

# Endovascular Aneurysm Treatment With Multiple Microsystems

A distal access catheter with a large inner diameter assists in treating a complex-shaped middle cerebral artery aneurysm.

BY SATOSHI TATESHIMA, MD

**E**ndovascular treatment of middle cerebral artery (MCA) aneurysms is challenging due to the involvement of multiple eloquent branches around the aneurysm neck body and dome.<sup>1</sup> To protect those eloquent branches from unexpected coil migration and resultant branch occlusion, the simultaneous use of a microcatheter for coil delivery and a microballoon is required. The balloon is inflated adjacent to the aneurysm neck while the coils are delivered, helping to keep the coils within the aneurysm. This double-catheter technique helps preserve vessels adjacent to the aneurysm neck from becoming occluded, but it requires a larger guide catheter for implementation.

Recently, a new distal access guide catheter, the ReFlex catheter with a 0.072-inch lumen (Reverse Medical Corporation, Irvine, CA), was introduced in the United States and European markets (Figure 1). The ReFlex catheter employs a combination of nitinol and a special tertiary polymeric composite. This unique structure results in a thin-walled device, possessing extreme flexibility and kink resistance and providing a large inner diameter (ID) for use as a guide catheter. The ReFlex catheter has a 6-F outer diameter (OD), which is the typical OD size used during intracranial intervention.

To gain intravascular access in tortuous extracranial carotid and vertebral anatomy as high as the skull base, the guide must be flexible with good column strength. Among neuro guide catheters, this 0.072-inch ID provides the largest access presently available. In this article, I report on the use of this new catheter for the endovascular treatment of a wide-necked right MCA bifurcation aneurysm, which was associated with multiple technical difficulties.

## CASE REPORT

A 39-year-old woman with a history of systemic lupus erythematosus, hypothyroidism, and diabetes was found

to have an intracranial aneurysm at the right MCA bifurcation. The aneurysm measured 7 mm in the largest diameter at its dome and 3.9 mm at the neck. There was a small bleb on the dome of the aneurysm. One of the branches of the intracranial MCA, the posterior division of the MCA bifurcation, was incorporated at the base of the aneurysm (Figure 2). There was also a small anterior temporal branch coming off near the right MCA bifurcation.

Considering the patient's young age and at least 0.5% annual risk of aneurysmal subarachnoid hemorrhage, the options of open surgical ligation and endovascular occlusion were discussed. The patient expressed a strong desire to avoid open surgery and opted for endovascular occlusion using detachable coils.

To protect the posterior division of the MCA from being occluded during coil delivery, balloon-assisted coil embolization was performed. However, there were some anatomical challenges in her intracranial vascular anatomy. The A1 segment of the right anterior cerebral artery and the right posterior communicating artery were aplastic. As a result, the right internal carotid artery (ICA) was very slender because it only fed the right MCA territory. The diameter of the right ICA required a special guide catheter.

The endovascular procedure was performed under general anesthesia. The right groin was punctured, and a 6-F Shuttle sheath (Cook Medical, Bloomington, IN) was advanced into the right common carotid artery. Via the sheath, a ReFlex catheter was gently advanced and placed at the petrous segment of the right ICA. Intra-arterial nitroglycerin was required to alleviate ICA spasm. Regardless, there was mild spasm in the ascending cervical segment of the right ICA, which resolved after a 5-minute pause of catheter manipulation.

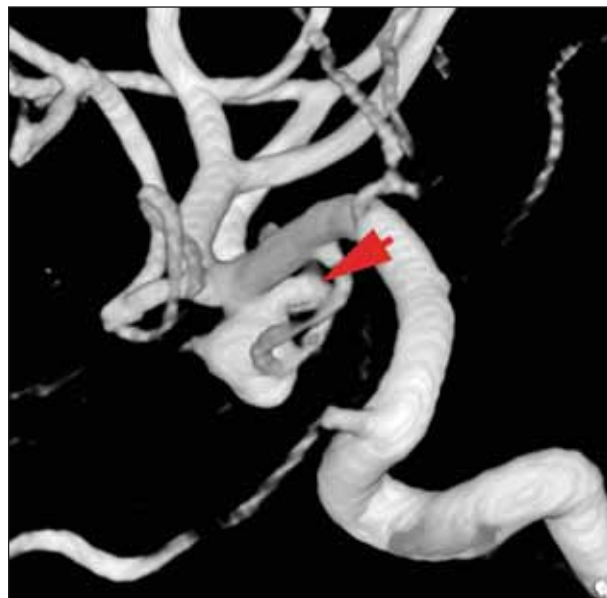
Both an Echelon 14 microcatheter with a 2.4-F OD (Covidien, Mansfield, MA) and a 4- X 7-mm HyperForm



**Figure 1.** The distal portion of the ReFlex catheter with a microcatheter and balloon. Note the large remaining lumen with two microsystems in the catheter.

occlusion balloon with a 2.8-F OD (Covidien) fit inside of the ReFlex catheter. A gentle curve was given to the tip of the microcatheter with a steam-shaping technique. The balloon was placed across the aneurysm neck and into the posterior division of the right MCA followed by placement of the microcatheter in the aneurysm dome over an Xpedion 14 microguidewire (Covidien).

