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Repeated Middle Cerebral Artery Occlusion Possibly Caused by Endoluminal Injury Due to Stent Clot Retriever: A Case Report

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Abstract

In acute ischemic stroke, various endovascular approaches have been reported with high recanalization rates and good clinical outcomes. However, the best device or technique for the first attempt at mechanical thrombectomy remains a matter of debate. We report a case in which endoluminal injury from initial stent clot retrieval possibly caused repeated middle cerebral artery occlusion. A 74-year-old man presented with left-sided hemiplegia and was diagnosed with a right internal carotid artery occlusion. He underwent endovascular thrombectomy using a stent clot retriever. Although complete recanalization was achieved in the first pass, repeated middle cerebral artery occlusion occurred. Angiography revealed an irregular inner surface and thrombus formation in the superior branch of the second segment of the right middle cerebral artery. There is a risk of endoluminal injury due to stent retrieval, especially using a large sized stent against small branches. Antiplatelet therapy may be effective for preventing recurrent occlusion.

Key Messages We report a case in which endoluminal injury from initial stent clot retrieval possibly caused repeated middle cerebral artery occlusion. There is a risk of endoluminal injury due to stent retrieval, especially using a large sized stent against nonvisible small branches.

Keywords
- acute ischemic stroke
- mechanical thrombectomy
- recurrent occlusion
- stent clot retriever

Introduction

Mechanical thrombectomy for acute ischemic stroke has been widely used since its efficacy was proved.[1] During the procedure, a physician guides a microcatheter into vessels not visible on fluoroscopy. In our patient with internal carotid artery (ICA) occlusion, we thought that the distal tip of the stent retriever was deployed in the first segment of the middle cerebral artery (MCA); however, the tip was in the narrow superior branch of the second segment (M2) that originated straight from the first segment (M1). As a result, repeated occlusion occurred, most likely due to endoluminal injury. The case shows one possible cause of endoluminal damage, and the management of patients is discussed to prevent periprocedural repeated occlusion.

Case History

A 74-year-old man was admitted to our emergency department with left-sided hemiplegia 80 min after onset. At

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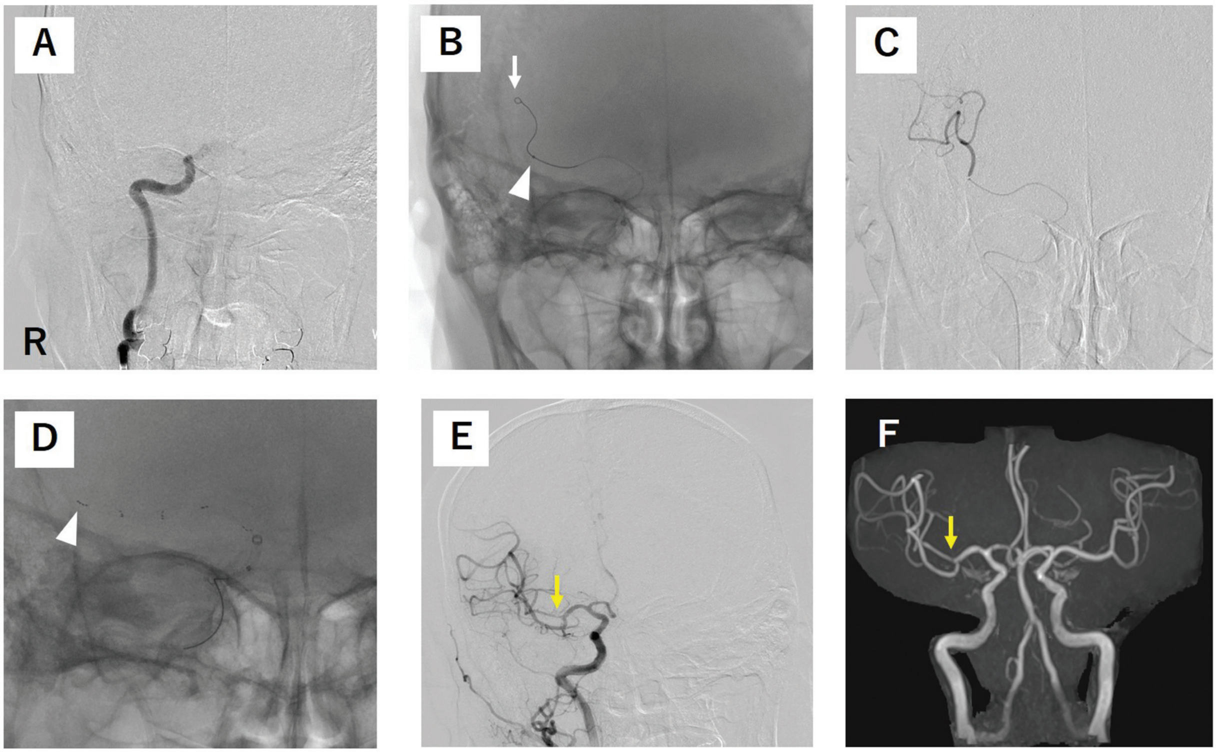

