Case Studies

Novel Vertebral Artery Flow Reversal Method for Preventing Ischemic Complication during Endovascular Intervention

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Background and Purpose: We report a secure endovascular approach for the treatment of vascular lesions of the posterior circulation. Even if a large profile guide catheter is wedged in the unilateral vertebral artery (VA), our VA flow reversal method can prevent ischemic complications, including the spinal cord infarction. *Case Presentation:* The patient was a 64-year-old woman who had been followed up for arteriovenous malformation (AVM) and an unruptured aneurysm of the basilar artery–superior cerebellar artery bifurcation. Endovascular treatment was performed because minor bleeding occurred from the AVM. When a 6-French guide catheter was navigated into the right VA, the guide catheter became completely wedged, and blood flow between the tip of the catheter and the VA union was fully stagnated. Because ischemia of the anterior spinal artery and right posterior inferior cerebellar artery could persist for a few hours during the endovascular procedure, we built a continuous reversal circulation from the guiding catheter tip to the femoral vein. The flow stagnation disappeared immediately. There was no complication during embolization of both the AVM and aneurysm. *Conclusions:* The VA flow reversal method was secure in this case in which the tip of the guide catheter became wedged in the VA during the endovascular procedure.

Introduction

In endovascular intervention of a posterior circulation lesion, tortuosity or small-vessel caliber sometimes prevents placement of a guiding catheter in the vertebral artery (VA). Even in such difficult situations, however, endovascular coil embolization is often the only treatment option when the aneurysm is inaccessible by microsurgery. Flow restriction caused by wedging a catheter in the VA may cause thromboemboli and/or hemodynamic insufficiency of the anterior spinal artery, which can result in devastating spinal cord infarction.[1] Although a simple coil embolization can be achieved solely by use of a microcatheter from the VA origin, a complicated procedure with some adjunctive techniques cannot be performed.[2] Here, we introduce a VA flow reversal method as a safe endovascular approach for vascular lesions of the posterior circulation. Even if a large profile guide catheter is wedged in the unilateral VA, our method can prevent ischemic complications, including spinal cord infarction.

Case Presentation

The patient was a 64-year-old woman who had been followed up for arteriovenous malformation (AVM) and

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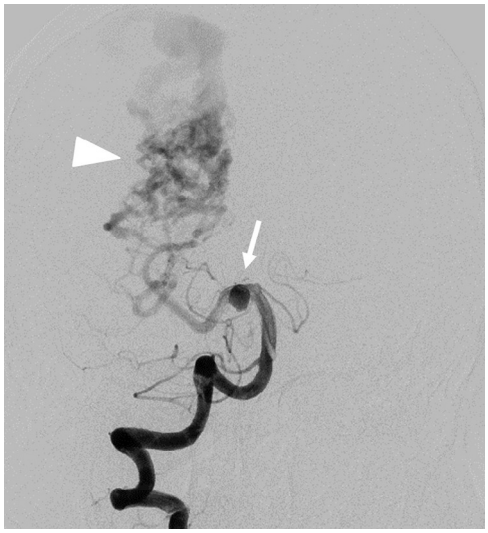

Figure 1. *Initial right vertebral artery angiogram showing the basilar artery–superior cerebellar artery aneurysm (white arrow) and the arteriovenous malformation (white arrowhead).*

