant remained between the detached balloon and neck of the aneurysm and was difficult to embolize in any way (Fig. 1D). The patient was neurologically unchanged during and after the procedure.

One month later, follow-up angiography showed enlargement of the remnant lumen of the aneurysm (Fig. 1E). A detachable balloon filled with slowly solidifying HEMA mixture was navigated up to the neck of the aneurysm in the same way as during the first approach. The balloon was inflated and adjusted to the remnant lumen (Fig. 1F). Subsequently, the aneurysm was no longer opacified, and the balloon was detached after the solidification of the HEMA. Postembolization angiography revealed successful obliteration of the aneurysm (Fig. 1G). The patient was discharged after 1 week, and 6 months after the procedure the visual acuity of his left eye had improved to the point where he could recognize hand movement.

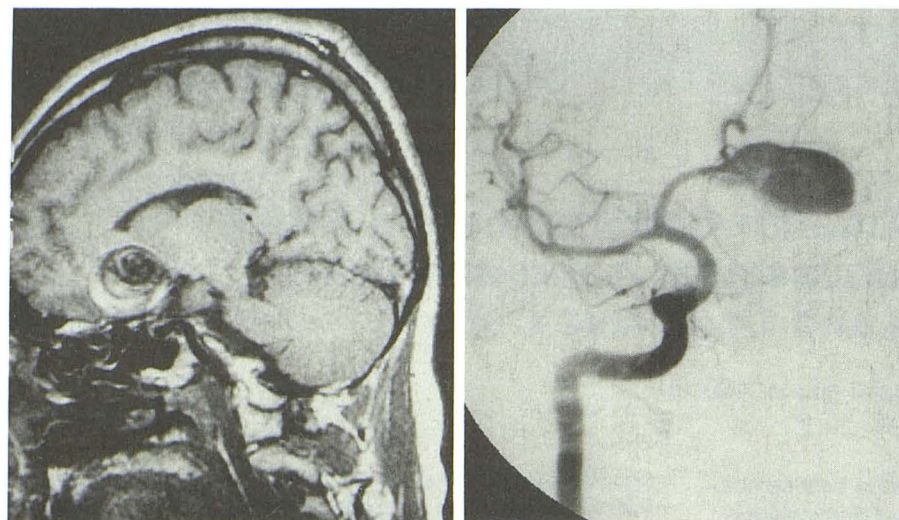
## Discussion

Direct surgery on giant cerebral aneurysms is still a problem, even with the development of modern microsurgical techniques. Recently, endovascular treatment has become an alternative treatment, with good candidates for balloon embolization including patients with giant aneurysms with large domes and restricted operative fields as in this patient [8–17]. The goal in treating an aneurysm is to eliminate it

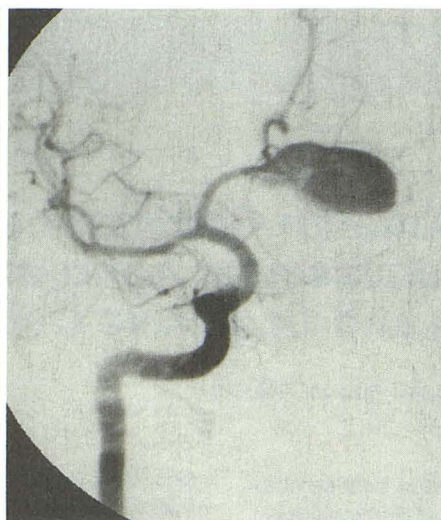
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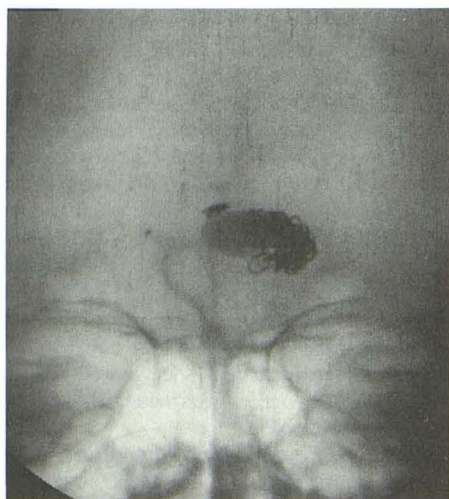




