Stroke Recognition and Management

Early identification and treatment are the keys.

Donald Jameson, an African American man in his mid-60s wakes up on a Saturday morning with plans to mow his lawn and wash the car (this scenario is a composite based on our experience). He makes breakfast for his wife and himself. While sitting at the kitchen table he attempts to take a bite of food but is unable to lift his right hand. He then uses his left hand to take a sip of his coffee, but the coffee drips down the side of his mouth. His wife, Pamela, witnessing all of this, asks him what's wrong, and he answers, but his speech is slurred and unclear.

Ms. Jameson, recognizing his behavior from television news shows as possible signs of a stroke, immediately dials 911 and describes her husband's symptoms to the dispatcher. Upon arrival at Mr. Jameson's home, the paramedics assess the patient's airway, breathing, and circulation, which are stable. He's transported to the ED. En route, the paramedics ask Ms. Jameson several questions: What time did the symptoms initially occur? When was his speech last not slurred? What is his medical—surgical history? What medications is he currently taking? Then they perform a focused neurologic assessment.

According to the 2011 update on U.S. stroke statistics (http://bit.ly/gvDPOS) from the American Heart Association (AHA), a stroke occurs, on average, every 40 seconds in this country. It affects about 795,000 Americans each year (about 610,000 are first strokes) and is the third leading cause of death after cardiovascular disease and cancers. Stroke "is a leading cause of serious, long-term disability,"1 with related health care costs of about $73.7 billion in the United States.2 The rate of death from stroke is higher among blacks than among whites, in part because the rate of stroke itself has gone down in whites while not diminishing in the black population.

Etiology and Types of Stroke

Strokes are classified according to etiology and are either ischemic or hemorrhagic. Ischemic strokes are caused by a sudden interruption of blood flow to the brain and account for 87% of all strokes.3

Ischemic strokes occur when there's an acute occlusion of cerebral blood vessels or systemic hypoperfusion depriving the brain of oxygen and glucose.3,4 Ischemic strokes are further classified as either thrombotic or embolic. Thrombotic strokes occur as a result of atherosclerotic plaque formation with subsequent rupture and thrombus development. Embolic strokes occur as a result of the formation of a thrombus, usually within the heart (cardioembolic) or large arteries within the chest (carotid). A segment of the thrombus breaks off, traveling through the bloodstream from the left heart into the cerebral circulation, occluding small distal blood vessels in the brain.2 There are a number of possible causes of cardioembolic and cardioaortic stroke:4,6

- atrial fibrillation (sustained or paroxysmal)
- atrial flutter
- sick sinus syndrome
- recent myocardial infarction (within one month)
- bioprosthetic and mechanical heart valves
- infective endocarditis
- patent foramen ovale
- atrial septum
- dilated cardiomyopathy
- left atrial or ventricular thrombus

Hemorrhagic strokes occur when a cerebral vessel ruptures and bleeds within the brain. Hemorrhagic strokes are classified as either intracerebral or subarachnoid.7 Intracerebral hemorrhages occur as a result of ruptured aneurysms, arteriovenous malformations, coagulopathies, tumors, cocaine abuse, anticoagulant therapy, and damage to small intracerebral arteries from chronic hypertension.6 A subarachnoid stroke occurs in the area between the brain and tissue that covers it. Aneurysms located at the base of the brain are the primary cause of subarachnoid hemorrhage. Patients experience a sudden, intense headache and nausea and vomiting as a result of increased intracranial pressure.
By Linda Kay Cook, PhD, RN, CCRN, CCNS, and Sheryl L. Clements, MSN, RN, CRNP, FNP-BC

Figure 1. Normal Functional Areas of the Brain. Depending on what part of the brain has been affected, stroke victims experience a variety of neurologic deficits. Illustration courtesy of The Anatomical Chart Company.

**BEFORE ARRIVAL AT THE ED**

Entry into the health care system for 29% to 65% of patients experiencing signs or symptoms of an acute stroke begins with emergency medical services (EMS); 19% to 60% of stroke patients arrive within three hours of the onset of signs and symptoms (three hours is the window for the use of recombinant tissue plasminogen activator [rt-PA]). The use of EMS is reflective of a sense of urgency on the part of the patient or witnesses in the face of the signs and symptoms.

