MRI Assessment Followed by Successful Mechanical Recanalization of a Complete Tandem (Internal Carotid/Middle Cerebral Artery) Occlusion and Reversal of a 10-Hour Fixed Deficit

Catalina C. Ionita, MD, Junichi Yamamoto, MD, PhD, Ramachandra P. Tummala, MD, Elad I. Levy, MD

From the Departments of Neurology and Neurosurgery, Stroke/ Neurocritical Care Division, School of Medicine and Biomedical Sciences, University at Buffalo, State University of New York, Buffalo, NY (CCI); Department of Neurosurgery and Toshiba Stroke Research Center, School of Medicine and Biomedical Sciences, University at Buffalo, State University of New York, Buffalo, NY (JY, RPT, EIL).

ABSTRACT

BACKGROUND

Mechanical clot extraction up to 8 hours after stroke onset is an alternative strategy for opening large vessels, especially for patients ineligible for intravenous thrombolysis. Safety beyond this therapeutic window is untested.

METHODS

An 81-year-old woman presented 8 hours after she developed left-sided weakness and dysarthria with a National Institutes of Health Stroke Scale (NIHSS) score fluctuating between 6 and 13. Neuroimaging revealed a large perfusion deficit with no diffusion abnormalities. An emergent cerebral angiogram revealed a complete internal carotid artery terminus occlusion.

RESULTS

Successful mechanical thrombectomy was performed without complication and resulted in almost complete reversal of the patient's deficit to an NIHSS score of 1, 10 hours after stroke onset.

CONCLUSION

Patients with large hypoperfused areas and minimal diffusion abnormalities on the MRI may benefit from mechanical thrombectomy beyond an 8-hour window.

Introduction

Thrombolytic treatment with recombinant tissue plasminogen activator is approved for use up to 3 hours after stroke onset. Multiple randomized trials failed to show any efficacy of intravenous thrombolysis beyond a 3-hour window. However, a subsequent meta-analysis¹ including other small studies demonstrated some benefit. Recent nonrandomized studies compared the outcome and complication rate of intravenous thrombolysis in computed tomography (CT)-selected versus magnetic resonance imaging (MRI)-selected patients, presenting within 6 hours of symptoms onset. In MRI-selected patients with persistent diffusion-perfusion mismatch, intravenous thrombolysis beyond a 3-hour window was safe, but efficacy remained undemonstrated.^{2,3} Endovascular pharmacological reperfusion approaches for patients presenting with strokes between 3 and 6 hours after the onset,⁴ mechanical thrombectomy alone,^{5,6} or in combination with intravenous thrombolysis⁷ up to 8 hours after the stroke onset are alternative strategies available.

We present a case with carotid artery occlusion, accompanied by neurological deficit without brain infarction and successful complete recanalization by mechanical thrombectomy with the Merci retrieval device (Concentric Medical, Mountain View, CA), 10 hours after the onset.

Case Report

An 81-year-old, right-handed woman, with no significant past medical history, presented with dysarthria, left facial droop, and mild left arm weakness and sensory loss, with an 8-hour delay after the onset of symptoms, because she expected spontaneous recovery to occur. Her NIHSS score at presentation was 6. Soon thereafter, she underwent an MRI (Fig 1) with (A) diffusion-weighted imaging (DWI), (B) perfusion-weighted imaging (PWI), and (C) magnetic resonance angiogram, demonstrating a faint diffusion abnormality of a small area surrounded by a large perfusion deficit in the right hemisphere, and severely reduced signal in the right internal carotid (ICA) and middle cerebral artery (MCA), consistent with severe stenosis or occlusion. Following MRI, her NIHSS score fluctuated between 6 and 13. The patient was loaded with clopidogrel 300 mg and aspirin 650 mg, and received a bolus of 500 ml of 0.9% NaCl. A subsequent cerebral angiogram revealed complete occlusion of the top of the right ICA with thrombus extending in the M1 segment of the right MCA (Fig 2A). After a bolus dose of heparin (50 U/kg) for an activated coagulation time above 250 seconds, mechanical thrombectomy with the Merci retriever was attempted. Partial recanalization (TIMI 2), with persistent occlusion of the A1 segment of the anterior cerebral artery (ACA) was achieved after the

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Correspondence: Address correspondence to Elad I Levy, MD, Department of Neurosurgery and Toshiba Stroke Research Center, School of Medicine and Biomedical Sciences, State University of New York at Buffalo, Millard. Fillmore Gates Hospital, Kaleida Health, 3 Gates Circle, Buffalo, NY 14209. E-mail: elevy@buffns.com.

