Combined Use of Invatec Mo.Ma Proximal Protection Device and Solitaire AB Retrievable Stent for Tandem Occlusions in a Patient With Acute Ischemic Stroke

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ABSTRACT: Recanalization of tandem vascular occlusions in the setting of an acute stroke is problematic. Here we report a successful treatment of an acute ischemic stroke with tandem cervical internal carotid artery and middle cerebral artery occlusions. A 56-year-old woman presented with acute left-sided hemiplegia. Diffusion magnetic resonance imaging showed an acute infarction in the right frontal and parietal lobes. We planned to perform rescue endovascular treatment after fibrinolytic therapy failed. Stent-assisted carotid angioplasty with proximal embolic protection device was followed by stent-based mechanical thrombectomy of the proximal middle cerebral artery occlusion. Her neurological condition improved after the procedure with National Institutes of Health Stroke Scale of 3 points. The combination of proximal embolic protection device and retrievable Solitaire stent could be a feasible and safe treatment strategy in acute ischemic stroke patients with extra- and intracranial tandem occlusions.

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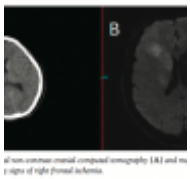
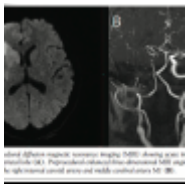
Key words: embolic protection device, retrievable Solitaire stent

Stroke is the most common cause of permanent disability and the third most common cause of death worldwide.[1] The majority of strokes are ischemic as a result of single or multiple cervical and intracranial arterial occlusions. Tandem lesions are defined as multiple stenoses that occur at more than one level, at least 3 cm apart, along the course of the carotid artery.[2] Previous studies have shown that despite similar stroke severity on admission, patients with tandem cervical internal carotid artery (ICA)/middle cerebral artery (MCA) occlusion have lower likelihood of MCA recanalization and poorer outcomes than those with isolated MCA occlusion.[3] In the context of these lesions, site of the intracranial artery occlusion may represent not only a surrogate of clot burden, but also may reflect different hemodynamic conditions and exposure to the thrombolytic agent, which may alter the response to systemic thrombolysis.[4] Recanalization of tandem vascular occlusions involving the cervical carotid artery and an ipsilateral intracranial large vessel in the setting of an acute stroke is a problematic therapeutic challenge. The question of which lesion should be treated first is controversial. We described a case of acute ischemic stroke due to tandem ICA and MCA occlusions treated with the Mo.Ma proximal embolic protection device (Invatec) and Solitaire retrievable stent (ev3). To the best of our knowledge, this is the first report about combined use of these devices in acute stroke setting.

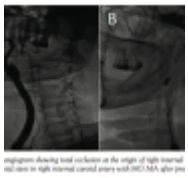


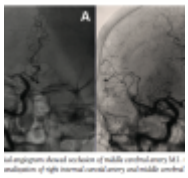
Case Report. *A 56-year-old woman presented to our emergency department with acute left-sided hemiplegia and slurred speech. On physical examination, her heart rate was 82 beats/min, and blood pressure was 110/70 mm Hg. A 12-lead eletrocardiography showed normal sinus rhythm. She had a history of essential hypertension. Her National Institutes of Health Stroke Scale (NIHSS) score at admission was 22. She was admitted to hospital 3.5 hours after stroke onset. On physical examination, she was drowsy, with speech disorder, gaze deviation, and left hemiplegia with hemihypesthesia. A head computed tomography (CT) and magnetic resonance imaging (MRI) showed early ischemic signs of right frontal area (Figure 1). Diffusion MRI showed an acute infarction in the right frontal and parietal lobes (Figure 2A). Cervical enhanced MRI angiography showed that the right internal carotid artery was occluded and imaging of the 3-dimensional time-of-flight MR angiogram showed acute occlusion of the MCA M1 branch (Figure 2B). Immediate fibrinolytic therapy with alteplase was initiated. We planned to perform rescue endovascular treatment after failure of fibrinolytic therapy.*



An emergency cranial angiography was decided. An 8 Fr Judkins right 4.0 Launcher guiding catheter (Medtronic, Inc) was used to cannulate the right internal carotid artery under the guidance of a hydrophilic guidewire (0.035˝, "J" peak, 150 cm in length). Angiograms showed ostial occlusion of the right ICA (Figure 3A). A Mo.Ma proximal cerebral protection device (Invatec) was advanced into the external carotid artery (ECA) and common carotid artery (CCA). After inflation of ECA and CCA occlusion balloons, the flow in the ICA was completely blocked, and a hi-torque Whisper LS guidewire (Abbott Vascular) was advanced to the distal part of ICA. The total occlusion was predilated with a 2.0 x 20 mm Maverick balloon (Boston Scientific) using