an unruptured aneurysm of the basilar artery–superior cerebellar artery bifurcation (Fig 1). These lesions were scheduled for endovascular treatment after some examinations; however, minor bleeding occurred from the AVM. Therefore, we performed a sub-emergency operation. The patient was administered 300 mg of clopidogrel and 100 mg of aspirin each day for the 2 days before the intervention. Under general anesthesia, a 6-French guiding sheath (Shuttle Sheath 80 cm; Cook Medical Inc., Bloomington, IN) was navigated into the right subclavian artery from the right femoral artery. Next, a 6-French guiding catheter (Cerulean DD6; Medikit, Tokyo, Japan) was navigated into the distal right VA. The guide catheter became wedged, and the blood flow between the catheter tip and the VA union became completely stagnated (Fig 2). The contrast medium remained for a long time. We worried that ischemia of the anterior spinal artery and right posterior inferior cerebellar artery possibly occurred during the endovascular procedure for a few hours. Hence, we built a continuous reversal circulation system from the catheter tip to the right femoral vein. A 4-French short sheath was inserted into the right femoral vein. An extensive tube for the external shunt was connected from the end of the guide catheter to the 4-French venous sheath. A schematic drawing is shown in Figure 3. When the circuit was opened, blood flow in the external shunt tube was good, and the stagnated contrast medium in the distal right VA immediately disappeared (Fig 4). The AVM was treated by performing transarterial embolization using

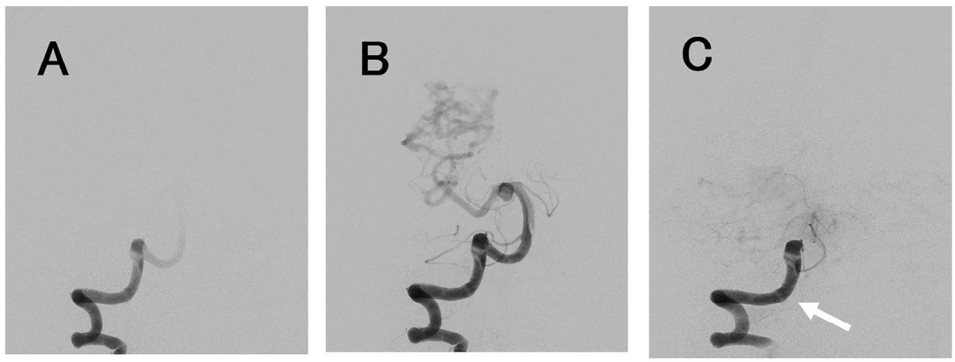

Figure 2. *Dynamics of the right vertebral artery angiogram showing complete blood flow stagnation between the guiding catheter tip and the vertebral artery union (white arrow). (A) early arterial phase, (B) arterial phase, (C) late venous phase.*

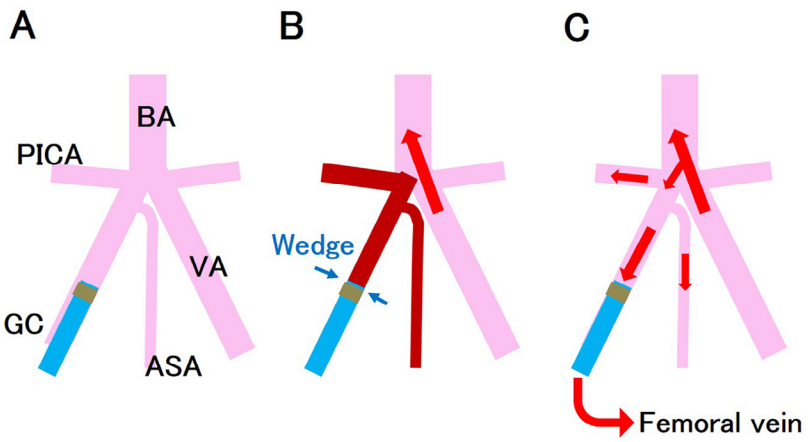

Figure 3. *Schematic drawing of the vertebral artery (VA) flow reversal method. (A) The guiding catheter (GC) is placed in the right VA. The posterior inferior cerebellar artery (PICA) and anterior spinal artery (ASA) originate from the right VA. BA indicates the basilar artery. (B) When the GC becomes wedged, blood flow from the left VA (red arrow) is passed to the basilar artery, and blood flow of the distal right VA is stagnated along its branches (brown part). (C) When the circuit of the VA flow reversal is established, the stagnated flow vanishes, and the arterial branches are supplied again (red arrows).*