Case Report/Case Series

Association Between Neurologic Improvement With Decline in Blood Pressure and Recanalization in Stroke

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Patients with stroke often have a decline in blood pressure after thrombolysis. Neurologic improvement could result from recanalization or better collateral flow despite persistent occlusion. We hypothesized that neurologic improvement with concurrent decline in blood pressure may be a clinical sign of recanalization after intravenous tissue plasminogen activator.

Methods

Patients
The Lesion Evolution of Stroke Ischemia On Neuroimaging registry includes patients with ischemic stroke evaluated at Suburban Hospital, Bethesda, Maryland, and MedStar Washington Hospital Center, Washington, DC, between August 1999 and October 2009. Patients from the registry were included in our study if they were treated with standard IV tPA, had a National Institutes of Health Stroke Scale (NIHSS) score and magnetic resonance angiography (MRA) done before and 24 hours after IV tPA treatment, and had an M1 middle cerebral artery (MCA) occlusion demonstrated prior to treatment. The recanalization status on 24-hour magnetic resonance angiography was classified as none, partial, or complete. Seventeen patients met study criteria. On 24-hour magnetic resonance angiography, 3 patients had no recanalization, 8 had partial recanalization, and 6 had complete recanalization. At 24 hours after thrombolysis, neurologic improvement with concurrent decline in systolic blood pressure of 20 mm Hg or greater was seen in 4 patients with partial recanalization, 4 patients with complete recanalization, and none of the patients with no recanalization.

Conclusions and Relevance
Neurologic improvement with concurrent decline in systolic blood pressure of 20 mm Hg or greater after intravenous tissue plasminogen activator may be a clinical sign of recanalization. This observation needs confirmation in a larger cohort.
Fig. 1. Study Sample From the Lesion Evolution of Stroke Ischemia On Neuroimaging (LESION) Registry

A total of 368 patients were screened in the LESION database and 17 patients met the study criteria. MRA indicates magnetic resonance angiography.

Results

Seventeen patients met the study criteria as described in the Figure. Table 1 shows the demographic, clinical, and recanalization variables of the patients with and without neurologic improvement; 13 were women, 13 were white, and 10 had atrial fibrillation. The mean (SD) age of the patients was 76 (13) years and the median baseline NIHSS score was 15. At 24 hours after IV tPA, 3 patients had no recanalization, 8 had partial recanalization, and 6 had complete recanalization.

The association of neurologic improvement, decline in SBP of 20 mm Hg or greater, or both with the MCA recanalization status on 24-hour MRA after IV tPA is shown in Table 2. All 6 patients with complete recanalization and 4 with partial recanalization had neurologic improvement but there were 2 patients with no recanalization who also had neurologic improvement. Four patients with complete recanalization and 5 with partial recanalization had a decline in SBP of 20 mm Hg or greater. One patient with no recanalization also had a decline in SBP of 20 mm Hg or greater. Neurologic improvement with a concurrent decline in SBP of 20 mm Hg or greater was not observed in any patient who did not have recanalization at 24 hours post-IV tPA. Four patients with complete recanalization and 4 with partial recanalization had combined neurologic improvement, with a decline in SBP of 20 mm Hg or greater.

Discussion

We found that neurologic improvement by 4 or more points on the NIHSS or an NIHSS score of 0 at 24 hours after IV tPA with a concurrent decline in SBP of 20 mm Hg or greater was more likely to be associated with recanalization after thrombolysis. If confirmed by larger studies, this clinical correlation could be useful in the management of patients with acute ischemic stroke. Patients who have recanalized may not need aggressive treatment with IV fluids or rarely pressors for management of declining blood pressure after stroke. Avoiding these therapies could be particularly valuable for those with congestive heart failure. In patients considered for bridging IV tPA with endovascular interventions, repeat vessel imaging could be considered prior to the procedure if there is neurologic improvement associated with a decrease in SBP of 20 mm Hg or greater because this finding might suggest recanalization.

Not all patients with neurologic improvement had recanalization. Improvement may have been due to good collateral flow from higher BP. In our series, 2 patients (patients 3 and 4; Table 1) had neurologic improvement without recanalization; neither had a decline in SBP of 20 mm Hg or greater. Four

Mattle et al found that patients recanalized by intracranial procedures had a decrease in mean SBP of 17.3 mm Hg. Therefore, we evaluated for the association of (1) decline in SBP of 20 mm Hg or greater, (2) neurologic improvement, and (3) neurologic improvement with a decline in SBP of 20 mm Hg or greater, with the recanalization status at 24-hour post-IV thrombolysis.
patients received 1 dose of IV antihypertensive medication, either labetalol hydrochloride or hydralazine hydrochloride, in the first 24 hours per tPA monitoring protocol. None of the patients received any oral antihypertensive medications during the first 24 hours after tPA.

The association of recanalization, decline in BP, and neurologic improvement may not be as useful in patients with lower NIHSS scores or pre-tPA SBP at baseline. Whereas the 4 patients (patients 8, 10, 11, and 12; Table 1) who had complete recanalization and demonstrated neurologic improvement with concurrent decline in SBP of 20 mm Hg or greater at 24 hours after IV t-PA had higher NIHSS scores at baseline (scores of 8, 23, 21, and 27 respectively), the 2 patients (patients 1 and 2; Table 1) who completely recanalized but did not have a decline in SBP of 20 mm Hg or greater had lower NIHSS scores at baseline (scores of 1 and 5 respectively). Patient 2 also had lower pre-tPA SBP of 126 mm Hg.

A limitation of our study was the small sample size. We also did not evaluate the BP and NIHSS score changes in patients without MCA occlusion on pre-tPA treatment scan. However, this is a clinically relevant proof-of-concept, hypothesis-generating study. The decline in SBP of 20 mm Hg or greater was considered to reflect recanalization based on previous studies. These observations need to be confirmed with larger studies. Our future plan is to verify our findings in a larger cohort with inclusion of patients with and without MCA occlusion on pre-tPA treatment scan. The clinical sign to determine recanalization may not apply when BP changes are influenced by other conditions, such as atrial fibrillation with rapid ventricular response, systemic hemorrhage, and intubation, or when there is a lower baseline NIHSS or SBP. Neurologic improvement with a concurrent decline in SBP indicates a high likelihood of recanalization but its absence does not necessarily indicate nonrecanalization.

Conclusions
Neurological improvement with a concurrent decline in SBP may be a useful clinical sign to determine recanalization.
Funding/Support: This research was supported by the Intramural Research Program of the National Institutes of Health, National Institute of Neurological Disorders and Stroke. Dr Adams has grant support from the National Institute of Neurological Disorders and Stroke.

Role of the Sponsors: The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Additional Contributions: We acknowledge and thank the National Institutes of Health Stroke Team; the staffs of Suburban Hospital, Bethesda, Maryland, and MedStar Washington Hospital Center, Washington, DC; and the patients for their valuable participation.

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