Assessment of the patient's airway, breathing, and circulation (the ABCs, not to be confused with CAB—compressions, airway, and breathing—the mnemonic currently recommended for use in cardiopulmonary resuscitation) is a priority upon identification of stroke. Upon stabilization of the ABCs, a focused neurologic assessment and assessment for the common presenting signs of stroke should be completed. In ischemic stroke, these are numbness or weakness; confusion or change in mental status; trouble speaking or understanding speech; difficulty walking, dizziness, or loss of balance; sudden severe headache; and deterioration of vision in one or both eyes. In hemorrhagic stroke, common presenting signs differ according to whether the patient is conscious or unconscious. If the patient is conscious, the primary presenting symptom is a severe sudden headache. In an unconscious patient, the practitioner should look for vomiting and seizure.

Tools used for neurologic assessment by EMS include the Los Angeles Prehospital Stroke Screen (LAPSS), the Cincinnati Prehospital Stroke Scale (CPSS), and the Face Arm Speech Test (FAST).

The LAPSS was developed for emergency medical technicians and paramedics to quickly identify stroke patients. One page in length, the LAPSS takes less than three minutes to complete and consists of four patient-history questions, a measurement of serum blood glucose, and three physical-assessment items that help reveal unilateral weakness. The FAST was developed in 1998 as a stroke-identification instrument for ambulance staff. These stroke-screening tools look for common presenting signs of a stroke, including facial droop, arm drift, and speech abnormalities.

The CPSS was also developed to assist in the early recognition of stroke in the community setting by prehospital providers and can be completed in 30 to 60 seconds. It was based on the National Institutes of Health Stroke Scale (NIHSS), a more
complete assessment designed for in-hospital use. In the CPSS, abnormalities in any one of three areas can indicate that the patient is having or has had a stroke:

**Facial droop**
- Normal: both sides of face move equally
- Abnormal: one side of face doesn’t move as well as the other

**Arm drift**
- Normal: both arms move the same or both arms don’t move at all
- Abnormal: one arm either doesn’t move or drifts downward, compared with the other

**Speech**
- Normal: patient uses correct words with no slurring
- Abnormal: patient slurs words, uses wrong word, or is unable to speak

Because of the need to administer rt-PA in a timely manner, prompt recognition of ischemic stroke is vital. A number of factors are associated with delays in meeting the eligibility for reperfusion therapy, including health care providers (both outside and within the hospital setting) not recognizing stroke symptoms, patients’ failure to recognize stroke symptoms, a patient experiencing only dizziness or headache, being a woman, and relatively mild strokes.10 Delays within the hospital setting also include waiting for access to computed tomographic (CT) scanning and neurologist assessment. The patient’s perception that symptoms aren’t severe or that she or he has control of them are factors that commonly lead to delays in seeking medical attention.10

**INTO THE HOSPITAL**

Depending upon the location of the acute ischemic stroke or intracranial hemorrhage in the brain, specific deficits may be apparent (see Figure 1).11 For instance, visual field deficiencies on the right side, right hemiparesis, or right hemisensory loss may indicate ischemic stroke in the left (dominant) hemisphere of the brain. Common signs of hemorrhage include focal neurologic deficits, headache, neck pain, intolerance of light, nausea or vomiting, and a decreased level of consciousness. Stroke symptoms can mimic other health care problems such as hypertensive encephalopathy, hypoglycemia, seizures, and complicated migraines.12 Obtaining a medical history focusing on the timing of symptom onset (or if that’s unknown, when the patient was last noted to be symptom free) and risk factors of a stroke, both modifiable ones, such as alcohol abuse, diabetes mellitus, and dyslipidemia, and non-modifiable ones, such as family history of stroke, age over 65 years, and male sex (see Table 1 for more), will assist in early identification of stroke patients.

