Transradial Approach for Deployment of a Flow Diverter for an Intracranial Aneurysm in a Patient with a Type-3 Aortic Arch

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Abstract

Background—Flow diversion with the Pipeline embolization device (PED) is an effective treatment for giant and wide-neck intracranial aneurysms, but the standard transfemoral approach may not be feasible in patients with Type-3 aortic arches.

Case Report—An 84-year-old woman presented with a right internal carotid artery (ICA) giant aneurysm and a Type-3 aortic arch, necessitating a transradial approach for access to the right common carotid artery. A triaxial catheter system made for a stable platform for the deployment of two telescoping PEDs to treat the patient’s right ICA giant aneurysm. The procedure was technically successful, and there were no immediate complications.

Conclusion—The transradial approach allows for carotid access in patients with challenging aortic arches, and this report demonstrates its effectiveness for deployment of flow diverters, especially with a triaxial catheter system. The peripheral access point facilitates hemostasis, which is of great importance in patients on antiplatelet medications to prevent thrombotic complications of flow diverters.

Keywords
Transradial; flow diversion; Pipeline embolization device (PED); Type-3 aortic arch; intracranial aneurysm

Introduction
Flow diversion with the Pipeline embolization device (PED) has been demonstrated to be effective for wide-neck and giant aneurysms [1]. Aortic arch configuration is an important preoperative consideration for diagnostic and interventional neuroangiography procedures. The Type-3 aortic arch often necessitates specialized catheters for accessing the common carotid arteries through the transfemoral approach. However, in certain patients with especially difficult access, owing to aortic arch anatomy or tortuous great vessels, alternative approach sites (e.g., radial, brachial, and cervical) must be considered. We present a patient with a Type-3 aortic arch in whom a PED was deployed through a transradial approach.

Case Description
An 84-year-old woman presented with one month of right face dysesthesias, blurry vision in the right eye, and right abducens nerve palsy. Non-invasive imaging demonstrated bilateral internal carotid artery (ICA) cavernous segment aneurysms, with a partially thrombosed, 4-cm right cavernous ICA aneurysm. Computer tomography angiography and subsequent aortogram (Figure 1) revealed a Type-3 aortic arch.

A diagnostic angiogram was performed to better define the anatomy of the right-hand-sided aneurysm, but despite the use of multiple different catheters, the patient’s aortic arch configuration rendered the right ICA inaccessible from the transfemoral approach. After passing an Allen’s test, a right-hand-sided transradial approach was used to complete the diagnostic angiogram and access the right ICA, thus allowing for proper imaging of the aneurysm (Figure 2).

Following the procedure, she was started on dual antiplatelet therapy in anticipation of placing a PED (Med-
tronic Neurovascular, Irvine, CA, USA) for the treatment of the giant right ICA aneurysm.

One month later, the patient was brought back for aneurysm treatment with the PED under general anesthesia through a right radial approach. Access was obtained using a five-French Arrow radial micropuncture kit (Teleflex Medical, Research Triangle Park, NC, USA), and a Penumbra Neuron MAX 6F 088 sheath (Penumbra Inc., Alameda, CA, USA) was placed in the right radial artery (Figure 3) and advanced over a Penumbra 5F Select SIM-1 catheter into the right ICA.

Using a platform of the Penumbra Neuron MAX sheath, a Navien 058 intracranial support catheter (Medtronic Neurovascular), and a Marksman microcatheter (Medtronic Neurovascular), two Pipeline Flex 5-mm × 30 mm devices were deployed across the aneurysm neck using a telescoping technique (Figure 4).

The patient tolerated the procedure well without complication and without radial vasospasm. No new neurological symptoms were observed post-operatively. She continued dual antiplatelet therapy, and was discharged on post-operative day 3.

**Discussion**

The PED is an effective treatment for intracranial aneurysms [1], but complex aortic arch configuration limits endovascular access to the carotid arteries for intervention [2]. Not only are giant intracranial aneurysms asso-
associated with advanced patient age [3], but aortic arch complexity is also associated with advanced patient age [4,5]. Therefore, techniques for navigating complex aortic arches are especially relevant to flow diversion interventions for giant aneurysms. In patients with Type-3 aortic arches, specialized catheters such as the Simmons catheters may facilitate common carotid artery access through the transfemoral approach. However, in some patients with extremely inferior origination of the innominate artery, the transfemoral approach is not conducive to accessing the right common carotid artery, even with these specialized catheters. In these cases, alternative approaches such as radial, brachial, or cervical are required.

There are two previously reported cases of PED treatment of aneurysms using the transradial approach [6,7]. Daou et al. described a biaxial system for a transradial approach to PED treatment. Our technique is unique in using a triaxial system involving a Neuron MAX catheter, a Navien 058 intracranial support catheter, and a Marksman microcatheter. Our ability to gain distal access using the Neuron MAX catheter allowed for excellent support for our intermediate catheter, which, in turn, ensured a stable platform for deployment of the PED.

The most important advantage of the transradial approach is the ability to access the supraaortic vessels in patients with aortic arches that preclude the transfemoral approach. In our opinion, the transradial approach is favorable over other alternative approaches such as cervical cut-down or brachial, owing to the superficial and distal location of the radial artery, which makes positioning, access, and compression easy. These advantages are even more significant in patients such as the one included herein on dual antiplatelet therapy due to the inherent concerns involving post-procedural hemostasis on potent antithrombotic medications.

**Conclusion**

The transradial approach allows access to the right common carotid artery in patients whose aortic arches prevent access through the transfemoral approach. Using a triaxial catheter system provided a stable platform for the deployment of the PED to treat a patient with a giant intracranial aneurysm.

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**References**