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Endovascular

# Distal intracranial catheterization of patients with tortuous vascular anatomy using a new hybrid guide catheter

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**Abstract**

**Background:** A hybrid guide catheter mates the traditional strong guide catheter with a thin, soft distal tip, allowing placement further into the distal cervical or proximal cranial circulation.
**Case Description:** We present 5 cases in which traditional guide catheters were unable to successfully navigate tortuous anatomy or provide stable support for intervention.
**Conclusion:** Hybrid guide catheters provided safe, stable support for successful treatment. Hybrid guide catheters allow for treatment for patients who previously were not candidates for neuroendovascular surgery.


*Keywords:* Hybrid guide catheter; Distal intracranial catheterization; Tortuous vascular anatomy

## 1. Introduction

Guide catheter stabilization is a fundamental of neuroendovascular surgery. A strong, large-bore catheter is placed in the cervical carotid or vertebral artery and provides a platform from which to advance microcatheters, microwires, stents, coils, balloons, and retrieval devices into the intracranial vasculature [1-4]. The attributes which afford excellent stability, however, are the same attributes that can make it difficult and sometimes dangerous to navigate tortuous vessels. A commonly used strategy in patients with tortuous anatomy is to select a vessel with a soft catheter, often referred to as a diagnostic catheter, then exchange that catheter for a guide catheter over a wire. There are many variations of individual diagnostic catheters, wires, and guide catheters and, therefore, many combinations of all 3, all of which give the interventionalist broad and effective options for working in tortuous vessels.

Nonetheless, a small percentage of intracranial lesions are still inaccessible and therefore not candidates for neuroendovascular surgery. To address this problem, a new hybrid catheter was recently introduced called the Neuron Intracranial Access System (Penumbra, San Leandro, CA.) This hybrid guide catheter adds a soft, flexible tip of variable length to a large-bore, strong platform, allowing placement of the guide catheter further into the cervical or even intracranial vessels. The soft tip can be advanced through tortuous anatomy, including 360° loops, but is still large enough to allow for coaxial navigation of microcatheters while allowing contrast to be injected for control angiography throughout the interventional procedure.

The Neuron Intracranial Access System is currently the only commercially available hybrid catheter on the market today. The catheter consists of a 6F coil reinforced shaft that tapers to a flexible 5F distal zone with a hydrophilic coating. It is available in 8 configurations of various lengths of support shaft and distal tip as well as H1 and Simmons shaped tips. The manufacturer recommends deploying the hybrid catheter over an exchange wire. The cost to the hospital for each device is currently $495.

*Abbreviations:* AVM, arteriovenous malformation; DSA, digital subtraction angiography; FDA, Food and Drug Administration.

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Table 1
Summary of cases using a hybrid guide catheter

| Cases | Sex | Age | Traditional guide catheter attempted and failed? | Procedure | Traditional guide catheter failed? | Procedure completed with hybrid guide catheter? | Hybrid catheter | Complications |
|---|---|---|---|---|---|---|---|---|
| 1 | 42 | Male | Yes | Basilar tip aneurysm coiling | Yes | Yes | Neuron 6F 115/6 straight | None |
| 2 | 42 | Male | Yes | Right middle cerebral artery aneurysm | Yes | Yes | Neuron 6F 115/6 straight | None |
| 3 | 70 | Female | Yes | Right ophthalmic artery aneurysm stent assisted coiling | Yes | Yes | Neuron 6F 115/6 straight | None |
| 4 | 70 | Female | Yes | Grade 3 AVM embolization | Yes | Yes | Neuron 6F 115/12 straight | None |
| 5 | 71 | Female | Yes | Right ophthalmic artery aneurysm coiling | Yes | Yes | Neuron 6F 115/6 straight | None |

We present 5 cases in which multiple combinations of traditional access systems were unable to provide the necessary stability and distal access to treat intracranial lesions. Our cases demonstrate how the hybrid guide catheter can assist in aneurysm coiling, AVM embolization, and intracranial stent placement (Table 1).

