Method to Navigate a Guiding Sheath Using an Intermediate Catheter without Intraaortic Manipulations in Transbrachial Right Carotid Artery Stenting

Youichi Mochizuki,1 Kazunori Akaji,1 Takehiro Katano,2 Hiroaki Kimura,3 Satoka Shidoh,1 Yoshio Tanizaki,1 Takao Kanzawa,4 and Ban Mihara3

Objective: Two cases in which right carotid artery stenting (CAS) was performed by navigating a 6 Fr guiding sheath through the transbrachial approach avoiding intraaortic arch manipulation are reported.

Case Presentations: Case 1: A 72-year-old male with asymptomatic right carotid artery stenosis was scheduled to undergo stenting. Bilateral femoral artery stenosis and brachiocephalic artery stenosis were noted, and since the angle between the right subclavian and right common carotid arteries was steep, transbrachial CAS was performed without manipulations in the aortic arch using a 5 Fr Cerulean catheter with a tip shaped into a pigtail form. Case 2: A 66-year-old male was scheduled to undergo stenting for symptomatic right carotid artery stenosis. Thoracic aortic aneurysm and brachiocephalic artery stenosis were noted, and as the angle between the right subclavian and right common carotid arteries was steep, transbrachial stenting was performed without manipulations in the aortic arch using a 5 Fr Cerulean catheter with a tip shaped into a pigtail form.

Conclusion: In direct navigation of a 6 Fr guiding sheath to the right common carotid artery for stenting by the transbrachial approach, a 5 Fr Cerulean catheter with a tip shaped into a pigtail form was useful.

Keywords: Cerulean catheter, carotid artery stenting, transbrachial approach

Introduction

In transbrachial carotid artery stenting (CAS), the guiding sheath is advanced using a Simmons-type catheter. In this procedure, the tip of the Simmons-type catheter is designed for manipulating the catheter in the aortic arch. If manipulations in the aortic arch should be avoided for various reasons, the guidewire or catheter has to be introduced directly to the common carotid artery through the subclavian artery for right-sided lesions, but direct navigation may be difficult depending on the angle between the two arteries. We report cases in which transbrachial CAS could be performed using a 5 Fr Cerulean catheter by shaping its tip into a pigtail form.

Case 1

The patient was a 72-year-old male with a primary complaint of memory disturbance. He had no particular past history.

Screening examinations due to memory disturbance led to detection of bilateral asymptomatic carotid artery stenosis. The lesion on the right side, which was the North American Symptomatic Carotid Endarterectomy Trial (NASCET) 80% stenosis (Fig. 1A), was decided to be treated by CAS. Since preoperative CT angiography (Fig. 1B and 1C)
showed stenosis of the bilateral femoral arteries and moderate stenosis of the brachiocephalic artery, it was decided to perform stenting by the transbrachial approach without manipulations in the aortic arch. Since the angle between the subclavian artery and common carotid artery was steep (Fig. 1C), direct selection of the common carotid artery was expected to be difficult.

**Neurologic findings: no abnormality**

Endovascular treatment: After inserting a 6 Fr Shuttle sheath (Cook Medical Inc., Bloomington, IN, USA) into the right brachial artery, we attempted to navigate a 4/6 Fr JB2-type catheter (Medikit, Tokyo, Japan) directly to the right common carotid artery using a 0.035 inch × 180 cm Radifocus guidewire (Terumo, Tokyo, Japan), but insertion of the guidewire was impossible because of the steep angle between the right subclavian and right common carotid arteries. However, the guidewire could be navigated to the external carotid artery using a 5 Fr Cerulean catheter 125 cm (Medikit) after shaping its tip into a pigtail pattern (Fig. 2) by winding it twice and applying steam to it. The Cerulean catheter could follow the guidewire into the common carotid artery, the 6 Fr Shuttle sheath was advanced coaxially, and it could be placed in the right common carotid artery (Fig. 3A–3C). A carotid GuardWire PS 200 cm (Medtronic, Minneapolis, MN, USA) was used as a distal protection device. Predilatation was performed using an Aviator Plus 4 mm × 30 mm (Cordis, Bridgewater, NJ, USA), a Carotid Wallstent 10 × 31 mm (Boston Scientific, Natick, MA, USA) was deployed, and postdilatation...
was performed using an Rx Genity 4.5 mm × 40 mm (Kanaka Medix, Osaka, Japan). The right internal carotid artery could be dilated satisfactorily (Fig. 3D and 3E). Following the procedure, the right upper extremity was fixed by splinting, the sheath was left placed, and, after its removal on the day after the treatment, hemostasis was achieved by manual compression for 20 minutes or longer. The postoperative course was uneventful, and the patient was discharge to home without any neurologic symptoms.

Case 2

The patient was a 66-year-old male who complained of weakness of the left upper and lower extremities. He had no particular past history.

Examinations for the cause of weakness of the left upper and lower extremities revealed right cerebral infarction and right internal carotid artery stenosis, which was NASCET 95% (Fig. 4A), and CAS was scheduled. Since preoperative CT angiography (Fig. 4B) showed thoracic aortic aneurysm and moderate stenosis of the brachiocephalic artery, it was decided to perform stenting by the transbrachial approach without manipulations in the aortic arch. As the angle between the subclavian and common carotid arteries was relatively steep (Fig. 4C), direct selection of the common carotid artery was expected to be difficult.

