A Case of Delayed Symptomatic Middle Cerebral Artery Stenosis Following Mechanical Thrombectomy

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Objective: A novel mechanical thrombectomy device for acute ischemic stroke has provided a favorable outcome. However, it is not well known that delayed stenotic change of the affected arterial wall can be caused by device scratching.

Case Presentations: A 73-year-old male presented with a symptomatic left middle cerebral artery (MCA) occlusion. The patient was recovered without any sequelae after stent-using mechanical thrombectomy. During follow-up in the outpatient department, magnetic resonance angiography and imaging revealed a progressive diffuse severe MCA stenosis and leukoencephalopathy. A hundred and eight days after the stent assisted procedure, the patient received percutaneous transluminal balloon-angioplasty, because of the resistance to any medical treatment and minor ischemic symptom.

Conclusion: The authors state that close observation of both vascular lumen and wall is mandatory after mechanical thrombectomy and postoperative symptomatic stenosis may occur as in this case.

Keywords ▶ delayed arterial stenosis, mechanical thrombectomy, stent retriever

Introduction

Endovascular treatment for acute intracranial arterial occlusion using a stent retriever was also recommended with a Class I evidence level by the American Heart Association/American Stroke Association Guidelines in June 2015.1) Recanalization therapy based on appropriate diagnostic imaging and indications was shown to contribute to dramatic improvements in the patient outcome. Since the time from the onset to recanalization of the occluded vessel markedly affects the patient prognosis, the earliest possible accomplishment of recanalization is desirable, and the above Guidelines also recommend consideration of prompt endovascular treatment with the minimum necessary preoperative examinations. However, intervention to occluded vessels occasionally causes procedure-related complications and unexpected events. Because of its structure, a stent retriever cannot capture thrombi without close contact with the vascular wall, and mechanical stimulation of the vascular endothelium is unavoidable. This report presents a patient with acute left middle cerebral artery occlusion in whom a stenotic lesion, present at the site of occlusion, progressed after mechanical thrombectomy, resulting in delayed symptomatic stenosis.

Case Presentation

The patient was a 73-year-old male presenting with disturbance of consciousness and right hemiplegia as primary symptoms. He had a history of atrial fibrillation with bradycardia. He had smoked 40 cigarettes/day for 30 years until he was 50 years old.

The patient had undergone surgery for rectal cancer 3 days before and had been admitted to the surgical ward of our hospital. The patient was last confirmed to be free of the event at 21:00 on the day before the onset. The time of the onset is estimated to be about 6:00, when the patient in the next room heard the sound of an object falling, and he was found lying on the floor at 6:45. The Manual Muscle Test (MMT) grade 2/5 paresis of the right upper and lower extremities, motor aphasia, and spatial agnosia were noted, and the NIHSS was 18. The Alberta Stroke Program Early CT Score (ASPECTS)-Diffusion Weighted Imaging (DWI)
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was 8. On MRI-FLAIR imaging, there was no finding suggestive of old infarction. On MRA, the left middle cerebral artery was not delineated distally to its proximal region (Fig. 1). ECG showed atrial fibrillation. A diagnosis of left middle cerebral artery occlusion due to cardiogenic cerebral embolism was made; endovascular thrombectomy was decided to be performed immediately, because intravenous t-PA was a contraindication for a patient 3 days after surgery for rectal cancer.

Endovascular treatment (thrombectomy) was performed as follows: At 8:05 (125 min after the onset), a 9 Fr sheath introducer (Medikit, Tokyo) was inserted into the right femoral artery under local anesthesia. After 3000 units of heparin were intravenously administered, a 9 Fr OPTIMO (Tokai Medical Products, Aichi) was guided and placed in the left cervical internal carotid artery. A Trevo pro catheter (Stryker, Kalamazoo, MI, USA) was guided distally to the site of occlusion using a Synchro 2 micro guidewire (Stryker), the presence of the tip of the micro catheter in the true lumen and the absence of distal embolism were confirmed, and the Trevo provue (Stryker) was deployed at the site of the thrombus. At 9:03 (183 min after the onset), dark brown thrombi could be resected en bloc by one stent expansion and retrieval procedure, and Modified Thrombolysis In Cerebral Infarction (TICI) grade 3 complete recanalization could be achieved (Fig. 1).

