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Tools and techniques

Successful carotid artery stenting of a dissected, highly tortuous internal carotid artery after straightening with a peripheral microguidewire

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ABSTRACT

Endovascular reconstruction for carotid artery dissection (CAD) involving a highly tortuous segment of the cervical internal carotid artery (ICA) is challenging because the tortuous ICA may preclude navigation of large-profile carotid stents. Successful recanalization using low-profile neurostents has been reported in small case series only. We herein describe two patients with CAD of a tortuous segment who were successfully treated with large-profile carotid stents after straightening the ICA with a stiff peripheral microguidewire. In Case 1, a 33-year-old man presented with steno-occlusive left CAD involving coiling of the cervical ICA and left M2 occlusion. We could not navigate a carotid stent through the tortuous segment of the ICA using a standard neuro-guidewire. A carotid stent was successfully deployed after straightening the tortuous ICA with a peripheral guidewire, and subsequent thrombectomy using a large-bore aspiration catheter for the occluded M2 branch resulted in recanalization. In Case 2, a 64-year-old man presented with right steno-occlusive CAD involving kinking of the cervical ICA. We successfully deployed two carotid stents after straightening the tortuous ICA with a peripheral guidewire. Stenting after straightening with a peripheral microguidewire is feasible and may provide a therapeutic option for CAD in patients with a highly tortuous ICA.

1. Introduction

Carotid artery dissection (CAD) is an uncommon but important cause of stroke, especially in young and healthy individuals, and can lead to severe sequelae [1]. Arterial tortuosity is frequently recognized in patients with CAD and has also been shown to be a surrogate for underlying subclinical connective tissue weakness [2,3].

Endovascular reconstruction for CAD is usually performed using large-profile self-expanding biliary or carotid stents [4]. However, severe cervical internal carotid artery (ICA) tortuosity may preclude navigation with these stiff, large-profile stents [5]. A previous study revealed the feasibility of low-profile neurostents for CAD with tonsillar loop anatomy [6], but limitations of the method included kinking and weak radial force of the neurostents.

We herein describe two patients with CAD in the tortuous ICA who were successfully treated using conventional carotid stents after straightening of the ICA with stiff microguidewires usually used for peripheral arteries.

2. Case reports

2.1. Case 1

2.1.1. Clinical presentation

A 33-year-old man without prior trauma was transferred to our hospital 45 min after onset of headache, global aphasia, and right hemiparesis with a total National Institutes of Health Stroke Scale (NIHSS) score of 20. Magnetic resonance imaging of the brain showed an early ischemic change in the left insula, and magnetic resonance angiography showed occlusion of the left ICA and M2 segment of the middle cerebral artery (Fig. 1A). We decided to attempt endovascular reconstruction.

2.1.2. Intervention

Endovascular therapy was performed under local anesthesia and systemic heparinization. Emergency angiography revealed left

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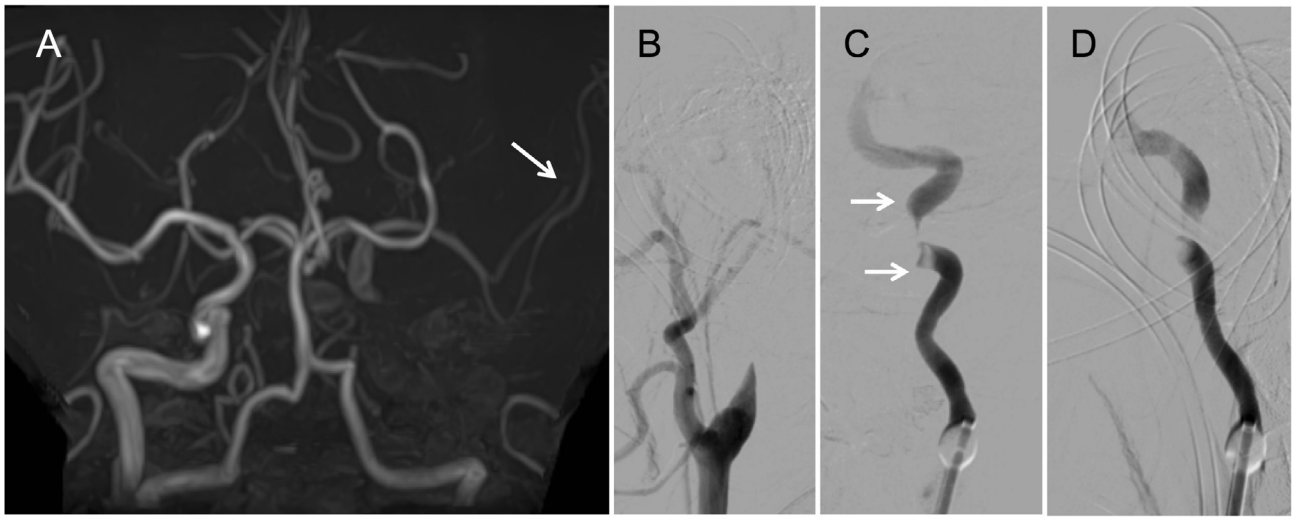

Fig. 1. Magnetic resonance imaging and angiography findings in Case 1. (A) Magnetic resonance angiography shows the left ICA and M2 occlusion (*arrow*). (B) Lateral view of the left common carotid angiogram shows the left ICA occlusion. (C) Anteroposterior and (D) lateral views demonstrate occlusive ICA dissection (*arrows*). ICA = internal carotid artery. M2 = insular segment of the middle cerebral artery.