A 4-mm X 10-cm Target 360 standard detachable coil (Stryker Corporation, Kalamazoo, MI) was gently placed in the aneurysm dome while the balloon was inflated across the aneurysm neck (Figure 3). After achieving a favorable coil frame, the aneurysm was completely embolized with subsequent placement of five Target detachable coils. Multiple intermittent angiograms were obtained during the coil embolization and confirmed the



**Figure 2.** Three-dimensional digital subtraction angiogram (medial-to-lateral view) showing a saccular aneurysm arising from the right MCA bifurcation. There is a branch incorporated at the base of the aneurysm (arrow).

patency of all branches arising from the right MCA bifurcation. The final angiogram showed complete obliteration of the aneurysm (Figure 4). After the procedure, the patient was extubated without any neurological deficits. She was discharged home the next day.

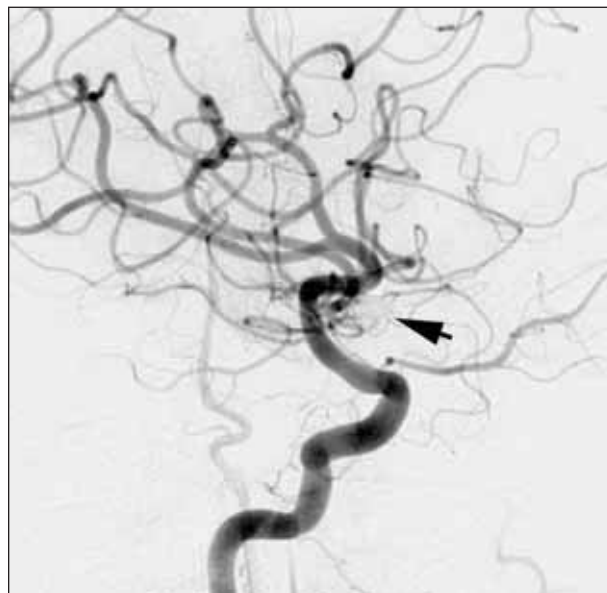
## DISCUSSION

Endovascular treatment for complex-shaped intracranial aneurysms frequently requires simultaneous use of a microcatheter for coil delivery and a balloon catheter for coil remodeling. A double-microcatheter technique has also been described for giant intracranial aneurysms requiring simultaneous delivery of coils from both catheters.<sup>2</sup> Distal purchase of the guide catheter determines the degree of control for the microcatheter and balloon system. Distal access is preferable, especially if the extracranial brachiocephalic anatomy is tortuous.<sup>3</sup>

The guiding catheter must have a large enough ID to accept the microcatheter and balloon catheter. There must also be appropriate space for contrast injections. During neurointerventional procedures, there are two ways to gain guide catheter stability. One way is to use a larger and stiffer guiding catheter. The other method requires a guide sheath with a coaxial guide catheter. Inherently, a larger guiding catheter or guide sheath is not flexible enough to be placed in the distal extracranial ICA or vertebral artery. By using a coaxial guide system, the more rigid, large-OD guide sheath can be positioned in a larger, more proximal portion of the



**Figure 3.** Intermittent right ICA angiogram (lateral view) shows a balloon placed across the aneurysm neck and a coil mesh in the aneurysm dome.



**Figure 4.** The final digital subtraction angiogram of the right ICA (lateral view) shows complete obliteration of the aneurysm (arrow) with preservation of all eloquent MCA branches.

brachiocephalic vessel. Using a nitinol braided 0.072-inch, 6-F guide catheter enables positioning of the distal guide tip near the skull base or, in this case, in the intracranial portion of the ICA. This allows the interventionist to position the microcatheters and balloon catheters in tortuous intracranial anatomy.

This patient's ICA tapered from 3.5 mm as it ascended from the extracranial to horizontal petrous segment. Extracranial and intracranial brachiocephalic vessels are prone to manipulation-based vasospasm in young women. A guiding catheter with a large ID was required to treat this patient's complex-shaped aneurysm with the use of a microcatheter and balloon catheter.

Furthermore, it was crucial to have additional space to allow a contrast injection so that angiography could be performed during balloon-assist coiling to ensure adjacent vessel patency. The ReFlex catheter met all of those needs with good navigation capability into the tapered ICA, a soft, spring-like structure that induced no significant arterial straightening, and a large 0.072-inch lumen that allowed contrast angiography during the coiling procedure.

Balloons typically used for balloon-assisted coiling include the 4- X 7-mm HyperForm and the HyperGlide balloon series (Covidien). The ReFlex catheter's lumen was large enough to accommodate the HyperForm and a microcatheter. The ReFlex also provides a platform for the treatment of challenging intracranial aneurysms using stent-assisted coiling techniques. The ReFlex also

has a large enough ID to facilitate placement of flow diverters. The large ID of the ReFlex catheter takes a commonly used stent delivery catheter, such as the Marksman (Covidien), as well as another microcatheter, such as the Echelon, and thus provides more options to neurointerventionists and makes intracranial stenting safer.

## CONCLUSION

The ReFlex distal access guide catheter was used to treat a complex, wide-necked MCA aneurysm with an MCA branch incorporated at its neck. The thin-wall, extreme flexibility, and large ID of the ReFlex helped to avoid vasospasm in an unusually tapered and narrow portion of the ICA anatomy and allowed the simultaneous and safe use of two microsystems. ■

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