After a medical history has been obtained and signs or symptoms of a stroke have been identified, a physical assessment can provide additional pieces of information that either explain the symptoms (if the person has suffered head trauma, for instance) or increase the suspicion of stroke (such as myocardial ischemia or irregular cardiac rhythms). A more formal stroke assessment scale, such as the NIHSS, allows the clinician to examine the major components of neurologic assessment (go to http://1.usa.gov/XzeHF to see the full scale and instructions on how to use it). Use of the NIHSS helps to ensure that neurologic assessments are completed in a timely manner and systematically address the major areas of neurologic assessment and can be repeated as needed for additional assessment information.13,17 Higher scores on the NIHSS indicate greater neurologic deficits, which result in poorer outcomes.

**DIAGNOSTIC TESTING**

The first goal in treating a patient suspected of having a stroke is to determine whether the stroke is ischemic or hemorrhagic in nature. Diagnostic testing involves imaging techniques such as CT scanning, magnetic resonance imaging (MRI), cerebral angiography, carotid artery Doppler studies, and transesophageal and transthoracic echocardiography. In addition to imaging techniques, testing can include electrocardiography, cardiac enzyme analysis, a blood glucose test, a complete blood count, prothrombin time and international normalized ratio, activated partial thromboplastin time, and a blood chemistry panel. Additional diagnostic studies may include toxicology screening, blood alcohol levels, and arterial blood gas levels.15

Noncontrast CT scanning is most commonly used initially in the acute phase of a stroke. It’s useful for quickly determining whether a stroke is ischemic or hemorrhagic, which will determine whether the patient is eligible for rt-PA reperfusion therapy.16 Noncontrast CT scanning is very sensitive for detecting subarachnoid and intracerebral hemorrhage, which are contraindications for the administration of thrombolytic therapy.17

The following criteria indicate that a patient is eligible for rt-PA administration in the ED18:
- The stroke is ischemic and administration would be within three hours of onset.
- The NIHSS reveals measurable deficit.
- CT scan doesn’t show hemorrhage or a non-stroke cause of deficit.
- Patient is older than 18 years of age.

The following are contraindications to rt-PA use19:
• The patient's symptoms are minor or rapidly improving.
• The patient had a seizure at the onset of stroke.
• The patient has had a stroke or serious head trauma within the past three months.
• The patient had major surgery within the last 14 days.
• The patient has a known history of intracranial hemorrhage.
• The patient has a sustained systolic blood pressure above 185 mmHg.
• The patient has a sustained diastolic blood pressure above 110 mmHg.
• Aggressive treatment is necessary to lower the patient's blood pressure.
• The patient has symptoms suggestive of subarachnoid hemorrhage.
• The patient has had gastrointestinal or urinary tract hemorrhage within the last 21 days.
• The patient has experienced an arterial puncture at a noncompressible site within the last seven days.
• The patient has received heparin within the last 48 hours and has an elevated partial thromboplastin time.
• The patient's prothrombin time is longer than 15 seconds.
• The patient's platelet count is lower than 100 x 10^9/mm^3.
• The patient's serum glucose level is lower than 50 mg/dL or higher than 400 mg/dL.

MRI is more sensitive than CT scanning and can demonstrate evidence of ischemic injury earlier than CT scanning can. Magnetic resonance angiography, which is also noninvasive, is used to visualize the vascular anatomy and occlusive disease of the head and neck without the use of contrast material. A limitation of both is that they're not available everywhere, nor are skilled staff who can interpret the results.

Cerebral angiography is used to evaluate the surface characteristics of a stenosed artery and is considered the "gold standard" for measuring the degree of stenosis of a cervical or cephalic artery.

Carotid artery duplex scanning is used to screen for possible carotid artery stenosis. Results of imaging will assist with the determination of additional interventions, whether medical or surgical in nature.

Transesophageal and transthoracic echocardiography are performed in patients whose strokes are suspected of having cardioembolic or cardioaortic causes, although some sources indicate that if a high-quality transthoracic echocardiogram is positive, transesophageal imaging isn't necessary. Echocardiography will evaluate the aortic arch and thoracic aorta for plaques or dissections or the presence of thrombus within the cardiac chambers.