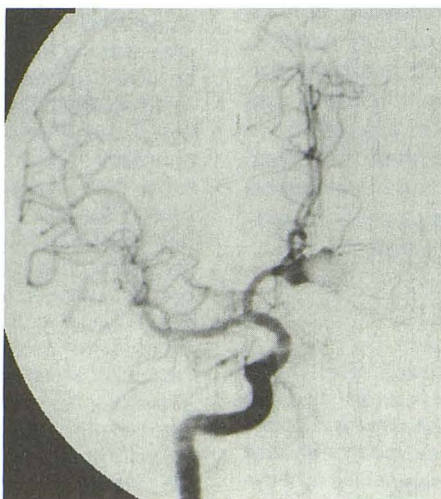
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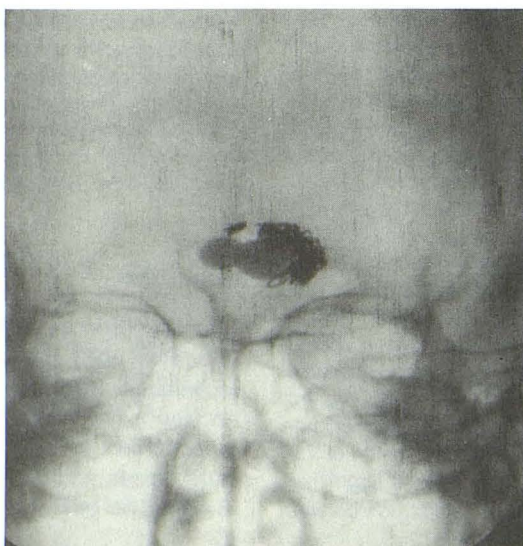
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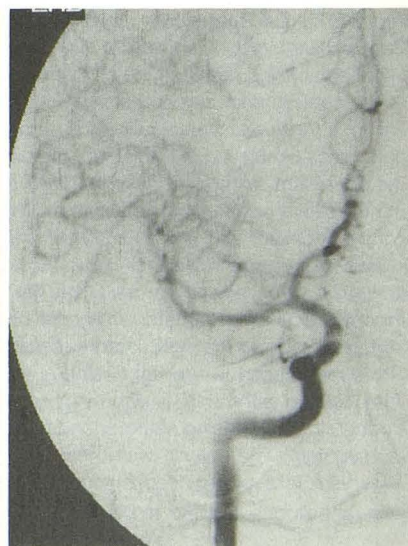
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Fig. 1.—A, Left parasagittal MR image (SE 400/20) reveals large suprasellar mass of heterogeneous signal intensity showing partially thrombosed dome of aneurysm.

B, Right carotid angiogram shows a giant anterior communicating artery aneurysm originating between pre- and postcommunicating segment of anterior cerebral artery. Aneurysm had a huge dome and rather narrow neck.

C, Plain radiograph during first procedure. Occlusive coils were packed in lumen of aneurysm past the initially detached balloon.

D, Right carotid angiogram immediately after first procedure. Note small remnant lumen at neck.

E, Right carotid angiogram before second procedure. Remnant lumen was enlarged.

F, Plain radiograph during second procedure. Second balloon was adjusted to remnant lumen at neck of aneurysm.

G, Right carotid angiogram after second procedure. Remnant lumen was almost completely obliterated.



from cerebral circulation and to preserve blood flow in the parent artery. Therefore, intraluminal obliteration may be desirable. However, initial efforts often failed to obliterate the lumen completely, and discouraging complications followed treatment for some aneurysms [8, 9, 17]. Owing to recent developments in equipment, it has become possible to embolize aneurysm lumens completely in many cases. In patients with poor collateral circulation and in whom bypass surgery is not possible, such as cases involving an anterior communicating artery or a basilar artery, intraluminal obliteration by an endovascular approach might be the preferred treatment.

It is necessary in intraluminal obliteration to occlude the aneurysm in order to avoid regrowth, rupture at the neck, or distal thromboembolism in the parent artery after treatment [18, 19]. In giant aneurysms, more than one balloon may be required to fill the lumen. In our case, several balloons seemed necessary, but the initial balloon prevented further insertions, and use of multiple balloons was impossible. If the aneurysm had been left in such a condition, with the first balloon acting like a ball valve, intraluminal pressure might have increased and caused the aneurysm to rupture. It therefore became necessary to pack the residual lumen by some other method. The tip of a Tracker-18 catheter, when combined with a steerable guidewire, is not as flexible as a detachable balloon catheter. This allowed the insertion of the catheter into the residual lumen past the first balloon and enabled us to use occlusive coils for packing. That such a condition might occur in the application of multiple balloons should be kept in mind.

Occlusive flower coils were very useful in obliterating the large lumen of the giant aneurysm, as they became spherical on release from the catheter and occupied a variable space according to the caliber of the coiling. When coils are used in the embolization of the lumen of an aneurysm, they may migrate from the lumen to the parent artery and cause a distal embolism [20]. In this case, the initial detached balloon acted as a plug at the orifice of the aneurysm, and the risk of coil migration was low. Another problem in using coils is enlargement of the remnant lumen after the procedure. Two mechanisms may be responsible in such a process. One involves decrease of the space between coils, and the other involves the burying of coils in the thrombus that existed before embolization. Careful follow-up to detect enlargement of any remnant lumen is necessary after these coils are used.

In our second procedure, slowly solidifying HEMA was used for the detachable balloon after initial adjustment of the balloon to the small remnant lumen. When precise adaptation of the balloon is necessary, exchanging the entire content of the balloon is not desirable, so slowly solidifying HEMA is indicated in such cases.

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