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## Clinical Review

### CLINICAL MIMICS: AN EMERGENCY MEDICINE-FOCUSED REVIEW OF STROKE MIMICS

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**Abstract—Background:** Stroke is a leading cause of death and disability and most commonly presents with focal neurologic deficit within a specific vascular distribution. Several other conditions may present in a similar manner. **Objectives:** This review provides emergency providers with an understanding of stroke mimics, use of thrombolytics in these mimics, and keys to differentiate true stroke from mimic. **Discussion:** Stroke has significant morbidity and mortality, and the American Heart Association emphasizes rapid recognition and aggressive treatment for patients with possible stroke-like symptoms, including thrombolytics. However, many conditions mimic the presentation of stroke, with up to a 31% rate of misdiagnosis, leading to potentially harmful treatment. Stroke mimics are conditions that present with stroke-like symptoms, including seizures, headaches, metabolic, infection, space-occupying lesion, neurodegenerative disorder, peripheral neuropathy, syncope, vascular disorder, and functional disorder. Factors of history and physical examination supporting stroke vs. mimic are discussed, though any sudden-onset, objective, focal neurologic deficit in a patient should be assumed acute stroke until proven otherwise. Head computed tomography noncontrast is the first-line imaging modality. Magnetic resonance imaging is the most sensitive and specific imaging modality. Neurology consultation is recommended in the majority of patients. If stroke is suspected after evaluation, shared decision-making for further management and consideration of thrombolytics is recommended. **Conclusions:** Stroke mimics present a conundrum for emergency providers. A new focal neurologic deficit warrants rapid

evaluation for stroke with neuroimaging and neurology consultation. Several mimics found on assessment may resolve with treatment. Published by Elsevier Inc.

**Keywords—stroke; cerebrovascular accident; thrombolytics; mimic; headache; seizure; encephalopathy; hypoglycemia; peripheral neuropathy; neurodegenerative; chameleon**

#### INTRODUCTION

Cerebrovascular accident (CVA) is among the top five causes of death and the number one cause of disability in the United States (1,2). Acute ischemic attack affects over 600,000 patients per year, with three-quarters of these presenting with a first-time stroke (1–5). With the potential morbidity and mortality of stroke, the American Heart Association (AHA) recommends rapid recognition and potentially aggressive treatment of patients presenting with possible stroke symptoms (3–7). A significant push exists to rapidly diagnose CVA and obtain glucose and head computed tomography (CT) in patients with concern for CVA, as thrombolytics require specific time criteria and contraindication considerations (6,7). Literature suggests that for every 15-min interval reduction in time to thrombolytics, patients demonstrate improved

morbidity and decreased risk of intracranial hemorrhage, the primary concern of providing thrombolytics (8,9).

Classically, strokes present as the sudden onset of a focal neurologic deficit in a vascular distribution (6,7,10). There are multiple diagnoses that may mimic this presentation. Misdiagnosis of stroke ranges from 5% to 31% of patients, which can potentially lead to unnecessary and harmful treatments if patients present within the thrombolytic time window (11–17). Patients can experience many conditions that may present as stroke, often confounding the clinical picture. These conditions are known as stroke mimics.

## DISCUSSION

A stroke mimic is defined as a nonvascular disease that presents with stroke-like symptoms, often indistinguishable from an actual CVA. The harmful side effects of thrombolytics, most commonly bleeding, are not insignificant; thus, accurate diagnosis is essential. Rates of mimic treated with intravenous thrombolytics vary from 1% to 20% (11–17). The rate of bleeding approaches 1–2% in these patients (14,15).

Acute CVA may present with a variety of symptoms including weakness, sensory changes, vision changes, dysarthria, dysphagia, vision abnormalities, seizures, and many others (11–13,17). Due to this wide variety of symptoms, many other conditions may, on initial impression, be diagnosed as acute stroke (17–23). Table 1 lists these common conditions (6–8,13,17–48).

### *Stroke Chameleons*

A stroke chameleon is a CVA that presents as a different condition (23,25,49). Movement disorders such as acute hemiballismus can occur with acute lesions in the subthalamic nucleus. This condition will present with wild movements, often uncontrollable, that are one sided. Confusion, agitation, and delirium may occur with acute lesions of temporal lobe limbic cortex, as well as the orbitofrontal regions (23,25,49). This can be difficult to differentiate from stroke syndromes with neglect or aphasia, as the patient may appear altered. Lesions affecting the parietal or thalamic regions may result in sensory loss. Cortical blindness is rare, but examination demonstrates normal pupillary light response and normal optic disks (23,25,49).

One key to differentiation and diagnosis of the stroke chameleon is evaluating for symptoms with abrupt onset. Risk factors for cerebrovascular disease such as cardiovascular disease, diabetes, hypertension, and hyperlipidemia can suggest stroke with atypical presentation, but by no means are they definitive (11,17–20,25). Another

key difference is the presentation of negative symptoms or deficit in strokes (25).

### *Differentiating Stroke vs. Mimic*

Diagnosis of stroke, compared to mimic, depends on the complaint, risk factors, onset time, vascular distribution of symptoms, and imaging modalities available to the provider. A variety of studies have evaluated signs or symptoms that can indicate stroke vs. mimic. One study found convulsions (odds ratio [OR] 4.59) and aphasia (OR 2.55) to predict mimic, whereas dysarthria (0.25), hemiparesis (OR 0.26), facial palsy (OR 0.22), and visual field neglect (0.15) predict stroke (20,50). A separate study suggests that chest pain (OR 16.7) and paresthesias (OR 10) more commonly suggest mimic (20,22). Ultimately, studies display conflicting results. Two or three focal findings (acute facial paralysis, arm drift/weakness, change in speech) with abrupt onset suggest CVA, whereas the lack of these findings suggest mimic (11,17–23,25,32,50–52).

This history is also vital, as younger age is more commonly associated with mimic in most studies, though one study by Winkler et al. finds it to be inconclusive (52). Risk factors such as atrial fibrillation (OR 11.4) are often associated with stroke, though other studies have found conflicting results (16–20,50). Other risk factors such as coronary artery disease, hypertension, hyperlipidemia, and diabetes are inconsistent, with some studies suggesting improved likelihood of stroke and others suggesting no correlation (11,16–23,25,32,51–54). A prior history of epilepsy, baseline cognitive impairment, and migraine can suggest mimic, but beware of contributing all conditions to these factors. Time of onset is a necessary part of the evaluation. A sudden-onset deficit in a vascular distribution suggests CVA, and several deficits fitting a specific anatomic distribution supports a diagnosis of acute ischemic stroke as well (11,16–23,25,32,51–53). Table 2 depicts factors supporting stroke and mimic (11,16–23,25,32,51–53).

### *Management*

The goals of care in evaluation of the patient with concern for CVA are rapid recognition of the deficit and rapid imaging. Stroke is one of the most life-threatening and time-sensitive conditions associated with focal deficit requiring diagnosis in the ED. The diagnosis of stroke mimic is most commonly completed only after advanced imaging, laboratory investigation, and neurology consultation (6–8). Any focal deficit should be assumed CVA. A focused history and physical examination must be completed in a rapid manner with assessment of the National Institutes of Health Stroke Scale (NIHSS)

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