12-14 atm for 15 seconds. A closed-cell design Xact carotid stent (Abbott Vascular) was placed across the stenosis and dilated (Figure 3B). Control angiogram showed occlusion of the right MCA M1 branch (Figure 4A). A Prowler Plus microcatheter (Cordis Corporation) was advanced to the thrombus under the guidance of a hi-torque Whisper LS guidewire. A Solitaire stent was deployed over the entire length of the thrombus. Partial recanalization was observed immediately after stent deployment. After 5 minutes, the proximal third of the stent was resheathed. The partially deployed stent was slowly pulled back under continuous aspiration through the guiding catheter. A large clot was removed with the stent (Figure 5). The final angiogram revealed complete revascularization of the right ICA, MCA and its branches, with no sign of vascular damage or residual distal occlusion (Figure 4B). Total time between femoral access and arterial recanalization was 50 minutes. The patient's neurological condition dramatically improved after the procedure. The NIHSS score improved to 0 points at discharge and modified Rankin score was 1 at 3-month follow-up exam.





Discussion. Ischemic strokes constitute a large part of all strokes.[5] Approximately 20% of ischemic strokes are related to severe extracranial carotid disease, and 10% of them present with carotid occlusion.[6] Cervical ICA occlusion is associated with a high incidence of intracranial tandem occlusions.[2] Tandem lesions must be treated urgently due to lack of collateral circulation.[4] Symptomatic improvement and better clinical course could be achieved by early revascularization of the distal occlusion.[7] Rapid intraarterial fibrinolysis could be used in patients with tandem lesions, but complete recanalization rates were lower compared to single lesions due to high thrombus burden and limited delivery of the fibrinolytic agent to the distal occlusion.[3] Nowadays, endovascular treatment has became a more preferred method for these patients rather than conservative modalities.

There are two steps in the endovascular treatment of tandem carotid lesions in the setting of acute ischemic stroke. Primary angioplasty and stenting of the proximal ICA occlusion is the first step. Due to fact that extracranial ICA occlusions usually contain an atherosclerotic plaque and a superimposed thrombus, primary stent implantation is the treatment of choice. Distal migration of the thrombus is the major problem during this procedure.[6] Currently, there are several types of cerebral embolic protection devices to prevent secondary embolization into the intracranial vessels.[8] Although distal protection devices are the commonly applied instruments nowadays, they have several disadvantages, such as difficulties in introducing and deploying the filter, suboptimal positioning in tortuous and asymmetric stenotic arteries, compromise of microembolus capture efficacy due to inadequate pore size, and loss of particles during filter retrieval, which decrease the performance of certain devices in preventing adverse neurologic events.[9] Proximal endovascular occlusion (PEO) is an alternative approach that uses balloons to occlude both the ECA and CCA, leading to blood flow arrest in the target ICA.[10] Fewer strokes have been reported with the use of PEO compared to other devices.[11] Moreover, a lower rate of microembolic signals with proximal occlusion compared with

distal filter protection has been demonstrated with transcranial Doppler in unselected patients undergoing carotid artery stenting.[12] Evidence comparing proximal and distal protection devices during carotid artery stenting is scarce.[8,13] Montorsi et al reported that in patients with high-risk, lipid-rich plaques undergoing carotid artery stenting, a proximal occlusion device provided better protection against microembolization than a distal protection filter.[13] Also, in the patient reported here, we decided to use the Invatec Mo.Ma proximal embolic protection device because of ostial ICA occlusion and presence of high thrombus burden.

The second stage after stenting the proximal lesion in the ICA could be intraarterial thrombolysis, balloon angioplasty, thromboaspiration, or mechanical thrombectomy in order to provide adequate recanalization of the MCA M1 occlusion. In our case, we performed mechanical thrombectomy with a Solitaire retriever stent system. The Solitaire stent is a new, fully retrievable, and self-expandable thrombectomy device. In a study by Castaño et al, the recanalization rate with Solitaire was 90%, and 16 patients showed immediate restoration of flow after stent deployment.[14] No significant procedure-related events occurred. Symptomatic intracranial hemorrhage occurred in 2 patients (10%), and 45% of patients showed good functional outcome at 3 months (modified Rankin Scale score ≤2). In another study, it was used with local intraarterial thrombolysis in acute ischemic stroke, and effective revascularization with reduced recanalization time was achieved.[15] Recently, Cohen et al demonstrated that stent-based thrombectomy could be used in selected cases of acute stroke with tandem ICA and concomitant intracranial major vessel occlusions.[16]

Conclusion. The presented case demonstrates the feasibility and safety of the Invatec Mo.Ma proximal cerebral protection device and ev3 Solitaire retrievable stent combination in acute ischemic stroke patients with extra- and intracranial tandem occlusions.

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