

Surgical Clipping of a Recurrent Small Saccular Aneurysm After Repeated Coil Embolization

—Case Report—

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Abstract

A 59-year-old healthy woman presented with sudden onset of severe headache. Computed tomography and digital subtraction angiography (DSA) demonstrated subarachnoid hemorrhage (grade I according to the Hunt and Hess classification) due to a ruptured small right posterior cerebral artery (PCA) aneurysm. The ruptured PCA aneurysm was completely embolized with three Guglielmi detachable coils (GDCs). However, follow-up DSA 3 months after the initial coiling confirmed refilling of the aneurysm. The aneurysm was successfully re-embolized with two GDCs. Follow-up DSA 10 months later revealed regrowth of the aneurysm. Surgical clipping was performed without compromising the parent vessels. Long-term angiographic follow up is necessary even in patients with small saccular aneurysms which are apparently completely embolized by endovascular coil treatment.

Key words: cerebral aneurysm, endovascular surgery, Guglielmi detachable coil, regrowth, surgical clipping

Introduction

Endovascular treatment for intracranial aneurysms is increasingly common, especially since the introduction of Guglielmi detachable coils (GDCs) in 1990, and is now considered an effective alternative to surgical clipping.¹⁴⁾ However, the long-term results of coil embolization are poorly documented, and many cases of incompletely embolized aneurysms or regrowth after complete coil embolization, particularly in wide-neck/large aneurysms, have been reported.^{1,3,4,6-8,13,18-20)}

We treated a patient with subarachnoid hemorrhage (SAH) due to a ruptured small saccular aneurysm twice with GDCs, and finally by surgical clipping for aneurysm refilling.

Case Report

A healthy 59-year-old woman presented with sudden onset of severe headache. Computed tomography (CT) revealed SAH (grade I according to the Hunt

and Hess classification) predominantly in the right ambient cistern. Digital subtraction angiography (DSA) demonstrated a small posterior cerebral artery (PCA) aneurysm (2.7 × 4.1 mm) projecting laterally at the bifurcation of the right posterior temporal artery (Fig. 1A). The ruptured PCA aneurysm was successfully embolized with three coils (1 GDC10, 3 mm Helix/6 cm; 2 GDC10, 2 mm Helix/2 cm) and the volume embolization rate was 29% (Fig. 1B). The patient made a remarkable recovery and was discharged without neurological deficits. Follow-up DSA 3 months after the endovascular treatment found refilling of the aneurysm at the neck (Fig. 2A). The aneurysm was again completely embolized with two coils (2 GDC ultra soft, 2 mm Helix/2 cm) (Fig. 2B). Follow-up DSA 10 months after the second coiling showed regrowth of the aneurysm (Fig. 3A). Further endovascular treatment was declined.

Surgical clipping was performed through a subtemporal approach. During the microsurgical procedure, most coils in the aneurysm dome were

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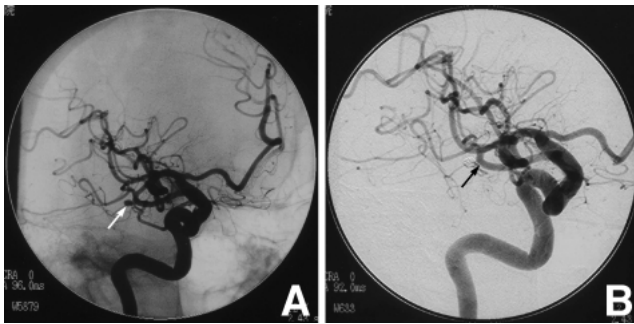


Fig. 1 (A) Right carotid angiogram taken before coil embolization, right oblique view, showing a small saccular aneurysm (arrow) of the posterior cerebral artery (PCA) projecting laterally at the bifurcation of the right posterior temporal artery. The PCA is perfused via the posterior communicating artery. (B) Right carotid angiogram taken immediately after coil embolization demonstrating complete occlusion of the aneurysm, and partial coil migration (arrow) from the aneurysm into the PCA.

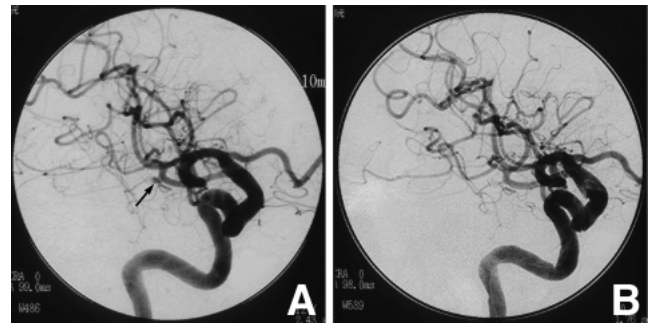


Fig. 2 (A) Follow-up right carotid angiogram obtained 3 months after the initial coil embolization showing recanalization of the posterior cerebral artery aneurysm (arrow) and the coil which migrated immediately after initial coil embolization in the neck of the aneurysm. (B) Right carotid angiogram immediately taken after repeated embolization with two coils demonstrating complete occlusion of the aneurysm.

