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Management of a Complicated Cerebral Aneurysm with Distal Migration of a Detachable Coil : A Case Report

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ABSTRACT

We describe our experience in which the migration of a coil into the parent artery occurred during the coil embolization. A feared complication during coil embolization of cerebral aneurysm is parent artery occlusion by migration of a detachable coil. Obstruction with migration of the coil into the parent artery may be especially hard to solve with an endovascular procedure. The patient had an unruptured internal carotid artery trunk aneurysm where endovascular treatment was performed with detachable coils. One of the packed coils escaped from the sac and migrated into the distal middle cerebral artery (MCA). Cerebral angiography demonstrated non-filling of a number of MCA branches. Repeated attempts at endovascular retrieval of the migrated coil were unsuccessful. Only after an emergent arteriotomy the migrated coil could be successfully removed. Subsequently, endovascular intra-arterial thrombolysis was required to dissolve the thrombus formed postoperatively in the distal MCA. The patient fully recovered with no neurological deficit. In our case a combined surgical and endovascular treatment of coil migration were performed. **(Kor J Cerebrovascular Surgery 11(3):118-21, 2009)**

KEY WORDS : Coil migrationm · Coil retrieval · Arteriotomy · Thrombolysis · Cerebral aneurysm.

Introduction

In the past two decades there has been a significant evolution in endovascular technology. However, various complications have arisen with the evolution, particularly in wide-necked aneurysms. Obstruction of distal arteries by a migrated coil is one of the most disastrous complications that can occur during an endovascular treatment of cerebral aneurysms. Endovascular retrieval of a distally migrated coil is almost impossible. We present a case of an internal carotid artery (ICA) aneurysm complicated by migration of a coil into the insular branch of the middle cerebral artery (MCA) that was retrieved by arteriotomy and required intra-arterial urokinase injection to dissolve a postoperative thrombus.

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Case Report

A 40-year-old man was referred to our cerebrovascular center for an aneurysm on the anterior wall of the left ICA that was found incidentally during a health check-up. The aneurysm was located on the left ICA ophthalmic segment with a supero-lateral direction. It had a maximal diameter of 4mm and multi-lobular in shape (Fig. 1). Even though the size of the aneurysm was small the decision was made to occlude it by endovascular embolization, considering the patient's relatively young age and the irregular shape of the aneurysm. The procedure was performed under general anesthesia, systemic heparinization, catheterized with a microcatheter and a guidewire. Although the neck of the

aneurysm was broad, coil embolization without a stent or balloon could be possible. The first and second coil were successfully packed. Unfortunately soon after the insertion of the third coil, it detached and escaped into the insular branch of the MCA causing complete flow blockage of the premotor and motor cortex (Fig. 2A and B). Repeated attempts at endovascular retrieval of the coil failed. Only an emergent craniotomy at the operating room could remove the coil. Still under general anesthesia a left frontotemporal craniotomy approach was done. The craniotomy was extended posteriorly as much as possible to provide access to the migrated coil. The Sylvian fissure was opened distally until the migrated coil could be identified. It was superficially located between the junction of the insular artery and its two branches (Fig. 3A). The precentral sulcal branch and the postcentral sulcal branch were totally occluded. The coil was removed through arteriotomy (Fig. 3B). Viable Doppler sound confirmed blood flow back on the insular artery and its anterior branch, but none on the postcentral sulcal branch. We believed that a thrombus developed distal to where the coil had migrated to. Attempts to dissolve the thrombus intraoperatively with heparin and urokinase failed. Efforts to remove the thrombus with microforceps and suctioning were also tried with no luck. Then, the arteriotomy vessel was repaired with 10-0 nylon without aneurysm clipping and the patient was moved to the angiography room. Immediate postoperative angiography confirmed recanalization of the insular artery to the

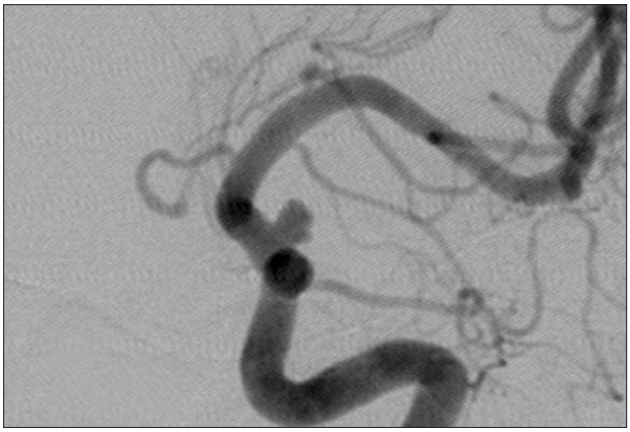

Fig. 1. Preoperative cerebral angiography showing an aneurysm on the dorsal wall of left ICA.

