

# Stroke Mimics under the Drip-and-Ship Paradigm

Sonal Mehta, MD,\* Nirav Vora, MD,† Randall C. Edgell, MD,\* Hesham Allam, MD,\*  
Aws Alawi, MD,\* Jennifer Koehne, RN, BSN, MSN,\* Abhay Kumar, MD,\*  
Eliahu Feen, MD,\* Salvador Cruz-Flores, MD,‡ and Amer Alsheklee, MD, MS\*

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*Background:* Recent reports suggested better outcomes associated with the drip-and-ship paradigm for acute ischemic stroke (AIS) treated with thrombolysis. We hypothesized that a higher rate of stroke mimics (SM) among AIS treated in nonspecialized stroke centers that are transferred to comprehensive centers is responsible for such outcomes. *Methods:* Consecutive patients treated with thrombolysis according to the admission criteria were reviewed in a single comprehensive stroke center over 1 academic year (July 1, 2011 to June 30, 2012). Information on the basic demographic, hospital complications, psychiatric diagnoses, and discharge disposition was collected. We identified those patients who were treated at a facility and then transferred to the tertiary center (ie, drip-and-ship paradigm). In addition to comparative and adjusted analysis to identify predictors for SM, a stratified analysis by the drip-and-ship status was performed. *Results:* One hundred twenty patients were treated with thrombolysis for AIS included in this analysis; 20 (16.7%) were discharged with the final diagnosis of SM; 14 of those had conversion syndrome and 6 patients had other syndromes (seizures, migraine, and hypoglycemia). Patients with SM were younger ( $55.6 \pm 15.0$  versus  $69.4 \pm 14.9$ ,  $P = .0003$ ) and more likely to harbor psychiatric diagnoses (45% versus 9%;  $P \leq .0001$ ). Eighteen of 20 SM patients (90%) had the drip-and-ship treatment paradigm compared with 65% of those with AIS ( $P = .02$ ). None of the SM had hemorrhagic complications, and all were discharged to home. Predictors of SM on adjusted analysis included the drip-and-ship paradigm (odds ratio [OR] 12.8, 95% confidence interval [CI] 1.78, 92.1) and history of any psychiatric illness (OR 12.08; 95% CI 3.14, 46.4). Eighteen of 83 drip-and-ship patients (21.7%) were diagnosed with SM compared with 2 of 37 patients (5.4%) presented directly to the hub hospital ( $P = .02$ ). *Conclusion:* The drip-and-ship paradigm and any psychiatric history predict the diagnosis of SM. None of the SM had thrombolysis-related complications, and all were discharged to home. These findings may explain the superior outcomes associated with the drip-and-ship paradigm in the treatment for AIS. **Key Words:** Stroke—acute ischemic stroke—stroke mimics—conversion disorder—thrombolysis—tPA—drip-and-ship.

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From the \*Department of Neurology and Psychiatry, St Louis University Hospital, St Louis, Missouri; †Riverside Radiology Associates, Columbus, Ohio; and ‡Department of Neurology, Texas Tech University Health Sciences Center, El Paso, Texas.

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Address correspondence to Sonal Mehta, MD, Department of Neurology, Saint Louis University School of Medicine, 1438 S, Grand Blvd, St Louis, MO 63104. E-mail: [smehta13@slu.edu](mailto:smehta13@slu.edu).

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## Introduction

Stroke Mimics (SM) are group of conditions that present in a manner similar to acute ischemic stroke (AIS); the most common of which are conversion disorder, migraine, seizures, and Bell's palsy.<sup>1,2</sup> The rates of SM among all AIS or "brain attacks" had reached as high as 31%<sup>3,4</sup>; similar high rates were found among patients with transient ischemic attack.<sup>5</sup> The clinical presentations are often difficult to distinguish from genuine ischemic syndromes especially in emergency settings. These

patients are not infrequently encountered within the window for thrombolytic therapy, and hence, they pose a clinical challenge. The rates of thrombolysis given for SM varied between 1.4% and 15.5% among all treated patients.<sup>1,6-9</sup> There is evidence to suggest that thrombolysis is safer in this population.<sup>7,10</sup> In 2005, Recognition of Stroke in the Emergency Room Study attempted to come up with a stroke recognition instrument based on the clinical history and physical signs.<sup>11</sup> Despite the high sensitivity, specificity, and predictive values, Recognition of Stroke in the Emergency Room Scale acquired little utilization in clinical practice especially in the United States where most centers adopt the simpler face arm speech test screening module.<sup>12</sup> These screening tests frequently overlook the SM especially in less experienced centers.