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Fig 1. Magnetic resonance imaging of the brain. (A) MRI: diffusion-weighted imaging, demonstrating faint diffusion abnormality (black arrow). (B) Perfusion-weighted imaging: time-to-peak, revealing significant delay consistent with hypoperfusion in the right MCA distribution. (C) MR angiogram: demonstrating lack of signal in the right ICA and MCA (arrow), consistent with occlusion or severe stenosis; R-right, L-left.



Fig 2. Digital subtraction angiogram of the right ICA. (A) Before mechanical thrombectomy: Complete occlusion of the right ICA terminus (arrow) at the top in antero–posterior (AP) view and lateral (L) view. (B) After mechanical thrombectomy: Partial recanalization (TIMI 2) of the right ICA and MCA in antero–posterior (B_{AP}) and lateral (B_L) views; persistent occlusion of the A1 segment of the ACA is visible in Figure 2B_{AP} (arrow).

first attempt (Fig 2B), with no complications and almost complete reversal of the neurological deficits. The postprocedural NIHSS score was 1, with only a mild residual left facial droop. The patient was discharged to home in 48 hours.

Discussion

MRI-DWI in combination with apparent diffusion coefficient imaging has been proven to be more sensitive and specific than CT in identifying acute infarction⁸ and irreversible ischemia.⁹ Whether MRI selection of patients for recanalization beyond a 3-hour window can improve the outcome is not a well-established fact. However, an increased safety profile due to a lower rate of intracerebral hemorrhage has been demonstrated.³ The improved safety profile is postulated to result from a more reliable exclusion of patients with large infarction core or neoplasms presenting as stroke.³

In MRI-selected patients with persistent perfusion/diffusion mismatch, thrombolysis with desmoteplase 3–9 hours after the stroke onset has been associated with a higher reperfusion rate, a better outcome, and a lower rate of symptomatic intracerebral hemorrhage, when compared to placebo.¹⁰

The only Food and Drug Administration (FDA)-approved endovascular treatment of large-vessel occlusions in patients ineligible for⁵ or following unsuccessful recanalization after intravenous thrombolysis with tissue plasminogen activator (tPA)⁷ is mechanical thrombectomy performed with the Merci retriever device. Using a noncontrast CT patient selection, recanalization rate was 48-54% when thrombectomy was performed alone^{5,7} and as high as 69% as adjunctive therapy (intraarterial tPA, mechanical),⁷ within an 8-hour window.

In our patient, the MRI study demonstrated a large perfusion deficit with minimal ischemic injury, 10 hours after the onset. Although she was beyond the 8-hour standard window, the presence of a large area of brain tissue at risk provided a good reason to attempt a rescue therapy.

Reversal of a 30-hour fixed deficit following accurate assessment of the ischemic core and penumbra with MRI-DWI/PWI techniques has been reported;¹¹ however, the deficit was associated with severe carotid artery stenosis without occlusion. A series of 4 patients MRI selected and treated with mechanical embolectomy beyond the 8-hour window reported successful recanalization in 3 of the 4 patients and asymptomatic bleeding in 2 of 4 patients; however, none of the patients achieved a nondisabled functional outcome.¹²

MR diffusion and perfusion techniques may be preferable for the identification of patients with persistent penumbra and salvageable tissue who may benefit from aggressive reperfusion techniques beyond a 6-hour window. An ongoing trial (MR RESCUE [magnetic resonance and recanalization of stroke clots using embolectomy]) is underway to answer the question of whether MRI can be used to select patients for mechanical embolectomy with the Merci retriever up to 8 hours after the onset.¹³ More data are needed to determine if MRI should be routinely used to select patients for mechanical recanalization beyond the 8-hour window.

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