Transcranial Clipping of Recurrent Cerebral Aneurysms After Endovascular Treatment

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Background and Purpose: Treatment of intracranial aneurysms by interventional neurovascular techniques may be useful as a therapeutic alternative. We describe two cases of recurrent aneurysms after endovascular treatment using detachable balloons.

Case Description: Two cases are reported of recurrence 2 years after endovascular treatment of cerebral aneurysms (posterior communicating in both cases). One patient had a subarachnoid hemorrhage after rupture of a posterior communicating aneurysm. The other patient had an aneurysm diagnosed incidentally after a contrast-enhanced computed tomographic scan of the head for an unrelated problem. Endovascular balloon embolization of both aneurysms was performed without any immediate complication. Two years after treatment, a cerebral angiogram showed recurrent aneurysms. Surgical clipping excluded both aneurysms definitely.

Conclusions: These cases highlight the importance of control angiography at long-term follow-up and emphasize the significance of balloon migration after endovascular treatment of aneurysms. (Stroke 1993;24:1087-1089)

KEY WORDS • angiography • balloon embolization • cerebral aneurysm • endovascular therapy

Since 1974, when Serbinenko first described an interventional technique using detachable balloons to treat cerebrovascular lesions by endovascular occlusion, many authors have successfully used this approach to treat cerebral aneurysms. Development of real-time digital subtraction angiography, detachable balloons, and permanent solidification agents paved the way to a secure technique, especially in those aneurysms that are difficult to manage surgically. Complications inherent in this technique are now well known. Aneurysms recurring shortly after balloon occlusion have been described, with the phenomenon of "water-hammer effect" proposed as being responsible for enlargement of aneurysms. Two cases of cerebral aneurysm treated by endovascular occlusion presenting recurrent aneurysms are described.

Case Reports

Case 1

A 46-year-old woman suffering from hypothyroidism was seen in consultation in the ophthalmology department for progressive decreased visual acuity in her right eye. She had been evaluated in the past for bilateral exophthalmia and treated medially.

Visual examination disclosed a decreased visual acuity in her right eye. Computerized tomography (CT) of the orbits revealed an aneurysm of the left posterior communicating artery contralateral to her visual deficit. Four-vessel arteriography confirmed this fortuitous diagnosis (Fig 1) of an ophthalmic and carotid-posterior communicating aneurysm.

The patient was reluctant to undergo a transcranial clipping of her aneurysm and preferred to have endovascular treatment. A Balt No. 3 x-ray balloon with HEMA was then put into the carotid-posterior communicating aneurysm. The technique was well tolerated, and she was discharged 10 days later after a control angiogram confirmed the success of the treatment (Fig 2). The ophthalmic aneurysm was left intact for an undetermined reason.

On follow-up, she complained of left retro-ocular and temporal pain, which became increasingly frequent and severe both in duration and intensity. Pain could not be controlled despite attempts with a variety of medications. Two years after her embolization she was still symptomatic, and a cerebral angiogram revealed a recurrence of the left carotid-posterior communicating aneurysm, larger in size and irregular in contour (Fig 3). The ophthalmic aneurysm on the same side did not show any significant change.

A left pterional craniotomy was performed. The aneurysm had a broad neck with a yellowish, indurated anterolateral side compared with the soft, grayish pos- terolateral portion. Proximally, the internal carotid artery was rigid on the lateral side, and during dissection of the neck of the aneurysm, slight medial retraction of the internal carotid artery caused an en bloc movement of the whole aneurysm. A long, straight Sugita clip was used to exclude the aneurysm, but the balloon had a tendency to slip the clip medially, causing a partial decrease of carotid artery lumen. The ophthalmic aneurysm was clipped at the same time without major difficulty.

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Postoperatively, the patient did well and was discharged 10 days later. One year later, she was still free of pain and not taking any analgesic medication.

Case 2
A 52-year-old woman suffered a spontaneous subarachnoid hemorrhage manifested by a sudden headache at work without any loss of consciousness.

Neural examination was normal except for neck stiffness and a positive Kernig's sign. CT revealed blood in the basal and left sylvian cisterns. Four-vessel angiography disclosed an aneurysm of the left posterior communicating artery (Fig 4).

Transcranial surgery was declined by the patient, and an embolization of the aneurysm was performed successfully using a Balt No. 3 x-ray balloon with HEMA (Fig 5).

On follow-up, she complained of left retro-ocular pain progressively more severe and difficult to control with medication. Eighteen months later, she underwent a cerebral angiogram that showed a recurrent aneurysm of the left posterior communicating artery, larger in size and irregular in shape. The balloon was still in place (Fig 6).

A left pterional craniotomy was performed the next week. The neck of the aneurysm was slightly rigid and yellowish. The balloon was partially visible through the aneurysm. Two clips were applied to obliterate the neck of the aneurysm, partially narrowing the internal carotid artery.

Postoperatively, the patient denied any retro-ocular pain. She was discharged 10 days later. Fourteen months later, she was still pain free without any medication.

Discussion
Surgical exploration and clipping remain the treatment of choice for the majority of patients diagnosed...
and thrombosis of the aneurysm is unpredictable. The importance of ensuring a close follow-up and angiographic control of the state of the aneurysm many months later is emphasized by these two particular cases. Intracranial aneurysm clipping entails more risk when it follows embolization mainly because of the larger size and fragility of the aneurysm. In the two cases we describe, the neck of the aneurysm and part of the internal carotid artery were more rigid than usual. These elements make it difficult to put a clip on the neck of the aneurysm without compromising the lumen of the major vessel. Also, if the balloon is still adherent to the proximal part of the aneurysm, induration at this level can impede complete closure of the surgical clip, rendering total exclusion of the aneurysm impossible. That induration may be impressive, especially during microdissection where en bloc movement of the lesion is observed. Induration of the vascular wall after embolization is probably secondary to an inflammatory process and should be documented more extensively. Actually, nearby nonvascular structures could suffer from this inflammation and, combined with vascular pulsations in the aneurysm, could explain the pain felt by these patients.

Recurrence of an aneurysm after balloon embolization is a complication that has been reported with increased frequency. Recently, a “water-hammer effect” phenomenon was proposed to explain these recurrences. The absence of significant change in the size of the ophthalmic aneurysm in the first patient, contrary to the increased size of the aneurysm treated by balloon embolization, is especially interesting and raises the possibility that the presence of a balloon in an aneurysm can accelerate its growth, perhaps by a water-hammer phenomenon. At this stage of development, balloon occlusion of cerebral aneurysm should be reserved for surgically intractable aneurysms and should not be offered to a patient as a less traumatic alternative treatment. Furthermore, initial complete obliteration of an aneurysm by balloon occlusion therapy should not be interpreted as a cure, as is demonstrated by these two cases and also by experimental studies.

**Conclusions**

Two patients with posterior communicating aneurysm were treated with intra-aneurysmal balloon occlusion. Recurrent aneurysms appeared many months later after an apparently successful therapy. Transcranial clipping of the aneurysms was performed successfully despite the larger size of the aneurysm and the solidified intra-aneurysmal balloon.

**References**

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