Fig. 1 Radiological images of the initial procedure. (**A**) Initial right carotid angiography showing internal carotid artery occlusion. R indicates the right-side. (**B**) Intraoperative X-ray image. Arrow indicates the tip of the microwire. The arrowhead indicates the tip of the microcatheter. (**C**) Selective angiography showing the distal artery. (**D**) Arrowhead indicates the tip of the deployed stent. (**E**) Postoperative angiography showing recanalization. Arrow indicates the narrow branch. (**F**) Magnetic resonance angiogram taken 8 hours after the procedure

admission, his National Institute of Health Stroke Scale score was 13.[2] The 12-lead electrocardiogram revealed atrial fibrillation. Emergency diffusion-weighted imaging demonstrated an area with partial high-signal intensity in the right cerebral hemisphere. Magnetic resonance (MR) angiography showed occlusion of the right ICA. The Alberta Stroke Program Early Computed Tomography score was 6.[3] Intravenous recombinant tissue plasminogen activator (rt-PA) injection was initiated 40 min after his arrival. He was transferred into the angiography room for endovascular thrombectomy without confirming the efficacy of the rt-PA.

Under local anesthesia, a balloon guiding catheter (9-F Optimo; Tokai Medical Products, Aichi, Japan) was advanced into the right ICA through the right common femoral artery. Right carotid angiogram revealed total occlusion of the ICA (►**Fig. 1A**). We attempted to recanalize via A Stent-retrieving into an Aspiration catheter with Proximal balloon technique.[4] An aspiration catheter (REACT 71; Medtronic, Minneapolis, Minnesota, United States), a microcatheter (Phenom 27; Medtronic), and a micro-guidewire (Eiger 14 FUMA; Medical Innovation Co., Ltd., Tokyo, Japan) were coaxially navigated. After the microcatheter was navigated into the distal portion of the horizontal segment of the MCA (►**Fig. 1B** and **C**), a 6×40 stent clot retriever (Solitaire; Medtronic) was deployed and withdrawn into the aspiration catheter, which was placed at the distal portion of the ICA (►**Fig. 1D**). Some pieces of clot were confirmed to be attached to both the stent and aspiration pump. Complete recanalization was achieved; however, we found that the stent retriever had been deployed in a narrower branch in the M2 than expected (►**Fig. 1E**). His symptoms immediately improved. An MR angiogram taken 8 hours after the procedure demonstrated the patency of the ICA and MCA (►**Fig. 1F**). Anticoagulation therapy with systemic heparinization was initiated 24 hours after the administration of rt-PA.

Thirty-two hours after the procedure, the patient again showed left hemiplegia. Emergency angiography revealed a right M1 occlusion (►**Fig. 2A**). We performed mechanical thrombectomy using the same system as the first procedure. The microcatheter was advanced into the superior branch of the M2 (►**Fig. 2B**). A Solitaire 4×40 stent clot retriever was used. A few clots were confirmed to be attached to both the stent and aspiration pump. Although recanalization was achieved, we confirmed an irregular inner surface and thrombus formation in the M2 (►**Fig. 2C**). We decided to wait and observe for 10-minute in the angiography room. Then, repeat angiography showed an M2 occlusion (►**Fig. 3A**). We performed another thrombectomy using the same devices. A tiny clot was confirmed to be attached to the stent. Recanalization was achieved, but the irregularity and thrombus formation in the M2 remained (►**Fig. 3B**). As a result, the thrombus was retrieved by the repeat stent retrieving, and it was determined that the cause of the occlusion was thrombus, not dissection. There were no findings of stenosis and dilation as in typical arterial dissection. The patient's hemiplegia improved.

Just after the procedure, antiplatelet therapy (cilostazol) was added. MR images taken 5 days after the second and

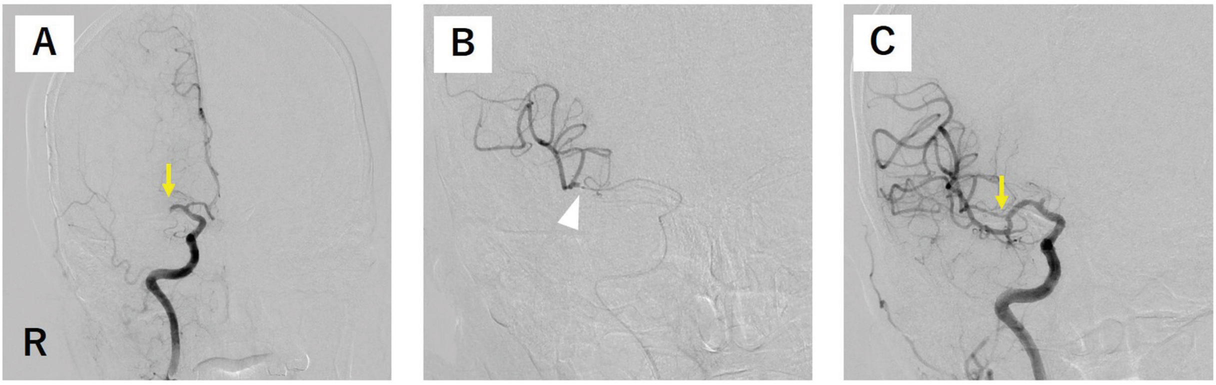

Fig. 2 Angiography images of the second procedure. (**A**) Right carotid angiogram showing middle cerebral artery occlusion (arrow). R indicates the right-side. (**B**) Selective angiography showing the distal artery. Arrowhead indicates the tip of the microcatheter. (**C**) Postprocedural angiography showing the recanalized branch (arrow).