**Neurologic findings: no abnormality**

Endovascular treatment: A 6 Fr Shuttle sheath was inserted into the right brachial artery, direct navigation of a 4/6 JB2 catheter to the right common carotid artery was attempted using a 0.035 inch × 180 cm Radifocus guidewire, but the guidewire could not be introduced due to the steepness of the angle between the right subclavian and common carotid arteries. When a 5 Fr Cerulean catheter 125 cm was used after steam-shaping its tip into a pigtail form (Fig. 2), the guidewire could be navigated to the external carotid artery. The Cerulean catheter could also follow the guidewire into the common carotid artery, and the 6 Fr Shuttle sheath was advanced coaxially and placed in the common carotid artery (Fig. 5A–5C). A 6 Fr Optimo (Tokai Medical, Aichi, Japan) was inserted.
Case 2: A 66-year-old male. Cervical 3D-CTA (A), 3D-CTA of the aortic arch (B and C). (A) NASCET 95% stenosis was observed in the right internal carotid artery (large arrow). (B) Thoracic aortic aneurysm (small double arrows) and moderate stenosis of the brachiocephalic artery (small arrow) were noted. (C) The angle between the right subclavian and right common carotid arteries (arrowhead) was relatively steep. NASCET: the North American Symptomatic Carotid Endarterectomy Trial.

Intraoperative fluoroscopic images (A–C). Preoperative angiogram of the right common carotid artery (D). Postoperative angiogram of the right common carotid artery (E). (A–C): A guidewire was navigated to the external carotid artery (small arrow) using a 5 Fr Cerulean catheter with a tip shaped into a pigtail form. A 6 Fr guiding sheath (arrowhead) was placed in the common carotid artery coaxially with the Cerulean catheter. (D and E) The carotid artery stenosis was completely dilated.
Guiding Sheath Navigation Using a Cerulean Catheter

Discussion

When CAS is difficult to perform through the transfemoral approach due to bilateral femoral artery stenosis or abdominal aortic aneurysm, the transbrachial approach is selected.\(^5\) For ordinal transbrachial CAS, a Simmons-type catheter is manipulated in the aortic arch, but it is necessary to directly navigate the guiding catheter to the right common carotid artery via the right subclavian artery if there are lesions such as brachiocephalic artery stenosis, thoracic aortic aneurysm, and marked atherosclerosis of the aortic arch or in patients after aortic arch replacement. Case 1 had bilateral femoral artery stenosis and stenosis at the origin of the brachiocephalic artery, and Case 2 had thoracic aortic aneurysm and stenosis at the origin of the brachiocephalic artery. Although navigation of the device to the right common carotid artery via the right subclavian artery was necessary, the angle between the subclavian and common carotid arteries was steep in both patients, and navigation of the guiding sheath to the common carotid artery was expected to be difficult. To perform transbrachial CAS, various techniques have been proposed, such as insertion of a Carotid GuardWire PS in the external carotid artery to improve the support force\(^5\) and the use of a guiding sheath curved over 7.5 cm from the tip.\(^5\) Misaki et al. reported a method to navigate a guiding sheath using a pigtail catheter by avoiding manipulations in the aortic arch.\(^9\) By inserting a guidewire into a pigtail catheter, it can be advanced in the reverse direction, so this method is appropriate for advancing a guidewire through sharply angled blood vessels. However, in their report, a 5 Fr Axcelguide stiff J1 (Medikit) was navigated coaxially with the accompanying 5 Fr SY2 (Medikit) by change of the guidewire to a half-stiff type and catheter exchange, and this may make the procedure more complicated. We, therefore, decided to use a 5 Fr Cerulean catheter after shaping the tip into a pigtail form. A 5 Fr Cerulean catheter is characterized by high supportability and followability due to its five-level flexible structure over the entire length.\(^3\) In our patients, we also directly navigated the guidewire to the common carotid artery via the subclavian artery using a 5 Fr Cerulean catheter with a tip shaped into a pigtail form, the Cerulean catheter could then follow the guidewire into the common carotid artery, and could advance a 6 Fr guiding sheath coaxially. Thus, we could perform the procedure simply without guidewire change or catheter change.

Transbrachial CAS can be performed with less intraaortic catheter manipulation and has been reported to reduce the occurrence of cholesterol embolism.\(^8\) It is a useful method in patients with a large amount plaque in the aorta and those with a history of cholesterol embolism, and is expected to further reduce the risk of cholesterol embolism by directly selecting the common carotid artery without intraaortic manipulations.

In transbrachial CAS, caution is necessary due to complications such as severe ischemia of the upper extremities due to brachial artery injury\(^9\) and median nerve injury.\(^10\) At our hospital, hemostasis is performed manually without using a hemostatic device. The upper extremity is immobilized by splinting until the day after surgery, the sheath is not removed until the day after surgery, and manual compression is maintained for at least 20 minutes. Compression using an elastic bandage and rest of the upper extremity are indicated for about 6 hours after removal of the sheath. We have experienced no major puncture site complications.

We used a 5 Fr Cerulean catheter in the cases reported here, but we tentatively used a 4 Fr Cerulean catheter with a tip shaped into a pigtail form. However, the 4 Fr Cerulean catheter provided inadequate support, and it was difficult to advance the guidewire in the reversed direction. Therefore, a 5 Fr Cerulean catheter was advantageous for navigating a 6 Fr guiding sheath to the common carotid artery. However, as other 5 Fr catheters or the 6 Fr Cerulean catheter...
may also be useful, their use may be worth attempting in cases with difficulties in catheter navigation.

## Conclusion

A method to navigate a 6 Fr guiding catheter for transbrachial right CAS without intraaortic manipulations was reported. A 5 Fr Cerulean catheter with a tip shaped into a pigtail form was useful for this procedure.

## Disclosure Statement

The author has completed a self-report of conflicts of interest (COI) to the Japanese Society for Neuroendovascular Therapy, and there are no COI to disclose in publishing this paper.

## References


