Case Report

Recanalization of Middle Cerebral Artery and Intracranial Aneurysm in the Same Ischemic Territory With Intravenous Administration of Recombinant Tissue Plasminogen Activator: Case Report

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We report a case of middle cerebral artery (MCA) embolism accompanied by unruptured intracranial aneurysm in the same ischemic MCA territory, successfully treated with intravenous administration of recombinant tissue plasminogen activator (rt-PA). A 66-year-old right-handed man presented with abruptly decreased consciousness and right motor paralysis. He had a National Institute of Health Stroke Scale (NIHSS) score of 26 points on admission. Computed tomography scan showed a hyperdense MCA sign on the left, and magnetic resonance angiography (MRA) demonstrated left MCA occlusion. Acute ischemic stroke was diagnosed, and rt-PA was administered intravenously. MRA at 2 weeks after onset demonstrated recanalization of the occluded left MCA and an aneurysm in the ischemic territory. The patient's NIHSS and modified Rankin Scale scores were each 1 at 3 months after onset. Recanalization of both the occluded MCA and the occluded intracranial aneurysm in the same ischemic territory was neuroradiologically confirmed. This case illustrates that the efficacy, safety, and risk of hemorrhage during intravenous thrombolysis for acute ischemic stroke patients with unruptured intracranial aneurysm merit further examination. **Key Words:** Fibrinolysis—reperfusion—alteplase—cerebral aneurysm—hyperdense sign.

Intravenous (IV) thrombolysis with recombinant tissue plasminogen activator (rt-PA) has become a standard treatment for acute cerebral ischemic stroke in selected patients.[1-4] According to the drug information in some countries, including the United States and Japan, the presence of intracranial aneurysm is a contraindication for the use rt-PA for thrombolysis. But unruptured intracranial aneurysms are not easy to find before thrombolysis on a conventional computed tomography (CT) scan, and whether an unruptured intracranial aneurysm increases the risk of intracranial hemorrhage in thrombolysis for acute ischemic stroke is controversial.[5-8] We report a case of middle cerebral artery (MCA) embolism accompanied by intracranial aneurysm in the same ischemic MCA territory that was successfully treated with IV administration of rt-PA.

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Received November 5, 2009; revision received December 10, 2009; accepted January 5, 2010.

There are no relevant conflicts of interest to disclose.

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1052-3057/$ - see front matter

doi:10.1016/j.jstrokecerebrovasdis.2010.01.008

Case Report

History

A 66-year-old right-handed man was admitted to our hospital with abruptly decreased level of consciousness and right motor paralysis. He had paroxysmal arterial