As for the postoperative course, the absence of intracranial hemorrhage was confirmed by head MRI 2 days after thrombectomy, and oral administration of apixaban at 10 mg/day...
changes were asymptomatic, oral therapy with clopidogrel at 75 mg/day and rosvastatin at 5 mg/day was initiated. On MRA performed on the 97th postoperative day, stenosis of the left middle cerebral artery was progressed further, and signals in the peripheries of the left middle cerebral artery were reduced, suggesting a decrease in the peripheral blood flow (Fig. 4). At this point, paralysis of about MMT4/5 was noted in the right upper extremity, and the Mini Mental State Examination (MMSE) score, which was 26/30 after thrombectomy 3 months before, was reduced to 22. While stenosis showed continuous progression on MRA, no change was noted in the signal intensity in T1 VISTA images, and no change in the plaque properties was observed. Since left middle cerebral artery stenosis was considered to be was initiated. MRA performed after 5 days showed mild stenosis in the recanalized vessel, but T1 VISTA (3D Fat saturation Volume ISotropic Turbo spin echo Acquisition) imaging using a 3.0 Tesla MRI system (Philips Achiva 3.0T, Holland) showed isointense signals considered to be due to atherosclerotic plaques and no hyperintense signals suggestive of intramural hematoma due to vascular dissection (Fig. 2). The patient recovered without sequelae such as paralysis of the right upper or lower extremity and aphasia and was discharged to home. During the outpatient follow-up, MRA performed 77 days after thrombectomy showed exacerbation of stenosis of the left middle cerebral artery, and MRI-FLAIR imaging also showed increases in hyperintensities considered to represent chronic ischemic changes (Fig. 3). While these
symptomatic lesion resistant to internal treatments, percuta-
neous cerebral angioplasty was performed on the 108th post-
operative day. In addition to clopidogrel at 75 mg/day, 
cilostazol at 200 mg/day was administered for 10 days before 
the procedure, and an 8 Fr OPTIMO (Tokai Medical Pro-
ducts) was placed in the left cervical common carotid artery 
via the right femoral artery under general anesthesia. Using 
Gateway 1.5 mm × 9 mm (Stryker), balloon percutaneous 
transluminal angioplasty (PTA) was performed by applying 
10 atmospheric pressures for 4 min. Satisfactory dilation 
could be achieved, but as recoil was observed, the balloon 
catheter was changed to Gateway 2.0 mm × 12 mm (Stryker), 
and PTA was performed again at 8 atmospheric pressures for 
3 min. Stenosis was 90% before PTA but was alleviated to 
30% after PTA, and no recoil occurred during about 40-min 
observation. Since delineation of the vessel distal to the 
lesion was improved, and since no finding suggestive of vas-
cular dissection was noted at the site of PTA, the procedure 
was ended (Fig. 5). The symptoms of the right upper extrem-
ity disappeared, and the MMSE score improved to 28. MRA 
performed on the 113th day after PTA showed no progression 
of restenosis. The patient is currently under strict follow-up 
and remains asymptomatic without developing vascular dis-
section or new ischemic foci.

**Discussion**

Intravenous alteplase therapy has become prevalent as an 
acute-phase treatment for acute occlusion of major arteries of 
the brain, and whether or not the occluded vessel is recana-
lized has begun to be recognized as an important prognostic 
factor. The introduction of thrombectomy devices, which 
bring about a high recanalization rate, has contributed to 
improvements in the patient outcome, but shortening of the 
onset-to-reperfusion time is important to achieve a favorable 
outcome. For this, the simplification/standardization of the 
steps until the beginning of recanalization therapy is sug-
gested to be essential. Since the procedure of thrombectomy 
itself is relatively simple, attention tends to be focused on the 
time course until the beginning of treatment and methods to 
shorten it including the techniques for diagnostic imaging. 
Also, as cerebral infarction is often caused by a cardiogenic 
mechanism, treatment for the prevention of recurrence inevi-
tably tends to be restricted to oral anticoagulant therapy, and 
the radiographic evaluation of the patency of the treated vessel 
or various problems after treatment such as consideration of 
the additional administration of antiplatelet agents for residual 
stenosis or endothelial damage are discussed less frequently.

Akpinar et al. reported a patient who developed stenosis of 
the middle cerebral artery at the site of previous placement of 
a stent type device 8 weeks before and exhibited marked ste-
nosis of 70% or more after 2 years although it was asymptom-
atom. Enomoto et al. reported asymptomatic stenotic 
changes by MRA 3 months after thrombectomy and their 
improvements after 12 months in 5 of 57 patients. According 
to Kurre et al., vasospasm occurred in 26% of 261 patients 
treated with a stent type device for embolic vascular occlu-
sion, and stenotic/occlusive changes were observed in 4.3%, 
3 months after the treatment. Gory et al. showed by an ani-
mal experiment that the use of a stent type device induces 
endothelial cell abrasion and medial edema but that the num-
ber of thrombus-capturing procedures was not correlated 
with the degree of vascular wall damage. The stent type 
thrombus retriever is undoubtedly a representative device 
that brings about a high recanalization rate, but as it is drawn 
out of the body with the stent remaining expanded, friction or 
direct damage to the vascular wall by the struts may occur. 
Repeated damage or exertion of external force on the surface 
of endothelial cells is known to induce intimal thickening, 
and the vascular wall that has undergone endovascular treat-
ment has also been reported to show changes in imaging find-
ings such as wall thickening and enhancement of intensity 
immediately after treatment.

In the present case, delayed symptomatic stenosis 
developed while the device passed the occluded site once. 
Postoperative MRI showed no vascular dissection, such as 
imtramural hematoma, but suggested the presence of apparently
artery stenosis after 3 months, and underwent percutaneously cerebral angioplasty. Since vascular stenosis may occur after recanalization therapy using a stent type thrombectomy device for acute cerebral artery occlusion, strict postoperative follow-up is necessary.

Disclosure Statement

The first author or any of the co-authors have no conflicts of interest to disclose regarding this article.

References


3) Saver JL, Goyal M, Bonafe A, et al: Solitaire™ with the Intention for Thrombectomy as Primary Endovascular Treatment