### Table 1: Modifiable and Nonmodifiable Risk Factors for Stroke

<table>
<thead>
<tr>
<th>Type of Risk Factor</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifiable</td>
<td>Atrial fibrillation</td>
</tr>
<tr>
<td></td>
<td>Alcohol abuse</td>
</tr>
<tr>
<td></td>
<td>Carotid artery disease (carotid stenosis)</td>
</tr>
<tr>
<td></td>
<td>Cardiac disease</td>
</tr>
<tr>
<td></td>
<td>Cigarette smoking</td>
</tr>
<tr>
<td></td>
<td>Cocaine and other illicit drug use</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td></td>
<td>Dyslipidemia</td>
</tr>
<tr>
<td></td>
<td>Previous stroke, transient ischemic attack, or myocardial infarction</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td>Obesity</td>
</tr>
<tr>
<td></td>
<td>Physical inactivity</td>
</tr>
<tr>
<td>Nonmodifiable</td>
<td>Age over 65 years</td>
</tr>
<tr>
<td></td>
<td>Family history of stroke</td>
</tr>
<tr>
<td></td>
<td>Being black or Hispanic</td>
</tr>
<tr>
<td></td>
<td>Male sex</td>
</tr>
</tbody>
</table>

Results of laboratory tests assist in the identification of nonstroke causes of changes in levels of consciousness, such as alcohol toxicity, the presence of neurologic depressant drugs (narcotics or sedatives, for example), sepsis, electrolyte imbalances, and hypoglycemia or hyperglycemia.

### Treatment

One quarter of patients who have a stroke will experience neurologic worsening during the initial 24 hours after the event, increasing the need for close monitoring by nurses specifically educated in the care of stroke patients. Admission to units that specialize in caring for stroke patients (stroke units) is preferred and has been shown to decrease morbidity and mortality in this population.

Stroke units are staffed by members of the healthcare team that focus on the management of the patient after stroke and include physicians, nurses, and physical, occupational, and speech therapists. According to a review from the Cochrane Collaboration, patients cared for on stroke units have better outcomes in terms of surviving the stroke event, returning home, and regaining independence.

After hospital admission, the goals of management, according to guidelines on the early management of
adults with ischemic stroke from the AHA and the American Stroke Association (ASA), are observing for any change in the patient’s condition that might prompt the initiation of medical or surgical intervention, observing and providing treatment for any bleeding secondary to the administration of rt-PA, assisting with the provision of medical or surgical interventions focused on improving poststroke outcomes, initiating measures to prevent subacute complications, planning for long-term therapies to minimize the risk of recurrent stroke, and starting efforts to restore neurologic function through rehabilitation and supportive care.7

RESEARCH
The National Institute of Neurological Disorders and Stroke (NINDS) provides financial support for and conducts clinical and bench research to better understand, diagnose, treat, and prevent neurologic disorders (go to www.ninds.nih.gov/index.htm to see a list of studies funded by the NINDS). NINDS researchers are examining the various mechanisms of stroke risk factors; genetic factors related to stroke; and how the brain repairs the damage from a stroke, restoring important functions. The NIH and the NINDS currently provide funding for stroke research through the Specialized Program of Translational Research in Acute Stroke (SPOTRIAS). SPOTRIAS (www.spotrias.org) is composed of eight stroke research centers around the United States with a goal of translating basic research findings into clinical practice. These centers perform early-phase clinical research, share data and outcome results, and promote new approaches to therapy for acute stroke victims. Additionally, the Stroke Trials Registry Web site (http://bit.ly/fJDLt0) provides information regarding ongoing and completed research on stroke.

NURSING CARE
The nursing plan of care is based on the type of stroke the patient has experienced. In the ED, nurses performing triage need to have a specialized checklist, such as the NIHSS, readily accessible to quickly identify stroke patients. Effective protocols include diagnostic procedures facilitating rapid confirmation of acute ischemic stroke or intracerebral hemorrhage and implementation of appropriate interventions, especially notification of stroke team members. These are specially trained health care providers who perform a more thorough neurologic assessment, validate the presence (or absence) of stroke, facilitate prompt treatment interventions, and are most often headed by a neurologist.

