Advancing Loop Technique for Endovascular Access to the Anterior Cerebral Artery

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Summary: Direct endovascular access to the anterior cerebral artery (ACA) with a guidewire and catheter is not always possible. A C-shaped guidewire advanced as a loop into the middle cerebral artery and then withdrawn to advance the guidewire into the ACA is a way to gain endovascular access to the ACA when the direct approach is unsuccessful.

The ability to readily access the anterior cerebral artery (ACA) distribution has become important because of the increasing role of endovascular techniques in the treatment of arteriovenous malformations (AVMs) (1), aneurysms (2–5), and vasospasm (6–10) involving the ACA. The ACA has a varied and complex development and anatomy (11–13), and gaining access to a vascular abnormality can be a formidable task. It is particularly difficult when the siphon is tortuous and there is an acute angle of origin of the ACA from the internal carotid artery (ICA).

Proper projection of the ICA bifurcation and the origin of the ACA can be most helpful. As a general rule, a 45° ipsilateral oblique projection will adequately display the anatomic configuration of the ICA bifurcation and origin of the ACA (Fig 1A and B). Shaping the microcatheter or guidewire or both may allow direct access to the ACA. Roadmapping combined with the proper projection and an appropriately shaped catheter or guidewire often facilitates access into the ACA (Fig 1C). However, despite the use of these techniques, access to the ACA sometimes remains elusive. A simple technique (advancing loop) involving a guidewire with a C curve combined with the proper projection and roadmapping has allowed access to the ACA in these difficult cases.

Technique

Shape a guidewire (FlexTip 14, Target Therapeutics, Fremont, Calif) into a C shape. Allow the C loop to form in the proximal ICA siphon. Advance the guidewire through the siphon, allowing it to elongate into a U shape (Fig 2A), and advance the loop into the MCA until the tip of the guidewire is distal to the origin of the ACA (Fig 2B). Then slowly withdraw the loop, with the tip of the guidewire directed toward the superior wall of the MCA and origin of the ACA (Fig 2C). The tip will engage the origin of the ACA and, with further withdrawal, will advance into the ACA (Fig 2D). Once the guidewire is in the A1 segment and the loop is reduced, the guidewire may be advanced farther into the ACA by direct advancement of the guidewire. When adequate purchase is obtained with the guidewire, the microcatheter (Fast Tracker 10, Target Therapeutics) can be advanced over the guidewire.

In our practice over the past 4 years it has been necessary to selectively access the ACA 12 times. The advancing loop technique has been used successfully in three of these cases without any associated complications. Before attempting selective endovascular access of the ACA it should be determined that selective access is absolutely necessary and that a nonselective approach will not suffice. The small-caliber vessels, complex and varied anatomy (14–21), and the significant perforating vessels that arise from the ACA (14, 15, 22, 23) make it imperative that the anatomy is well defined, understood, and profiled, and that great care is used in any attempt to access the ACA, as damage to this vessel can cause significant neurologic harm (24). We used the advancing loop technique to access the ACA in three cases in which the direct approach to endovascular treatment of saccular aneurysms had been unsuccessful.

In cases of vasospasm involving the ACA, we limited attempts to access the ACA to the direct approach and, if unsuccessful, elected to forego balloon angioplasty and infuse papaverine into the distal ICA. However, advances in over-the-guidewire angioplasty balloon technology may make the ACA more accessible for angioplasty. AVMs have not presented problems for endovascular access, as the vessels are large and there is preferential flow into the ACA, which facilitates direct access.

Discussion

Excessive guidewire and catheter manipulation with any technique in the small-caliber arteries of the ACA potentially increases the risk of intimal damage, dissection, and spasm, resulting in significant complications (embolic stroke, ischemia, or vascular damage). Any attempts to access the ACA should be used with appropriate discretion. Our philosophy has been 1) to determine if selective ACA access is necessary, 2) to obtain appropriate angiographic projections to define the anatomy and pathology, 3) to use roadmapping to profile the anatomy, 4) to make limited attempts with the direct approach and, if unsuccessful, 5) to attempt to access the ACA via the advancing loop technique.
In the three cases in which the advancing loop technique was used, no more than five attempts were required to successfully access the ACA. No associated complications occurred. Multiple attempts and aggressive manipulation of guidewire and microcatheter by any technique potentially increase the risk. We believe that the limited number of attempts and the simplicity of the advancing loop technique did not increase the potential for complications as compared with continued multiple unsuccessful attempts using the direct approach.

In our series, we only used one guidewire (the FlexTip) and one microcatheter (the Fast Tracker 10) combination. There are probably other combinations of guidewires and microcatheters that can be used for the advancing loop technique. The keys to selecting a guidewire/microcatheter combination include a soft, flexible microcatheter with a small diameter, and a guidewire with a distal segment that is soft and flexible enough to allow the C curve to easily elongate yet stiff enough to advance into the MCA and support the advancement of the microcatheter across the origin of the ACA.

**Conclusion**

The ACA has a complex and varied anatomic configuration. Failure to recognize and understand this anatomy and the importance of the small perforating arteries that arise from the ACA can result in significant neurologic deficits, complicating endovascular access of the ACA. The necessary angiographic projections and roadmapping that profile the anatomy and vascular lesions of the ACA are critical for gaining selective access for endovascular treatment of lesions of the ACA. If endovascular access of the ACA is necessary, we recommend trying the direct approach first. If the direct approach is not successful, we suggest using the advancing loop approach, a technique that is easily performed with currently available microcatheter and guidewire systems.

**References**