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Case Report

Iatrogenic dissection on atherosclerotic stenosis of the middle cerebral artery caused by stent retriever thrombectomy for internal carotid artery embolic occlusion

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ABSTRACT

Background: Arterial dissection is a rare complication of mechanical thrombectomy, and the risk factors and clinical course are not well known. We report a case of iatrogenic dissection on atherosclerotic stenosis of the middle cerebral artery (MCA) caused by stent retriever thrombectomy for internal carotid artery (ICA) embolic occlusion.

Case Description: A 78-year-old woman underwent mechanical thrombectomy for ICA embolic occlusion. Preprocedural angiography indicated a thrombus from the C1 segment of the left ICA to the proximal M1 segment of the left MCA and slow antegrade contrast opacification of the mid- to distal-M1. A stent retriever was deployed across the stenotic lesion and pulled back to retrieve a thrombus. Although reperfusion was achieved, mid-M1 occlusion occurred the next day. We considered that endothelial damage from the stent retriever caused iatrogenic dissection at existing atherosclerotic stenosis at mid-M1.

Conclusion: Stent retriever thrombectomy can worsen atherosclerotic stenosis. Vascular imaging follow-up is important after thrombectomy in patients with intracranial stenotic lesions. Clinicians should be aware that iatrogenic dissections can be more likely in atherosclerotic vessels following stent retriever thrombectomy.

Keywords: Acute ischemic stroke, Dissection, Mechanical thrombectomy, Stent retriever

INTRODUCTION

Mechanical thrombectomy is highly effective for acute ischemic stroke, and the indications for this treatment have been expanding.[10] The complication rate of mechanical thrombectomy with sequelae is 15%, including 4% access-site related, 6% hemorrhagic events, and 5% embolic events.[4] Arterial dissection is a rare complication,[4] and the risk factors and clinical course are not well known. Herein, we report iatrogenic dissection on atherosclerotic stenosis of the middle cerebral artery (MCA) caused by stent retriever thrombectomy for internal carotid artery (ICA) embolic occlusion.

CASE PRESENTATION

A 78-year-old woman presented with the right hemiparesis and aphasia. Her initial National Institutes of Health Stroke Scale score was 28. Magnetic resonance imaging (MRI) on admission showed infarcts in the territory of the left MCA [Figure 1a]. Magnetic resonance angiography (MRA) showed left ICA occlusion [Figure 1b]. T2 star-weighted imaging showed the presence of a red thrombus from the C1 segment of the left ICA to the proximal M1 segment of the left MCA [Figure 1c]. We diagnosed embolic occlusion of the left ICA, intravenous alteplase was initiated, and mechanical thrombectomy was performed. Preprocedural angiography indicated a thrombus from C1 to proximal M1 and slow antegrade contrast opacification of the mid-to-distal-M1 [Figures 2a and b]. A microcatheter over a microguidewire was navigated across the thrombus into distal-M1 [Figure 2c]. A 5 × 37-mm EmboTrap III (Cerenovus, Irvine, CA, USA) was deployed from distal-M1 to C1, and a Cereglide 71 aspiration catheter (Cerenovus) over the microcatheter was navigated proximal to the thrombus [Figure 2d]. The stent retriever and the aspiration catheter were pulled back together through the balloon guide catheter under continuous aspiration, and a thrombus was retrieved. Post-thrombectomy angiography showed successful reperfusion of the left ICA and residual stenosis in mid-M1 [Figure 2e]. As this stenosis did not progress, we considered it a chronic atherosclerotic lesion and did not perform additional endovascular treatment. The patient's right hemiparesis improved immediately after treatment; however, this symptom recurred the next day. Left