As mentioned above, assessment of the patient’s ABCs and management of related issues are a priority and the basis of general supportive nursing care. Stroke patients may require endotracheal intubation and mechanical ventilation because of decreases in the level of consciousness, respiratory rate, or ability to manage oral secretions. Oxygen saturation monitoring should be used to check for signs of hypoxia, and patients with oxygen saturations less than 92% should be given supplemental oxygen.8

Blood pressure values play a vital role in the treatment of stroke patients; an elevation in blood pressure can be either the cause of an ischemic stroke or the result of one. Excessive poststroke elevation of blood pressure can contribute to hemorrhagic transformation (the development of hemorrhage in the ischemic area) after the administration of rt-PA and is a risk factor for recurrent stroke.7 Hypotension can result in diminished cerebral perfusion and can lead to a worsening of cerebral ischemia; this may necessitate the initiation of vasopressor therapy, although the patient may respond to fluid boluses.9 Target values are a systolic blood pressure less than 160 mmHg and a diastolic blood pressure less than 110 mmHg.10

Currently rt-PA is the only thrombolytic drug approved by the Food and Drug Administration for the treatment of acute ischemic stroke.7 If no contraindications to the use of rt-PA are present, according to NINDS guidelines, the benchmark for its initiation is within 60 minutes of arrival at the ED.10 Expansion of that window to within 4.5 hours of the onset of symptoms in eligible patients is the current recommendation from the AHA and the ASA, although they do advise that delays be avoided whenever possible.10 Depending on when stroke symptoms began and whether there were delays in medical care, the administration time may be shortened upon arrival at the ED. Patients who have received thrombolytic therapy need to be closely monitored for deterioration in neurologic status from recurrent stroke, intracerebral hemorrhage, and signs of systemic bleeding (such as hematuria, epistaxis, or upper gastrointestinal bleeding).12,13 Aspirin is the only antiplatelet agent recommended and is used to reduce the risk of recurrent stroke.12 The initiation of aspirin therapy (50 to 325 mg) is held until 24 hours after the administration of thrombolytic therapy.

Management of glucose levels is an important aspect of stroke treatment. Hypoglycemia can mimic the signs and symptoms of a stroke and, if identified, should be treated with one ampule of 50% dextrose.4 In stroke patients, however, the use of dextrose-containing IV solutions, such as 5% dextrose in water, should be avoided because it increases the risks of

REFERENCES

ajnonline.com

AJN • May 2011 • Vol. 111, No. 5
cerebral edema and hyperglycemia. Patients with elevated blood glucose levels have poorer outcomes after ischemic stroke, even after the administration of thrombolytic therapy. Monitoring serum glucose levels with a goal of keeping them between 80 and 140 mg/dL and administering insulin in patients with blood glucose levels higher than 140 mg/dL are important in the management of stroke patients. Adequate hydration of stroke patients can be accomplished through the infusion of normal saline at 75 to 100 mL/hr.

IN TRANSITION
Control of modifiable risk factors for stroke serves as the cornerstone of secondary stroke prevention. Getting hypertension, diabetes mellitus, and cholesterol under control is beneficial in preventing recurrent stroke, as is lifestyle modification. Encouragement of smoking cessation, the elimination of or a reduction in alcohol intake; weight management (with a goal of a body mass index between 18.5 and 24.9 kg/m²); and, if the patient is physically able, participation in 30 minutes of moderate-to-intense physical exercise, can all help reduce the risk of recurrent stroke.

Stroke continues to be a major issue in modern health care and can have devastating effects on patients and families. Early recognition of stroke symptoms by patients, families, and nurses can increase intervention options, which in turn increases the chances of favorable outcomes. Telemedicine may also provide the opportunity for remote evaluation of possible stroke patients, which can facilitate early treatment. The AHA Stroke Council, the Council on Epidemiology and Prevention, the Interdisciplinary Council on Peripheral Vascular Disease, and the Council on Cardiovascular Radiology and Intervention have recommended its use, and it may one day offer patients in underserved areas the opportunity for better outcomes after stroke.

Linda Kay Cook is a professor of nursing and Sheryl L. Clements is an assistant professor of nursing, both at Prince George’s Community College, Largo, MD. Contact authors: Linda Kay Cook, lcook@pgcc.edu. Emergency is coordinated by Polly Gerber Zimmermann, MS, MBA, RN, CEN: pollyzimmermann@msn.com.

REFERENCES