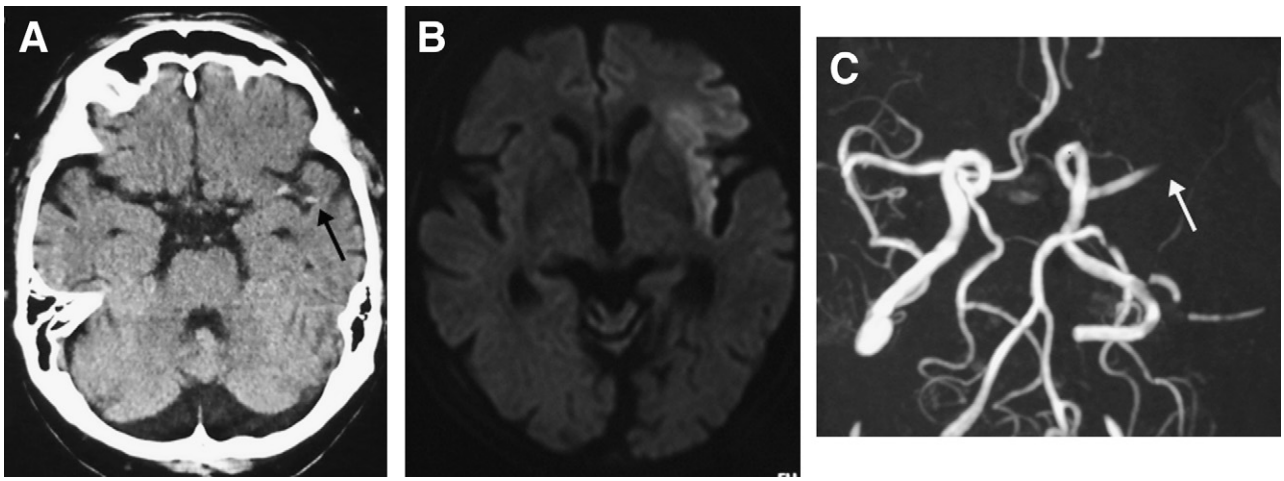

Figure 1. *(A) CT scan obtained on admission showing HMCAS of the left MCA. A small hyperdense nodule on the left MCA might retrospectively implies a possible cerebral aneurysm (arrow). Neither hemorrhage nor massive early signs of infarction were apparent. (B) Diffusion-weighted MRI image obtained on admission showing an ischemic area of the left frontal lobe and the left insular cortex. (C) MRA obtained on admission demonstrating an obstruction of the sphenoidal segment of the left MCA (arrow).*

fibrillation with inadequate warfarin therapy. He was a nonsmoker and drank temperately. His family history was unremarkable.

Clinical and Neuroradiologic Examinations

On arrival, the patient had a National Institute of Health Stroke Scale (NIHSS) score of 26 points. CT scan revealed a hyperdense sign of the left MCA (HMCAS), with a small hyperdense nodule (Fig 1A). Magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) revealed acute ischemic stroke due to left MCA occlusion (Fig 1B and C).

Treatment and Posttreatment Course

IV alteplase was administered at a dose of 0.6 mg/kg body weight starting at 2 hours after onset. By the next

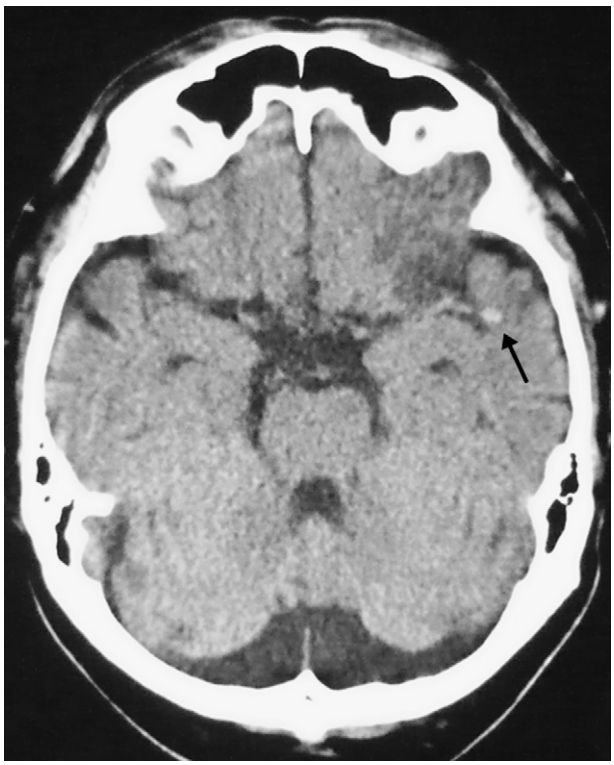

Figure 2. *CT scan obtained the day after onset, showing cerebral infarction in the left frontal lobe and a persistent hyperdense nodule (arrow).*