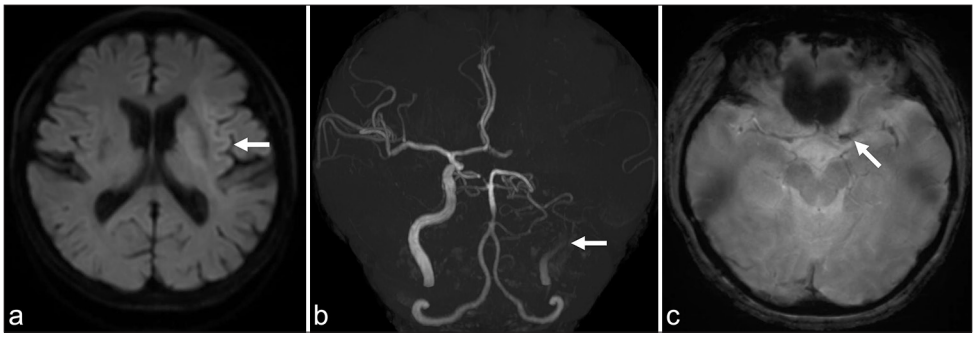

Figure 1: (a) Magnetic resonance imaging on admission showing infarcts in the left putamen and insular cortex (arrow). (b) Magnetic resonance angiography showing left internal carotid artery occlusion (arrow). (c) T2 star-weighted imaging showing the susceptibility vessel sign from the C1 segment of the left internal carotid artery to the proximal M1 segment of the left middle cerebral artery (arrow).

Figure 2: Preprocedural angiography showing (a) the thrombus outline as a contrast-filling defect from C1 to proximal M1 and (b) slow antegrade contrast opacification of mid-M1 (arrows). (c) Angiography through a microcatheter confirms that the microcatheter has passed through the thrombus. (d) A 5 × 37 mm EmboTrap III stent was deployed from distal-M1 to C1, and a Cereglide 71 aspiration catheter was navigated proximal to the thrombus. (e) Postprocedural angiography showing successful reperfusion of the left internal carotid artery and residual stenosis in mid-M1 (arrow).

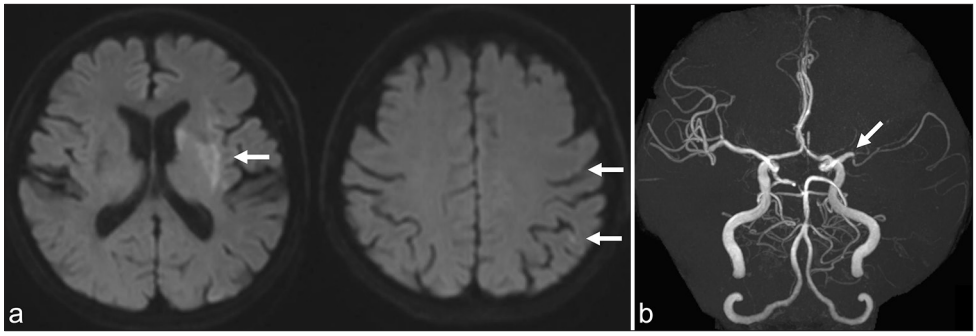

Figure 3: (a) Magnetic resonance imaging showing new infarcts in the territory of the middle cerebral artery (arrows). (b) Magnetic resonance angiography showing left middle cerebral artery occlusion (arrow).

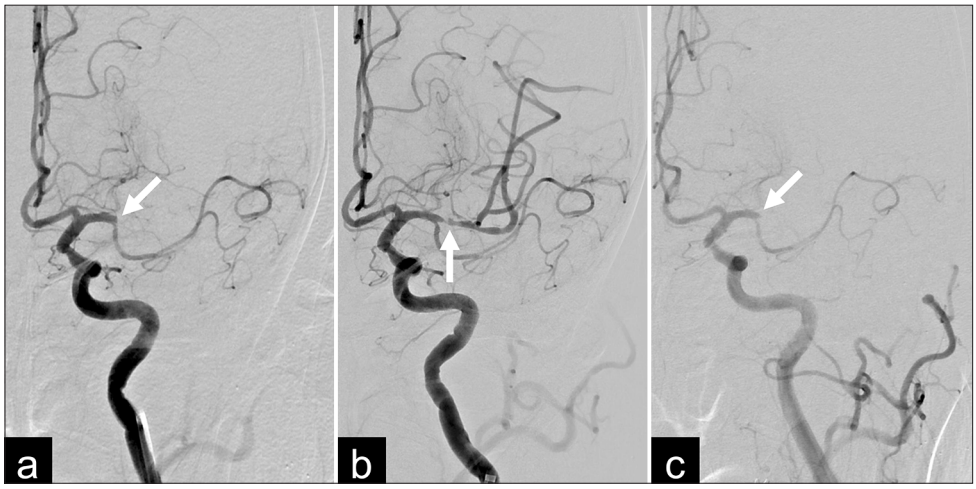

Figure 4: (a) Preprocedural angiography showing mid-M1 occlusion during the second mechanical thrombectomy (arrow). Angiography after several thrombectomy attempts shows (b) recanalization with irregular stenosis at mid-M1 and (c) reocclusion several minutes after recanalization (arrows).

