Missed Opportunities for Recognition of Ischemic Stroke in the Emergency Department

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Introduction: Evidence suggests that a significant number of patients discharged from the hospital with a diagnosis of ischemic stroke are not identified as having a stroke on admission. Those presenting with "nontraditional" stroke symptoms may be less likely to be diagnosed correctly. We aimed to establish whether there was an association between symptom presentation and diagnostic accuracy and to identify the type and frequency of nontraditional symptoms that resulted in a missed diagnosis in the emergency department.

Methods: We reviewed the medical records of 189 patients discharged with a diagnosis of ischemic stroke from Yale-New Haven Hospital. We performed χ^2 analysis to determine whether an association existed between symptom presentation and diagnostic accuracy. Descriptive statistics allowed us to identify symptom type and frequency in patients with a missed diagnosis.

Results: A diagnosis of suspected stroke was missed in 15.3% of patients who presented to the emergency department. We found a strong association ($P < 0.0001$) between symptom presentation and diagnostic accuracy. Of the patients presenting with any "traditional" symptom, 4% were missed. Of those presenting with only nontraditional symptoms, 64% were missed (odds ratio, 43.4; 95% confidence interval, 15.0-125.4). Nontraditional symptoms included generalized weakness, altered mental status, altered gait, and dizziness.

Discussion: In order to facilitate appropriate management of patients with ischemic stroke, emergency nurses must be aware that symptom presentation is highly variable. Patients presenting with nontraditional symptoms may benefit from an immediate and comprehensive neurological evaluation.

Key words: Missed diagnosis; Ischemic stroke

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The American Heart Association estimates that 795,000 persons have a stroke each year. Stroke is the fourth leading cause of death and is the primary cause of adult disability in the United States.[1] For patients presenting with acute ischemic stroke, intravenous tissue plasminogen activator (tPA) is most advantageous when given as early as possible within the first 4.5 hours after symptom onset. For patients to benefit from this intervention, it is imperative to expedite rapid triage. Thus an accurate clinical assessment—including time of symptom onset and a noncontrast head computed tomography scan to exclude hemorrhage—is essential to timely initiation of treatment. Emergency nurses are often the first clinicians in the emergency department to assess the patient and should, therefore, be able to recognize patients who present with acute stroke symptoms.

Although the abrupt onset of focal neurologic deficits, such as unilateral weakness, visual disturbances, and language impairment, is the hallmark sign of acute ischemic stroke, symptom presentation can be highly variable depending on the location of the affected vascular terri-

tory.[2] Patients may present with common and nonspecific symptoms such as dizziness, nausea, vomiting, altered mental status, unsteady gait, and headache.[3] In older adults manifestations include falls and reduced mobility—symptoms not typically associated with stroke.[4] Patients who have strokes in the part of the brain where blood flow is supplied by the posterior circulation, such as in the cerebellum, frequently present with headaches, dizziness, or feeling off balance.[5] These symptoms are not typically or traditionally associated with ischemic stroke and can lead health care providers to consider other diagnoses. Conditions such as seizures, complex migraines, or hypoglycemia are considered "stroke mimics" because they present with similar clinical findings but have very different etiologies.[6] Other stroke mimics include electrolyte abnormalities, brain tumors, delirium, and vestibular dysfunction.[7]

The overall rate of acute ischemic stroke misdiagnosis by emergency physicians is reported to range from 5% to 38%.[8] Evidence suggests that stroke is less likely to be diagnosed when patients present with nontraditional or atypical symptoms. This finding is based on comparing admission diagnosis with final discharge diagnosis. Health care providers mistakenly attribute symptoms to one of the stroke mimics.[2] Screening tools that are frequently used by emergency nurses—such as face, arm, speech, time (FAST)—may fail to capture more than 10% of symptoms.[9]

Our small preliminary study in 2006 showed that 15 of 87 patients (17%) discharged with a diagnosis of ischemic stroke over an 8-month period were admitted with a diagnosis other than stroke. Most of these patients presented with altered mental status, vertigo, and syncope. These patients arrived within a 3-hour time window and in retrospect were deemed eligible for, but did not receive, tPA. This represented a missed opportunity not only for acute stroke treatment but also for appropriate nursing care, rehabilitation, and implementation of interventions aimed at reducing complications and preventing recurrent stroke. Early, accurate recognition of stroke symptoms is essential for facilitating timely, comprehensive neurologic evaluation and stroke workup.

The purpose of this study was to determine whether an association exists between symptom presentation and diagnostic accuracy in patients who present to the emergency department with acute stroke symptoms. Our research addressed 2 questions:

1. Is there an association between symptom presentation and diagnostic accuracy in patients with a discharge diagnosis of ischemic stroke who presented directly to the emergency department?
2. If there is an association between symptom presentation and diagnostic accuracy, then what are the type and frequency of "nontraditional" symptoms that result in a missed diagnosis in the emergency department?

TABLE 1
Classification of symptoms

Traditional symptoms	Nontraditional symptoms
Facial droop	Vision changes
Arm weakness	Altered gait
Leg weakness	Dizziness
Facial numbness	Fall
Arm numbness	Altered mental status
Leg numbness	Seizure
Aphasia	Syncope
Slurred speech	Generalized weakness/fatigue
Headache	Nausea/vomiting
	Neck pain
	Shortness of breath

Methods

We collected data through a retrospective medical record review. Our population was all patients who were initially admitted to the hospital through the emergency department of the study institution and then later discharged with a diagnosis of ischemic stroke. Our sample included patients discharged between October 2008 and June 2009 (N = 189). We included patients in whom stroke was diagnosed by magnetic resonance imaging within the first 24 to 48 hours after admission. In several cases where magnetic resonance imaging was contraindicated, patients were diagnosed through clinical judgment by the neurology team. We also included patients who initially presented with atypical symptoms but progressed to typical symptoms. We excluded patients who were aged less than 18 years, who were discharged with a diagnosis of transient ischemic attack or hemorrhagic stroke, or in whom stroke symptoms developed after hospital admission. We also excluded patients who were transferred from an outside hospital or in whom stroke was diagnosed before arrival to the emergency department. The study site is a 966-bed teaching hospital that serves as a primary care center for area residents and a referral center for patients from around the state and the country. It is a level 1 trauma center and both a Joint Commission–certified and Department of Public Health–certified Primary Stroke Center.

The institution's Human Investigation Committee application was first approved in July 2007 and has been