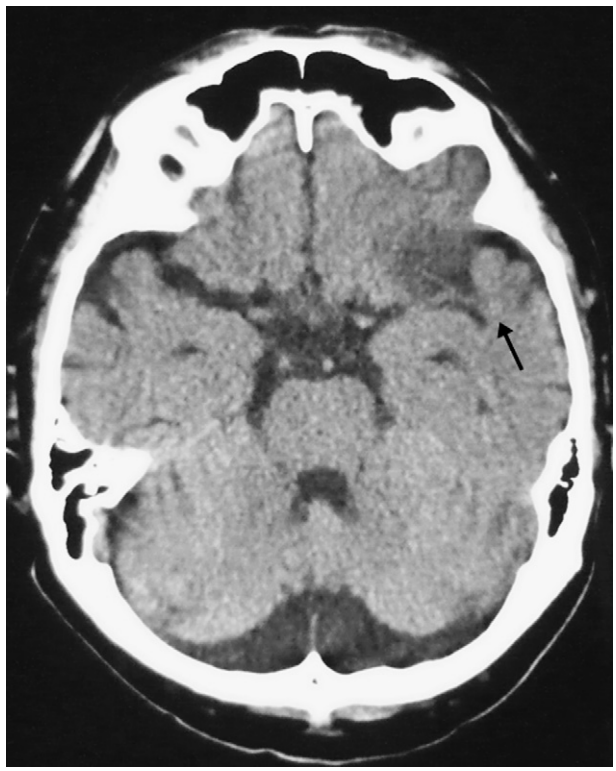

Figure 3. *CT scan obtained at 1 week after onset showing no HMCAS or hyperdense nodule (arrow).*

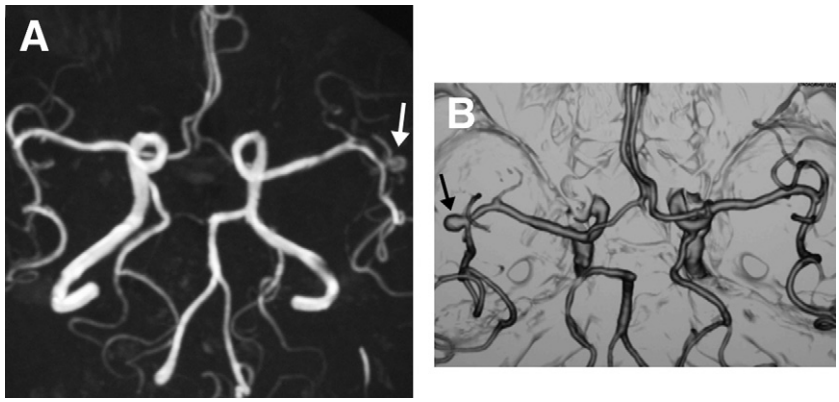

Figure 4. *(A) MRA obtained at 2 weeks after onset demonstrating recanalization and good left MCA patency. A cerebral aneurysm can be seen (arrow). (B) Three-dimensional volume-rendered images after CT angiography, in posterior view, showing a cerebral aneurysm of the left MCA (arrow).*

morning, the patient had regained an almost normal level of consciousness. The HMCAS, including the hyperdense nodule, was still evident on CT performed the next day (Fig 2), but disappeared by 1 week after onset (Fig 3). Recanalization of the occluded MCA and the aneurysm in the same ischemic MCA territory was confirmed neuroradiologically at 2 weeks after onset (Fig 4A and B). He was discharged with slight nonfluent dysphasia 16 days after admission. His NIHSS and mRS scores at 3 months after onset were both 1.

Discussion

The main finding of the present case is that both an occluded MCA and an occluded intracranial aneurysm in the same ischemic MCA territory were safely recanalized with IV administration of rt-PA. The recanalization of occluded vessels, in general, can be accomplished with administration of fibrinolytic agents, such rt-PA or urokinase, either IV[1-4] or intra-arterially.[9,10] One of the most adverse complications of such treatment is symptomatic intracranial hemorrhage, which occurs in 5.8%-6.4% of patients receiving IV thrombolysis with rt-PA.[3,4] There is concern as to whether the presence of unruptured intracranial aneurysm may put patients at greater risk for hemorrhagic complication in thrombolysis.[6] Three patients with aneurysm in whom severe hemorrhage occurred have been reported (Table 1), 2 of whom were treated with intra-arterial thrombolysis, one with urokinase and the other with rt-PA.[11,12] The third patient was treated with IV rt-PA, but the clinical diagnosis was myocardial infarction, not cerebral ischemic stroke.[13] On the other hand, 3 uncomplicated cases have been reported (Table 2). All 3 were treated with IV rt-PA for acute cerebral ischemic stroke and had an unruptured intracranial aneurysm.[14,15] Unlike in the present case, however, in these uncomplicated cases, it was not stated whether or not the aneurysms were occluded and recanalized.