MCA occlusion and new infarcts in its territory were shown on MRI and MRA [Figure 3], and repeat thrombectomy was performed [Figure 4]. Heparin was administered during the treatment. After several thrombectomy attempts, we achieved reperfusion with irregular stenosis at mid-M1 and observed immediate reocclusion. On the basis of this angiographical finding and deployment of a stent retriever in the first mechanical thrombectomy, we considered that endothelial damage from the stent retriever during the first mechanical thrombectomy caused iatrogenic dissection at existing atherosclerotic stenosis at mid-M1. Therefore, we discontinued endovascular treatment to avoid worsening the dissection and performed superficial temporal artery–MCA bypass surgery. Antiplatelet therapy was administered postoperatively. We followed the patient for 5 months, at which point, follow-up MRA showed reperfusion of the left MCA with residual stenosis at mid-M1. We detected no cardioembolic source or other specific cause of embolism. The patient was finally diagnosed with an embolic stroke of undetermined origin in the left ICA and chronic atherosclerotic stenosis of mid-M1. Antiplatelet therapy has been continued to prevent secondary stroke, which has not recurred.

DISCUSSION

The present case highlights two important clinical issues. First, stent retriever thrombectomy can worsen atherosclerotic stenosis. Second, vascular imaging follow-up is important after thrombectomy in patients with intracranial stenotic lesions.

Stent retriever thrombectomy can worsen atherosclerotic stenosis. Endothelial damage caused by stent retriever thrombectomy has been observed in animal models.[12] In humans, intimal injury due to stent retrievers has also been observed by vessel wall imaging on MRI.[1] Acute occlusion or stenosis due to endothelial damage or dissection has also been reported at a rate of 1.0–4.2% as a complication of stent retriever thrombectomy, and most of these cases

were extracranial lesions.[2,7,11] Only a small number of intracranial stenoses or occlusions after thrombectomy have been reported.[3,9,14] The cause of the stenosis or occlusion after thrombectomy was considered dissection in these cases on the basis of the appearance of irregular stenosis or progressive occlusion. Some cases suggest that atherosclerosis is a risk factor for iatrogenic dissection in mechanical thrombectomy. In addition, compared with large vessel diameters, small vessel diameters have been associated with more severe endothelial damage during mechanical thrombectomy.[13] Therefore, clinicians should be aware that iatrogenic dissections are more likely in atherosclerotic vessels following stent retriever thrombectomy. Particular attention must be paid to atherosclerotic stenosis distal to the occluded lesion because this is easy to miss. A small stent retriever appropriate for the vessel diameter or the aspiration catheter that does not require crossing the lesion should be used to prevent vessel dissection, especially in cases where preprocedural angiography shows atherosclerotic stenosis distal to the occluded lesion, as in our case.

Vascular imaging follow-up is important after thrombectomy in patients with intracranial stenotic lesions. Notably, there was a case in which progressive irregular stenosis was observed on vascular angiography after thrombectomy that was rescued by stenting.[9] However, stenosis that was considered arteriosclerotic, without clear findings of dissection immediately after recanalization, was occluded on angiography the next day in our case. Clinicians should recognize that even if blood flow is maintained immediately after mechanical thrombectomy, latently or obviously dissected vessels can subsequently develop progressive narrowing or occlusion. In addition, stent retriever thrombectomy can be associated with delayed stenosis or occlusion, with previous studies showing 3.4% *de novo* stenosis at the 3-month follow-up[8] and 13% arterial abnormalities (intracranial artery occlusive disease, stenosis, or dilation) at the 1-year follow-up[6] after stent retriever thrombectomy. The mechanism of these delayed stenoses and occlusions may be microendothelial damage caused by stent retrievers and subsequent intimal hyperplasia.[5] These findings show the importance of vascular imaging follow-up from the acute phase to the chronic phase. Clinicians should follow a patient's neurological symptoms and vascular imaging, with the possibility that treated vessels can develop progressive narrowing or occlusion. It is important to treat immediately when a patient's neurological symptoms worsen or when treated vessels develop progressive narrowing or occlusion.

CONCLUSION

Stent retriever thrombectomy can worsen atherosclerotic stenosis. Vascular imaging follow-up is important after thrombectomy in patients with intracranial stenotic lesions. Future studies are warranted to examine the safe and effective method of thrombectomy in patients with atherosclerotic vessels.

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