Stroke Chameleons

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Background: Many conditions called "stroke mimics" may resemble acute stroke. The converse of the "stroke mimic" is a presentation suggestive of another condition, which actually represents stroke. These would be "stroke chameleons." The recognition of a chameleon as stroke has implications for therapy and quality of care. *Methods:* We performed a retrospective chart review, including all cases for 1 year in which patients had a stroke missed on hospital presentation. Initial erroneous diagnoses were compared for all patients correctly admitted with those diagnoses to determine positive predictive value (PPV) for each chameleon. *Results:* Ninety-four cases were identified as chameleons where brain imaging revealed acute stroke. The common chameleons were initially diagnosed as altered mental status (AMS) (29, 31%), syncope (15, 16%), hypertensive emergency (12, 13%), systemic infection (10, 11%), and suspected acute coronary syndrome (ACS) (9, 10%). The total number of patients who were diagnosed with these conditions over the same year were AMS (393), syncope (326), hypertensive emergency (144), systemic infection (753), and suspected ACS (817) (total N = 2528). For each chameleon diagnosis, the PPV of each presentation for acute stroke was AMS (7%), syncope (4%), hypertensive emergency (8%), systemic infection (1%), and suspected ACS (1%). *Conclusions:* Stroke chameleons may result in patients not receiving appropriate care. The largest proportions of chameleons were AMS, syncope, hypertensive emergency, systemic infection, and suspected ACS. Patients diagnosed with hypertensive emergency or AMS had an 8% and 7% chance of having an acute stroke. Physicians should consider stroke in patients with these diagnoses with a lower threshold to obtain neuroimaging with subsequent appropriate management. **Key Words:** Acute stroke—stroke mimic—syncope—hypertensive encephalopathy—hypertensive emergency—psychosis.

Introduction

Stroke is most clearly characterized by the sudden onset of an acute neurologic deficit. We coined the term "stroke mimic" to describe a clinical syndrome suggestive of stroke, yet not actually caused by an ischemic event.[1] In a prior study, we showed that of approximately 400 patients diagnosed as stroke, the prevalence of stroke mimics was found to be 19%. These conditions were

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found to primarily include seizures (17%), systemic infections (17%), brain tumor (15%), and toxic metabolic disturbances (13%). The rate of stroke mimics in other studies has been as low as 4% with the addition of computed tomography and laboratory analysis.[2]

As opposed to stroke mimics, a related, but not well-explored concept is what may be called a "stroke chameleon."[3] This concept encompasses syndromes that do not appear to represent a stroke on initial presentation but are later found to represent an acute stroke. Stroke chameleons may present as malaise, loss of consciousness, encephalopathy, and acute psychosis and a myriad of other conditions. Although symptoms such as weakness, sensory loss, and hemianopia are easy to recognize, the more subtle presentations of stroke may be easily missed. Abulia, for instance, is well documented in anterior cerebral arterial vascular distribution infarcts. Even more subtly, simple confusion is well documented in infarcts of multiple areas including thalamus, nondominant parietal lobe, and caudate nucleus. Cases of peduncular hallucinosis, for example, are well described as a consequence of stroke and symptoms may easily be attributed to an acute psychiatric event. Thalamic infarcts may have presentations indistinguishable from schizophrenia (with the exception of the acuity of onset).[4]

The rapid recognition of a chameleon as an acute stroke has significant clinical implications, in terms of acute therapy, secondary prevention, and overall quality improvement of stroke care. This vigilance may assist with compliance with performance improvement instruments such as "Get with the Guidelines"[5] and result in improved patient care. Clarification of the most common stroke chameleons would allow clinicians to devote appropriate resources to investigate and treat patients for stroke, who might otherwise be missed. In patients determined to be at a higher risk for having had an acute stroke, it may be advantageous to have a lower threshold for brain imaging followed by appropriate workup.

Methods

A retrospective chart review was performed on all cases from January 2011 to January 2012, in whom an acute stroke was missed on initial hospital presentation. Data were pulled from the administrative database of a state Department of Health–certified primary care stroke center. All such cases then had a full chart review before inclusion or subsequent exclusion. Included were all patients presenting with an acute syndrome leading to hospital admission and given an initial admitting diagnosis other than stroke but later determined to have actually had an acute ischemic stroke. In these cases, the diagnosis of acute stroke was made via incidental neuroimaging (both computed tomography and magnetic resonance imaging) and not via neurological examination. Patients were only included in our analysis if the specific symptoms leading to their initial hospital presentation were felt to be purely as a consequence of acute stroke and not because of any comorbid illnesses or conditions. Patients under the age of 18 were excluded. Cases with acute symptom onset during hospitalization without prior reported focal neurologic deficits ("in-house" strokes) or in which the timing of stroke was unclear were excluded from the analysis. Cases of hemorrhagic stroke were also excluded. We excluded any patients who were admitted to a stroke unit, received acute stroke supportive therapy, or who on review of their admitting history and physical examinations had any mention of consideration of stroke.

These presentations, henceforth referred to as chameleons, were tabulated, and the most common chameleons were compared with the total number of patients correctly admitted with that diagnosis. These controls were patients who were discharged with the same diagnosis as they had on admission. We were, thereby, able to establish the positive predictive value (PPV) for each of the most common stroke chameleons as an indicator of the likelihood of an acute stroke.

Statistical Analysis

In calculating the PPV for these analyses, an incorrect admitting diagnosis that turned out to be stroke was considered to be a true positive and a correct admitting diagnosis for the same condition was considered to be a false positive. The analyses were performed using the EpiR package in the R computing package (version 2.12.1; R Development Core Team, Wien, Austria).

Results

Among the 94 patients found to present with stroke chameleons, the 5 most common were altered mental status (AMS), syncope, hypertensive emergency, systemic infection, and suspected acute coronary syndrome (ACS). Figure 1 shows the breakdown of these stroke chameleons. These stroke chameleons and their PPVs are depicted in Table 1. A list of the remaining chameleons is summarized in Table 2. In the same 1-year period, a total of 2528 patients were admitted with the same diagnoses as the stroke chameleons, 2434 of which were discharged with diagnoses other than stroke. The specific breakdowns of these were AMS (393), syncope (326), hypertensive emergency (144), systemic infection (753), and suspected ACS (817).

Discussion

Stroke mimics and stroke chameleons present a diagnostic challenge to the clinician evaluating patients in the acute setting. The most common stroke chameleon in our study was AMS. Presentations labeled as AMS included acute psychosis, perceived delirium, memory