In several large clinical trials regarding thrombolysis (ie, Japan Alteplase Clinical Trial [J-ACT], Middle Cerebral Artery Embolism Local Fibrinolytic Intervention Trial [MELT], and Alteplase Thrombolysis for Acute Noninterventional Therapy in Ischemic Stroke [ATLANTIS]), the presence of intracranial aneurysm was considered a contraindication.[4,7,10,16] On the other hand, there was no reference to intracranial aneurysm as a contraindication in the European Cooperative Acute Stroke Study (ECASS), ECASS II, National Institute of Neurological Disorders and Stroke (NINDS) trial, and Prolyse in Acute Cerebral Thromboembolism (PROACT) II, all of which confirmed the effectiveness of thrombolysis.[1-3,7,9] CT can reveal relatively large, thrombosed, occluded, or calcified unruptured intracranial aneurysms.[12,14] In the present case, the aneurysm projected laterally about 6 mm in the longest diameter and was occluded, so that it might have been possible retrospectively to suspect aneurysm on the basis of a hyperdense nodule on the CT scan. Three-dimensional images reconstructed by multidetector CT[17] may reveal an aneurysm in patients with HMCAS before thrombolysis.

Although there may be a tendency to not report poor outcomes, there has been no report of a ruptured intracranial aneurysm associated with thrombolysis with IV rt-PA in acute ischemic stroke.[7] On the other hand, this is the first report of an unruptured intracranial aneurysm in an ischemic MCA territory that remained stable after recanalization therapy with IV rt-PA. The frequency of HMCAS in acute ischemic stroke ranges between 15% and 35%, and HMCAS is associated with severe brain ischemia and poor outcome.[18] The findings in the present

Table 1. *Complicated cases*

Case	Age, years/sex	Location of aneurysm	Thrombolytic agent	Administration route	Clinical diagnosis
1[11]	52/F	RMCA	Urokinase	Intra-arterial	CI
2[12]	72/M	LMCA	rt-PA	Intra-arterial	CI
3[13]	66/F	AComA	rt-PA	IV	MI

Table 2. *Uncomplicated cases*

Case	Age, years/sex	Location of aneurysm	Thrombolytic agent	Administration route	Clinical diagnosis
1[14]	37/F	LICCA	rt-PA	IV	CI
2[14]	79/M	AComA	rt-PA	IV	CI
3[15]	66/F	AComA	rt-PA	IV	CI

Abbreviations: L, left side; R, right side; MCA, middle cerebral artery; AcomA, anterior communicating artery; ICCA, intracavernous carotid artery; CI, cerebral infarction; MI, myocardial infarction.

case may suggest that patients with acute ischemic stroke accompanied by unruptured aneurysm in the ischemic territory with HMCAS could benefit from thrombolysis with IV rt-PA. However, treatment may have a seriously adverse, even fatal, outcome[11–13] when rupture of an aneurysm occurs during or after administration of rt-PA. Therefore, if the presence of aneurysm is suspected before treatment, it is important to consider its characteristics, such as size, location, and daughter sac, as well as patient-related factors, such as age, medical status, hypertension, smoking, excessive alcohol consumption, and family history,[19] before reaching a decision as to treatment. It is difficult to evaluate the risk of aneurysm rupture before treatment in patients with acute ischemic stroke, but as far as possible, it is important to take into account the relative risks of aneurysm rupture with or without thrombolysis, as well as the risk of neurological deficit because of cerebral infarction. Given that about 3.6%-6.5% of persons over age 30 harbor an unruptured intracranial aneurysm,[20] the efficacy, safety, and risk of hemorrhage during IV thrombolysis for acute ischemic stroke patients with unruptured intracranial aneurysm merit further examination.

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