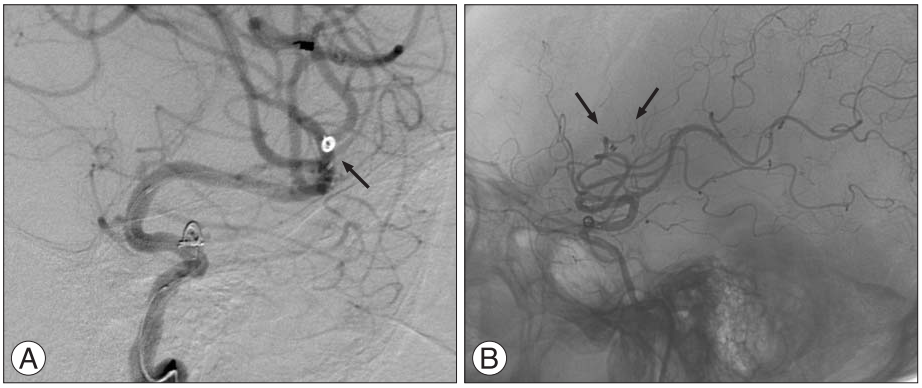

Fig. 2. A ; an AP view of the angiogram showing detachment of the third coil soon after it was inserted which migrated into the distal MCA. The coil could be seen on the branching site of one of the insular artery (arrow). B ; a lateral view showing the flow of the insular branches cut off (arrow).

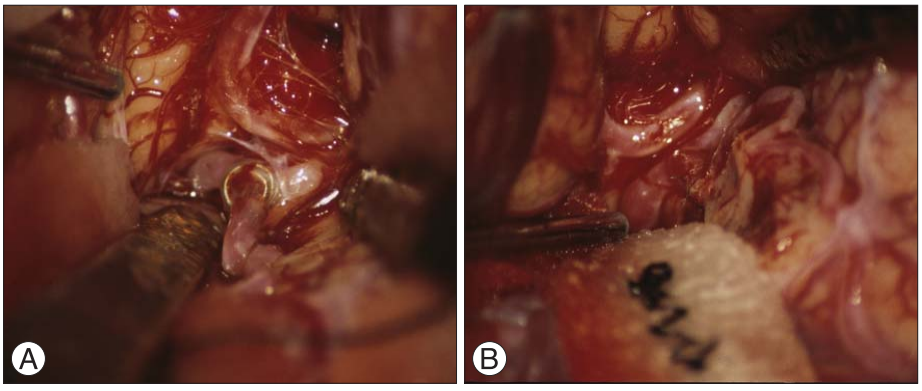

Fig. 3. A; migrated coil seen at the junction of insular artery and its two branches. B; the coil was removed by arteriotomy. Viable doppler sound confirmed flow on insular artery and its anterior branch, but none on its posterior branch.

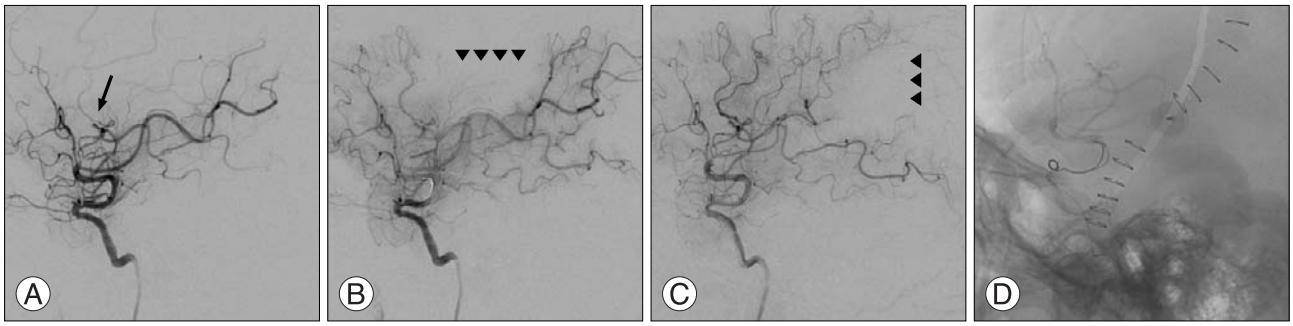

Fig. 4. A; postoperative angiogram showing recanalization of precentral sulcal branch of the insular artery (arrow). Postcentral sulcal branch remained occluded. B; during intra-arterial injection of urokinase avascular zone was noted and central sulcal branches were not visualized. C; occluded branches were partially recanalized after injection of urokinase, but the posterior parietal branches of the left MCA were not visualized. D; occlusion of the posterior parietal branches were probably due to thrombus from the unraveled coil.

precentral sulcal branch had succeeded, but the postcentral sulcal branch was still blocked (Fig. 4 A, B). Intra-arterial injection of urokinase and heparin was tried. To make matters worse the posterior parietal branches of the left MCA were also occluded (Fig. 4 C) during the intervention probably due to the thrombus from the unraveled coil (Fig. 4D). After injection of 300,000 units of urokinase, all occluded branches were completely recanalized. For the prevention of thrombus reformation intra-arterial irrigation with tirofiban (1.5mg) was done. Afterwards the aneurysm was finally completely packed with detachable coils under stent assistance. Final cerebral angiogram confirmed that the aneurysm was totally occluded and that cerebral blood flow was completely restored (Fig. 5). The patient later fully recovered from anesthesia without any neurological deficits. Computed tomography (CT) scan obtained a day after the operation was unremarkable and showed no ischemic lesion.