The “drip-and-ship” paradigm has continued to gain popularity over the recent years especially with recent studies showing a similar safety profile when patients are treated within the spoke and hub hospitals compared with regional stroke centers.<sup>13,14</sup> This practice model has increased the utilization of thrombolytic therapy.<sup>15</sup> Moreover, outcome studies suggested a comparable and perhaps superior safety and efficacy of thrombolysis if administered within the drip-and-ship paradigm.<sup>16</sup> Our personal observations suggested a higher rate of SM among patients who were evaluated by spoke hospitals within our stroke network and treated with the drip-and-ship paradigm. In this study, we hypothesize that there is a greater likelihood of SM among patients undergoing thrombolytic therapy for AIS in the drip-and-ship paradigm.

## Methods

A retrospective review of consecutive thrombolysis-treated patients admitted to a single comprehensive stroke center (St Louis University hospital) during 1 academic year (July 1, 2011 to June 30, 2012) was conducted. St Louis University hospital also serves as the main hub for the Mid-America Stroke Network. The network is a collaborative system of hospitals that work together to deliver quality stroke care throughout the region. In addition, the network provides member hospitals with 24-hour access to specialists, express transportation services for stroke patients, and state-of-the-art technology for consultative and diagnostic services. All patients within the network (including the hub hospital and the spoke hospitals) were treated with thrombolysis for neurological symptoms compatible with the diagnosis of AIS. To qualify for thrombolysis, all patients must meet the guideline criteria including the measurable neurological deficit based on the National Institutes of Health Stroke Scale (NIHSS), head imaging, and the time window for therapy. Once thrombolysis initiated, all treated patients must receive a post-thrombolysis care in a specialized

stroke unit or intensive care unit for close monitoring of the vital status and neurological symptoms. All treated patients must be followed with a 24-hour head imaging unless the clinical course dictate otherwise. We extracted information on the basic demographic, vascular risk factors, psychiatric diagnoses, and discharge information. We identified patients who were treated with thrombolysis by the spoke hospitals and then transferred to the hub hospital (ie, drip-and-ship paradigm).

## Outcome Measures and Statistical Analysis

Outcomes measures included the discharge NIHSS, discharge modified Rankin Scales, intracerebral hemorrhage, hospital mortality, discharge destination, and the length of hospital stay. Final clinical diagnosis was made by the vascular neurologist based on the clinical presentation and the hospital evaluation. We grouped patients who were treated with thrombolysis but were not given the discharge diagnosis of AIS as SM. Comparative analysis using student *t* test and Fisher exact test were used to compare the mean and proportions for continue and categorical variables. A logistic regression model was built to evaluate covariate associated with outcome of “SM.” Covariate included the drip-and-ship paradigm if implemented in the care of patients. Lastly, a comparative analysis was performed for the demographics and outcomes stratified by the drip-and-ship status.

## Results

During 1 academic year, 120 patients underwent thrombolysis for acute stroke and admitted to the hub hospital. Because of the nature of the sizable stroke network, more patients were treated with drip-and-ship paradigm ( $n = 83, 69\%$ ). One hundred patients were discharged with the clinical diagnosis of AIS and 20 (16.7%) patients were discharged with other conditions that were grouped as SM. Of these 20 patients with SM, 14 had conversion disorder and 6 patients had other syndromes (2 patients with migraine, 1 for each of these diagnoses: seizures, hypoglycemia, peripheral herpes zoster, and an exacerbation of an old stroke because of systemic infection). Patients with SM were younger ( $55.6 \pm 15.0$  versus  $69.4 \pm 14.9$ ,  $P = .0003$ ), had a similar gender distribution (females: 55% versus 46%), and were more likely to harbor a history of psychiatric diagnosis (45% versus 9%;  $P \leq .0001$ ). Among the SM, 9 patients had prior psychiatric diagnoses and these included 4 patients with depression, 4 with generalized anxiety disorder, and 1 patient with a bipolar disease. All vascular risk factors except hypertension and atrial fibrillation were equally represented in both groups. Patients with SM had lower NIHSS score on presentation (median: 6 versus 12,  $P < .0001$ ). Eighteen of the 20 SM patients (90%) were treated in the spoke hospitals using the drip-and-ship treatment paradigm

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