Effectiveness of the Combined Use of Distal Filter Protection Device and Mo.Ma Ultra: Technical Note

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Background: Although Mo.Ma Ultra is an embolic protection device for interrupting the anterograde blood flow to the internal carotid artery, incomplete blood stagnation is often observed. We report the effectiveness of the combined use of a distal filter protection device and Mo.Ma Ultra (Medtronic, Minneapolis, MN). *Materials and Methods:* Our case series comprises 10 consecutive patients (11 carotid arteries) who underwent carotid artery stenting (CAS) using Mo.Ma Ultra and FilterWire EZ (Boston Scientific, Natick, MA). *Results:* The superior thyroid artery originated from the proximal side of the bifurcation of the common carotid artery, except for 1 artery. Although complete blood stagnation was observed in 6 arteries, filter debris was detected in 3 of these 6 arteries. Positive postoperative findings on diffusion-weighted magnetic resonance imaging were observed in 3 cases (3 arteries). Only 1 patient had transient neurological deficits. *Conclusion:* The combined use of a distal filter protection device and Mo.Ma Ultra could provide a more reliable embolic protection in CAS. **Key Words:** Carotid artery stenting—double protection—Mo.Ma Ultra—FilterWire EZ.

Introduction

Because several large studies have shown no inferiority of carotid artery stenting (CAS) compared to carotid endarterectomy, CAS has become a frequently performed procedure for carotid artery stenosis.[1-3] Because CAS confers a higher risk of distal embolization than carotid endarterectomy, the use of embolization protection devices (EPDs) became a standard when CAS is performed according to the recommendations of the American Heart Association.[4-8] Mo.Ma Ultra (Medtronic, Minneapolis, MN) is an EPD for proximal protection, which can interrupt the anterograde flow to the internal carotid artery (ICA) by using external carotid artery (ECA) and common carotid artery (CCA) occlusion balloons.[9] Although some favorable results have been reported with this device, anterograde flow to the ICA may not be interrupted completely in case the origin of the superior thyroid artery (STA) cannot be occluded by an ECA occlusion balloon.[9-13] For these cases, combination with another EPD such as a distal balloon or a distal filter protection device might be useful for decreasing the risk of distal embolization.

In the present article, we assessed the effectiveness of the combined use of Mo.Ma Ultra and other EPDs, particularly FilterWire EZ (Boston Scientific, Natick, MA), based on our experiences.

Materials and Methods

Subjects

Ten patients underwent CAS for carotid artery stenosis with combined use of Mo.Ma Ultra and FilterWire EZ in our hospital from July 2013 to November 2014. The

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Table 1. *Clinical and radiographic characteristics of cases*

Case	Age/gender	Side of the lesion	Preoperative symptom	NASCET (%)	Plaque image		Preoperative antiplatelet
					T1WI BB	Echography	
1	81M	Right	–	>95	n.d.	Iso	Clopidgrel + cilostazol
2	66M	Right	–	>95	High	Low	Clopidgrel + cilostazol
3	72M	Right	+	>95	n.d.	Low	Aspirin + clopidogrel
4	68M	Right	+	83	n.d.	High	Aspirin + clopidogrel
5	73M	Left	+	54	High	Iso	Aspirin + clopidogrel
		Right	–	93	Iso	High	Aspirin + clopidogrel
6	77M	Left	+	50	n.d.	Iso	Aspirin + cilostazol
7	71M	Right	–	60	High	Iso	Aspirin + clopidogrel
8	80M	Left	–	60	n.d.	High	Aspirin + clopidogrel
9	75M	Right	+	78	n.d.	Low	Aspirin + clopidogrel
10	64M	Left	+	90	n.d.	Iso	Aspirin + clopidogrel

Abbreviations: BB, black-blood imaging; NASCET, North American Symptomatic Carotid Endarterectomy Trial; T1WI, T1-weighted imaging.

candidates of this modality of treatment were chosen from patients satisfying all of the following criteria: (1) presence of suspected unstable plaque, (2) absence of type III aortic arch, and (3) absence of severe stenosis of the ipsilateral ECA in preoperative examinations. All patients were male and only 1 patient had stenosis of the bilateral carotid arteries. The characteristics of the patients are shown in Table 1. The mean age of the patients was 72.7 years (range, 66-81 years). The mean ratio of stenosis was 77.5% including 3 pseudo-occlusions (cases 1-3), and 6 patients (6 arteries) had some symptoms before the procedure.

Procedure

All of the patients were prescribed 2 of the following 3 antiplatelets at least 2 weeks before undergoing CAS: 100 mg of aspirin, 75 mg of clopidogrel, and 200 mg of cilostazol per day. CAS was performed under general anesthesia in 4 patients and under local anesthesia in 8 patients, depending on the risk of hyperperfusion or ischemic tolerance. In all of the patients, the femoral artery approach was adopted and the activated clotting time was kept between 250 and 400 seconds by administering heparin infusion during the procedure. The process of this procedure is shown in Figures 1 and 2. First, a test catheter was inserted to the ECA of the affected side and replaced with Mo.Ma Ultra with a stiff-type Radifocus Guidewire M (Terumo, Tokyo, Japan) or Amplazts Super Stiff guidewire (Boston Scientific). Then, an ECA occlusion balloon was inflated, and interruption of the anterograde flow to the ECA was confirmed by injection of a contrast agent. After the guidewire was removed, the CCA occlusion balloon was also inflated, and stagnation of blood flow was confirmed by slow injection. FilterWire EZ was introduced to the distal side of the stenotic lesion, and the stent was placed with or without pre- and postballoon dilation. The adopted stents were Carotid Wallstent (Boston Scientific) in 9 cases and Precise stent (Cordis; Johnson & Johnson, Fremont, CA) in 2 cases. After that, at least 60 mL of blood was aspirated from Mo.Ma Ultra and checked for debris. Then, the ECA occlusion balloon was deflated after the CCA balloon deflation. The reperfusion was confirmed, and FilterWire EZ was retrieved finally.

We assessed the origin of the STA on angiography; the degree of the anterograde flow stagnation to the ICA; the presence of debris in the blood aspirated from Mo.Ma Ultra and attached to the filter device, both macroscopically and microscopically; postprocedural cerebral infarctions on magnetic resonance imaging—diffusion-weighted imaging; and postoperative clinical complications.

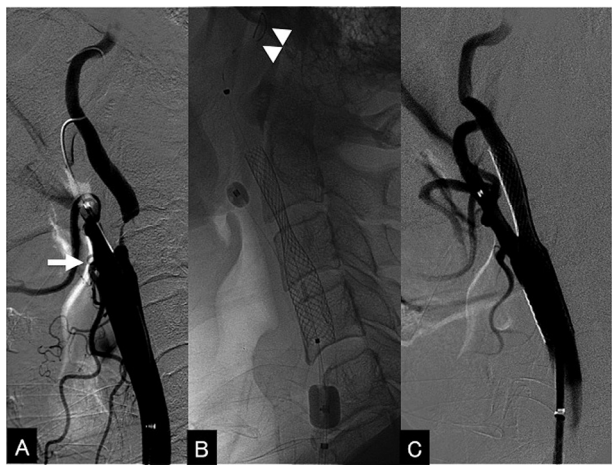

Figure 1. *Angiographic findings in case 2. (A) Right common carotid artery angiogram after dilation of the external carotid artery balloon. The balloon cannot occlude the superior thyroid artery (arrow). (B) Fluoroscopic finding just after stenting. A FilterWire EZ is placed in the distal internal carotid artery for distal protection (arrowheads). (C) Right common carotid artery angiogram obtained after the procedure.*