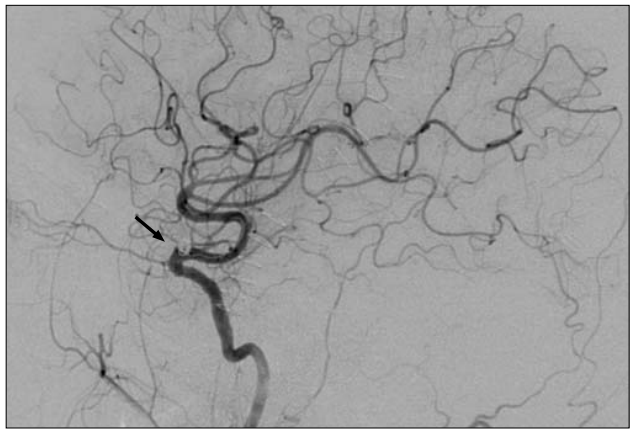

Fig. 5. Final cerebral angiography showing complete packing of the aneurysm (arrow) and cerebral blood flow completely restored.

Discussion

In the management of unruptured intracranial aneurysms, endovascular embolization has become a widely used method. With the introduction of Guglielmi detachable coils in 1990 by Guglielmi, intracranial aneurysms could be treated minimally invasively with this therapeutic option.[6] Thanks to the improvement of endovascular technology and equipment throughout the years, an increasing number of cerebral aneurysms are treated with this technique. However, as shown by our instance numerous complications have arised.[1)3)11)13)] Recent trends show that the neurosurgeons are reducing the number of surgically treated aneurysms, while at the same time endovascular related complications are proportionally increasing which in general are a difficult surgical agenda.[2)] Despite modern advances in endovascular techniques coil embolization are associated with fatal complications such as parent artery occlusion by thromboembolism, coil migration or incomplete treatment which in turn requires surgery. Although coil unraveling has been reported to occur in less than 2% of cases, the most serious complications of endovascular treatment are premature rupture and obstruction of the parent artery by coil migration.[1)13)] Endovascular re-treatment of a coil-embolized aneurysm is usually impossible; obstruction with migration of a coil into the parent artery may be especially hard to resolve with an endovascular procedure. In this

situation surgical treatment should be considered first.[2)9)14)] It is very important to remove the migrated coil and thrombus as soon as possible by means of arteriotomy and intra-arterial thrombolytics.[7)14)] Unfortunately current advanced coils are made of thrombogenic material and intra-venous heparin is contraindicated during operation. Thrombus formation at the distal branch of the occluded artery will aggravate even if the coil is removed. Frequently the flow of the parent vessel does not re-canalize as intended.

In our case the migrated coil was removed through arteriotomy but a thrombus developed distal to the migration and cut off the flow of the insular branches. Heparin and urokinase injection through the arteriotomy site had limited effect. Only one branch was partially re-canalized while the other remained occluded. Under the circumstances it was a prompt and wise decision to resolve the occlusion by intervention because the degree and the range of the occlusion could not be fathomed through the operation field. Rapid extraction of the migrated coil maybe the most important procedure, but does not always guarantee a re-canalization of the obstructed artery. If the distal flow is not re-canalized after arteriotomy and coil removal, an angiogram should be performed immediately.

Through this case we have learned that a balloon or a stent would have helped the endovascular coiling bearing in mind that the aneurysm had a wide neck.[5)8)] Another factor that has to be considered was the inappropriate size between the coil and the aneurysm. A 2 × 2 mm coil (Trufil; Cordis Neurovascular, Miami, FL, USA) was used in a 5-mm-diameter aneurysm. The anatomical position of the aneurysm enabled blood flow currents to sweep away an undersized, loosely packed coil through a relatively broad exit. This complication will hopefully not happen in the near future if a suitable sized coil is used under a stent or balloon assistance.[4)10)12)] Only the harmony of vascular neurosurgeons and endovascular specialists can provide the optimal management in endovascular related mishaps.

Conclusions

Distal coil migration during endovascular treatment of an intracranial aneurysm can result in thromboembolism and obstruction of parent artery. This can be solved successfully by combining arteriotomy and intra-arterial injection of urokinase. Nevertheless a cerebral angiogram should always confirm re-canalization of occlusion as soon as possible.

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