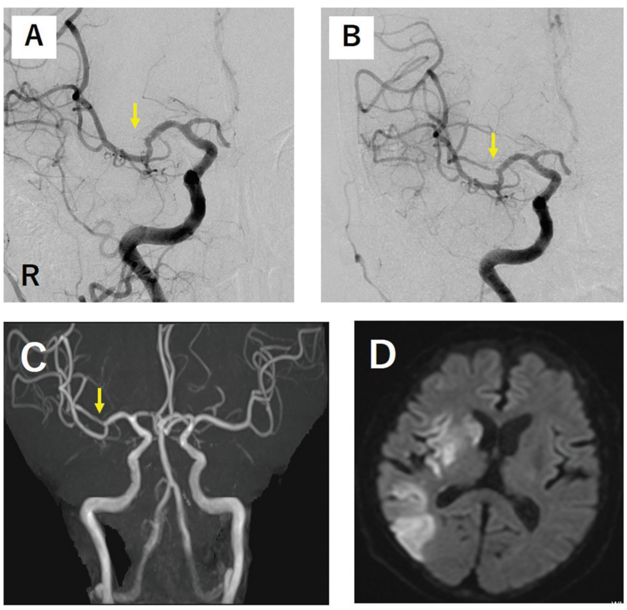

Fig. 3 Radiological images of the third procedure and follow-up. (**A**) Right carotid angiography showing the superior branch of the second segment of the middle cerebral artery (arrow). (**B**) After stent retrieval, the occlusion was recanalized (arrow). (**C**) Magnetic resonance (MR) angiography showing the patency of the recanalized branch (arrow). (**D**) MR image showing no extension of the infarction.

third procedures showed the patency of the right M2 and no extension of the infarction (►**Fig. 3C** and **D**).

Discussion

Endovascular thrombectomy in patients with acute ischemic stroke is different from other endovascular operations because of a lack of preprocedural anatomic information. Moreover, a microcatheter must be navigated into a nonvisible, small, and fragile intracranial artery upon fluoroscopy to use a stent clot retriever. The incidence of perioperative complications during endovascular thrombectomy has been estimated to be more than 10%, including arterial perforation (0.9–4.9%), arterial dissection (0.6–3.9%), and vasospasm (3.9–23%).[5–7] Some authors have mentioned that minimizing the radial force of stent clot retrievers or friction force against vessel walls may reduce the incidence of complications related to such vessel injuries.[8–10]

In our case, we thought that the stent clot retriever had been deployed in the horizontal part of M1 during the initial procedure, because the pigtailed-tip micro-guidewire had been smoothly passed through. However, ►**Fig. 1D** shows that the distal markers of the Solitaire stent clot retriever do not appear adequately dilated. When this finding is observed, the deployed stent should be withdrawn in an extremely slow manner to prevent vessel injury. Moreover, we regret our strategy of using a stent clot retriever in the second thrombectomy of the M1 occlusion. Direct clot aspiration using an aspirator would have been better and gentler for the narrow branch. As a result of the subsequent stent retrieval, repeated occlusion may have been encouraged.

How do we recognize the size of a nonvisible artery during endovascular thrombectomy? One way is to refer to the contralateral anatomical condition. However, as ►**Fig. 1F** shows, the left and right MCA anatomy are entirely different. Visually, the right M1 is much shorter than the left M1. Microcatheter-withdrawing angiography can help identify the actual crab claw sign, which indicates the precise position of a clot.[11] It may also identify the size of the nonvisible artery. However, as the authors mention, microcatheter-withdrawing angiography requires penetrating the clot at least twice with the tip of the microcatheter. This may result in clot distal migration or separation.

For postoperative management, we added an antiplatelet over the anticoagulant after the last procedure. The patient has not experienced another occlusion. Therefore, the additional antiplatelet therapy may be effective in preventing thrombosis for the narrow, damaged artery.

We report a case in which the cause of repeated MCA occlusion is thought to be endoluminal injury due to the initial stent clot retrieval. Physicians should be aware of the risk of endoluminal injury due to a stent clot retriever, especially when using a large-sized stent against small branches. When there is the possibility of endoluminal injury, adding antiplatelet therapy may be effective in preventing further thrombosis.

Authors' Contributions

Tomotaka Ohshima was involved in conceptualization, designing, literature search, and manuscript preparation. Shigeru Miyachi helped in manuscript editing and review.

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None.

Conflict of Interest

S.M. and T.O. reported speaker fees from Medtronic.

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