ICA occlusion (Fig. 1B). A 9-Fr balloon guiding catheter was advanced into the left ICA, where angiography by slow injection of contrast revealed a near-occlusive segment of the cervical ICA suspected to be CAD (Fig. 1C, D). A 0.014-inch microguidewire and SL-10 microcatheter (Stryker, Kalamazoo, MI, USA) were used to traverse the steno-occlusive ICA. We had difficulty traversing the occlusive segment. Microangiography confirmed that the microcatheter was in the true lumen and revealed the distal limit of the occlusive segment. We exchanged the microcatheter for a balloon catheter (Sterling 4 mm × 40 mm; Boston Scientific Corp., Boston, MA, USA) over a 0.014-inch microguidewire and inflated the balloon to a pressure of 6 atm for 30 s (Fig. 2A) under proximal flow control. A left internal carotid angiogram demonstrated an intimal flap, indicating CAD, and coiling of the ICA containing the CAD (Fig. 2B, C). We then attempted carotid artery stenting to seal the dissection. Immediately after the need for stenting was confirmed, the patient was administered a loading dose of aspirin (200 mg) and clopidogrel (300 mg) via a nasogastric tube.

We were unable to navigate an 8-mm × 21-mm Carotid WALLSTENT™ (Boston Scientific Corp.) through the tortuous segment of the ICA over a standard neuro-guidewire because the tortuous segment could not be straightened (Fig. 2D). We therefore exchanged the microguidewire for a stiffer peripheral microguidewire (Spindle XS 0.7, a non-tapered 0.014-inch steel guidewire with a tip load of 0.7 g, 300 cm; Asahi Intecc Co., Ltd., Aichi, Japan) through an SL-10 microcatheter to straighten the course of the ICA. We were then able to navigate and deploy the Carotid WALLSTENT™ (Boston Scientific Corp.) to cover the dissection (Fig. 2E, F). Next, we performed aspiration thrombectomy for the remaining M2 occlusion using the 5MAX™ ACE (Penumbra Inc., Alameda, CA, USA) to achieve complete recanalization. The 5MAX™ ACE was smoothly negotiated through the carotid stent. The time from puncture to recanalization was 85 min.

2.1.3. Postoperative course

The patient was discharged home from the hospital on postoperative day 8 with an NIHSS score of 1. At the patient's 3-month follow-up, angiography demonstrated patency of the stent and no return of tortuosity (Fig. 2G). By the 12-month clinical follow-up, the patient had completely recovered. Carotid ultrasonography 12 months later revealed patency of the stent and preserved distal flow.

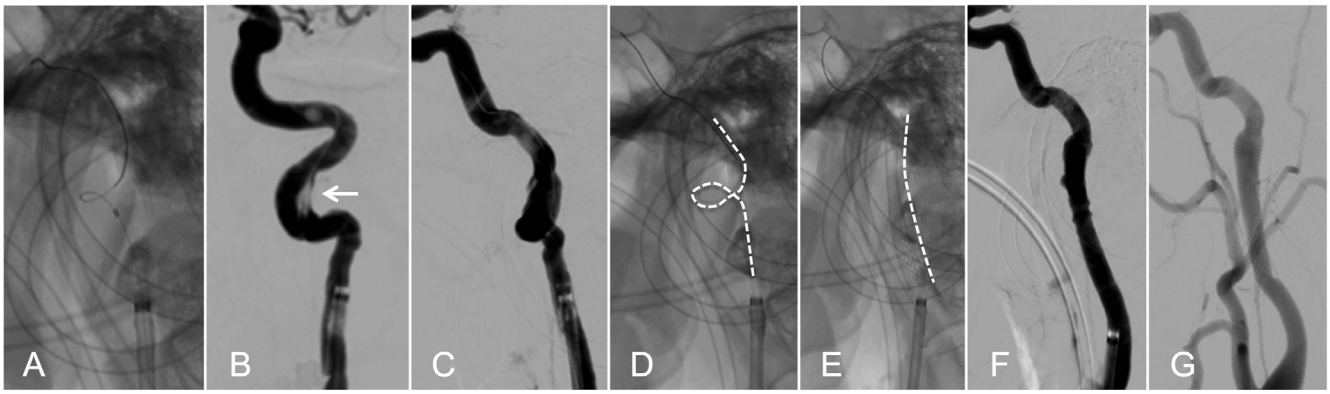

Fig. 2. Angiography of the carotid artery stenting procedure in Case 1. (A) A balloon catheter is navigated to the left cervical ICA over a standard 0.014-inch neuro-guidewire. The course of the catheter shows the coiling of the ICA. (B) Anteroposterior and (C) lateral views of the left internal carotid angiogram show the tortuous ICA and intimal flap indicating carotid artery dissection (*arrow*). Lateral views show the course of the ICA (*dashed lines*) with (D) a standard 0.014-inch neuro-guidewire and (E) a stiff peripheral guidewire. (E) The lateral view shows successful carotid stent deployment after straightening of the cervical ICA with a peripheral guidewire. (F) Lateral view of the postoperative angiogram shows successful dilation of the left ICA. (G) Lateral view of the angiogram 3 months later demonstrates no return of tortuosity and patency of the left ICA. ICA = internal carotid artery.