## 2. Cases

Case 1 is a 41-year-old man with sickle cell anemia and bilateral carotid occlusion who presented with a subarachnoid hemorrhage. A digital subtraction angiogram revealed a basilar artery aneurysm. Two separate attempts to coil the aneurysm by 2 separate interventionalists at an outside institution were unsuccessful secondary to vertebral tortuosity of both vertebral arteries, despite the use of many diagnostic, guide, and microcatheter combinations. The tension needed to force the microcatheter through the turns of the vertebral artery pushed guide catheter back toward the aorta, preventing any further microcatheter movement. Six months after his hemorrhage, a third attempt was made to coil the aneurysm with a hybrid guide catheter. The catheter was able to traverse the tortuous left vertebral artery with relative ease and provided a steady platform for coil embolization (Fig. 1).

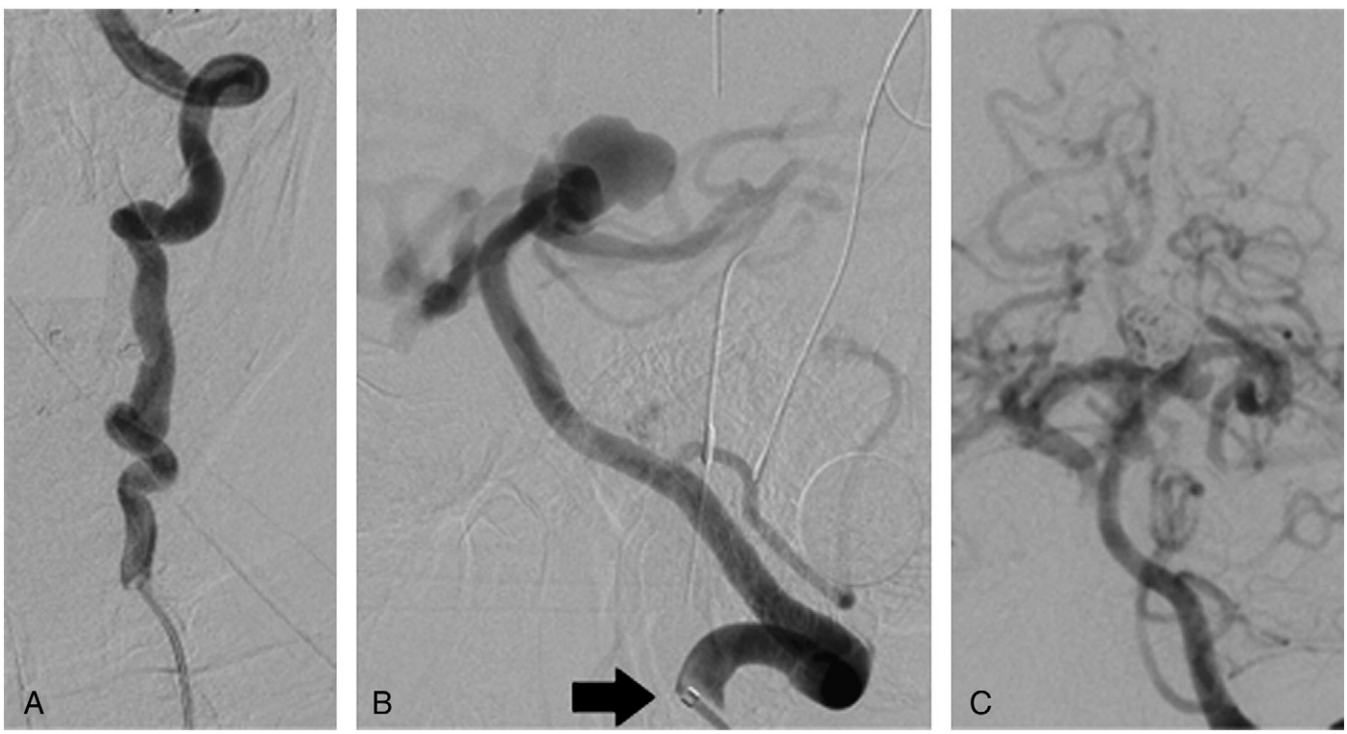


Fig. 1. Digital subtraction angiogram of the vertebral and basilar arteries. A: Anteroposterior projection of the tortuous cervical vertebral artery. B: Lateral projection of intracranial vertebral artery and basilar tip aneurysm. Black arrow indicates hybrid catheter tip advanced distal to tortuous segment. C: Anteroposterior projection of coiled basilar tip aneurysm.