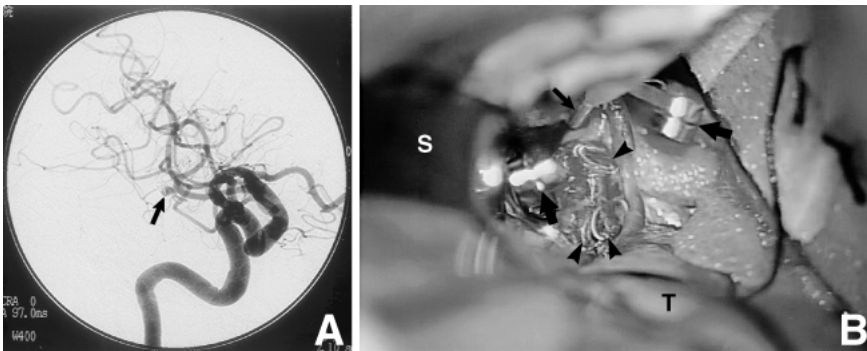


Fig. 3 (A) Follow-up right carotid angiogram taken 10 months after the second coil embolization showing refilling of the aneurysm (arrow) at the fundus. (B) Intraoperative photograph showing coils (arrowheads) through the thinned translucent membrane, and the temporary clips applied to the posterior cerebral artery (thick arrows) and to its branch (arrow). S: spatula, T: temporal lobe.

observed through the thinned translucent membrane, but some coils had protruded and adhered to the temporal lobe. This membrane was slightly yellowish, which was probably due to the inflammatory response to the coils (Fig. 3B). After temporary occlusion of the parent vessels, the wall of the dome was sharply cut, and removal of these coils was attempted before clip application. However, the strong adhesion of the coils to the organized thrombus and the arterial wall allowed only partial removal. Finally, a curved clip was applied with preservation of some coils near the neck of the aneurysm without compromising the parent vessels.

The postoperative course was uneventful, and the patient returned to normal daily life.

Discussion

Most previous cases of aneurysm clipping after coil embolization occurred after initial incomplete coiling or regrowth of a wide-neck/large aneurysm, whereas only a few cases involved recurrent small aneurysm after complete GDC embolization.^{1,20)} In the present case, follow-up DSA 3 months after complete GDC embolization of the ruptured small PCA aneurysm revealed neck regrowth, and

complete GDC re-embolization was performed. Ten months after re-embolization, follow-up DSA again confirmed neck regrowth.

The natural history of residual and recurrent aneurysms after GDC embolization remains unclear, and the indications for immediate further treatment for regrowth/refilling of an aneurysm have not been defined. Based on 5-year experience with coil embolization for ruptured aneurysms, the repeat rupture rate was 8% for aneurysms with progressive regrowth.²⁾ In our case, surgical clipping was chosen because the aneurysm regrowth had occurred within a short time after repeated embolization by endovascular coil treatment.

The necessity for coil extraction is controversial in the surgical clipping of a previously embolized aneurysm.^{3,4,7,18)} In our case, the coils around the aneurysm fundus had become incorporated into a dense scar within the vessel wall and could not be removed, so finally the clip was applied to the aneurysm neck without stenosis of the parent vessels. Nevertheless, compromising the parent artery by clip application without complete removal of coils may require bypass surgery, such as superficial temporal artery to PCA anastomosis.

Several causative factors have been proposed for the mechanism of aneurysm refilling: the "water-hammer effect" of the pulsating blood stream^{5,11)}; low coil packing density especially if the volume embolization rate is below 20%^{10,17)}; migration of GDCs into preexisting fresh thrombi in the dome of the aneurysm; and extrusion of GDCs. In the present case, DSA 3 months after the first embolization demonstrated displacement of the GDCs despite the apparently complete obliteration (Fig. 2A). Fresh thrombi in addition to pulsating blood flow probably resulted in coil compaction and/or coil migration, although preoperative CT and DSA did not identify any fresh thrombi. According to the findings during surgical clipping, only small parts of the GDCs had protruded and adhered to the temporal lobe. Therefore, there was probably no close relationship between the coil protrusion and the aneurysm regrowth. As the aneurysm regrowth occurred in a short period in spite of the additional endovascular coiling, the inflammatory change in the aneurysm wall confirmed during the operation may have interfered with neointimal formation across the aneurysm neck.

Aneurysm recurrence may be reduced by further technological innovations, such as new coil designs that incorporate bioactive materials.^{9,12,15,16)} However, recurrence will continue to be a serious problem as a large number of aneurysms have been treated with bare coils, so the number of cases of

recurrent aneurysm will undoubtedly increase with time. Long-term angiographic follow up is essential to monitor for possible sequelae, even in patients with small saccular aneurysms that were completely embolized with GDCs.

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