COURSE OBJECTIVE: The purpose of this course is to present an up-to-date discussion of the recommended emergency response for acute stroke.

LEARNING OBJECTIVES
Upon completion of this course, you will be able to:

- List the basic types, causes, and symptoms of stroke
- Explain how patients, family, or bystanders should respond to a potential stroke
- Discuss the actions recommended for emergency responders to potential stroke victims

STROKE BASICS

A stroke is the abrupt appearance of focal neurological deficits that are caused by damage to blood vessels of the brain (Crocco et al., 2009).

Ischemic versus Hemorrhagic Strokes

Stroke—also called cerebrovascular accidents (CVAs) or brain attacks—result from injuries to the blood vessels of the brain. The two main classes of strokes are ischemic and hemorrhagic:

- **Ischemic strokes** result from injuries that reduce blood flow to a region of the brain without initially causing significant cerebral bleeding; usually, the vascular damage is caused by the sudden blockage of a cerebral artery. Most ischemic strokes are due to blood clots.
- **Hemorrhagic strokes** result from injuries that cause bleeding into the brain or the cerebrospinal fluid (CSF) from the outset; usually, the vascular damage is a tear in an artery or the rupture of an aneurysm.
Both types of vascular damage—clots and ruptured vessels—can also occur in the spinal cord, and neurologists often call these **spinal cord strokes**. The simple term *stroke*, however, generally refers to vascular damage to the brain.

In the United States, as many as 87% of all strokes are ischemic strokes, and the remaining 13% of strokes are hemorrhagic strokes.

**The Symptoms of an Acute Stroke Reflect the Specific Brain Regions that Are Damaged**

Strokes reduce the blood flow to particular regions of the brain, and the loss of circulating blood causes the affected regions to stop functioning. As a consequence, the patient loses the ability to perform the tasks that are localized in those regions. Loss of blood flow is called *ischemia*, and both ischemic strokes and hemorrhagic strokes cause neurological deficits due to ischemic damage. In hemorrhagic strokes, bleeding can also cause nonischemic physical damage.

In the cerebral vasculature, each artery feeds a particular brain region. Because most brain regions are associated with a characteristic neurological function, damage to cerebral arteries tends to lead to characteristic losses of neurological functions. This correlation of arterial fields with specific neurological functions is often abbreviated by the phrase "strokes cause focal neurological deficits."

Specific neurological functions are dependent on particular brain regions and the arteries that supply blood to them. (Source: NIDA, 2009.)

Common focal stroke symptoms include:

- Numbness or weakness on one side of the body
- Confusion, difficulty speaking, or difficulty understanding
- Difficulty seeing
- Difficulty walking
  (NINDS, 2010)

These particular deficits result from ischemia in brain regions that are especially prone to stroke damage.

**Incidence**

Each year, almost 800,000 Americans suffer a stroke. This means that, on average, one American suffers a stroke every 40 seconds. An American dies of a stroke every 3 to 4 minutes. There are about 140,000 stroke deaths each year, and stroke is listed as a contributor to an additional 100,000 deaths. Thus, stroke is the third leading cause of death in this country, after heart disease and cancer (CDC, 2010a, b).

**Age:** Most people who have a stroke are older than 65 years, and the chance of dying from a stroke increases with the patient's age.
Most strokes occur in the elderly. These figures are for the United States in 2005. (Source: Drawn from data in NCHS, 2006.)

**Gender:** Men younger than age 75 have a higher incidence of stroke than women of the same age. However, stroke is most common in people older than age 75, and women live longer than men. Therefore, overall, 1.5 times more women than men die of stroke in the United States each year (CDC, 2010a, b).

**Race:** African Americans have the highest incidence of and death rate from stroke (CDC, 2010a, b).

**Strokes Need Prompt Treatment**

At the moment, there is still no effective "in-the-field" treatment for a stroke; for medical care, stroke patients must be taken to a hospital. Moreover, they must be taken quickly, because the clock is ticking for acute stroke victims—secondary damage from strokes increases as time passes, and early intervention can save critical brain tissue. Therefore, stroke victims need to be taken immediately to an emergency department that has the personnel and equipment to provide comprehensive acute stroke treatment.

For stroke management, the motto is "time lost is brain lost." After an ischemic stroke, the amount of irreversible damage increases steadily as long as brain regions remain without sufficient blood supply. In those parts of the affected region that have no blood flow, neurons begin to die in less than 10 minutes. In those areas with <30% of the normal blood flow, neurons begin to die within an hour. In those areas with 30%–40% of the normal blood flow, some neurons begin to die within an hour, but others can be revived for many hours.

The impetus for high-priority emergency stroke treatment began in 1996 when the FDA approved the use of a thrombolytic agent for stroke. For some patients, this drug—recombinant tissue plasminogen activator (rtPA, also known as tPA)—can reverse the neurological effects of an acute ischemic stroke. RtPA must generally be administered within 4.5 hours after a stroke occurs, and the new paradigm considers all stroke symptoms to be potential emergencies in the class of acute myocardial infarctions (heart attacks). Although there has not yet been the same dramatic innovation for treatment of hemorrhagic strokes, which are less common than ischemic strokes, they too require emergency care.

**FIRST RESPONSE TO A SUSPECTED STROKE**

**Educating Those at Risk**

Recognizing that a stroke may be taking place is the first step in caring for the patient, so the public needs to know how to recognize potential strokes.

Health professionals cannot assume that their patients know how to recognize potential strokes. Even people who have suffered one or more strokes need education: a survey by the American Heart Association (AHA, 2010) found that only 55% of patients who had had a stroke could identify even one stroke warning sign.
Therefore, all patients at risk for a stroke should be told its signs and symptoms, which include these sudden occurrences:

- Loss of sensation on one side of the body
- Weakness or paralysis on one side of the body
- Problems walking
- Problems speaking
- Problems understanding
- Problems with vision
- A severe headache

(NLM, 2010.)

Patients should be told that if they are having any of these symptoms, they should call 911 or get someone else to call 911.

However, even people who have been taught the warning signs may not realize that they are having a stroke. Among the contributors to this lack of self-awareness are:

- Strokes can change a person's level of consciousness.
- Strokes can make a person confused.
- Stroke victims misunderstand the seriousness of their bodies' signals; for instance, pain is a major symptom of illness, but most strokes are painless.
- Stroke victims with damage to their nondominant parietal lobe can lose the ability to recognize that they are ill.

The Role of Family or Bystanders

Because people may not realize they are having a stroke, it is often the family or a bystander who first notices that a medical problem is occurring. The public should understand that, if there is the possibility that someone is having a stroke, onlookers should not hesitate—they should call 911 immediately.

STROKE TEST: A 3-PART TEST FOR RECOGNIZING POTENTIAL STROKES

The signs of a stroke are being publicized through a number of different campaigns (e.g., the Massachusetts Health Promotion (n.d.)). A modified form of the Cincinnati Prehospital Stroke Scale (CPSS) (see "EMS Stroke Assessment: The Cincinnati Prehospital Stroke Scale" below) has been presented as a simple STRoke test, with the first 3 letters of stroke standing for:

- Smile. Ask the person to smile. Does their face look uneven?
- Talk. Ask the person to repeat a phrase. Does their speech sound strange?
- Raise your arms. Ask the person to raise both arms. Does one arm drift down?

The public is being advised that the sudden appearance of any one of these 3 symptoms indicates a possible stroke and 911 should be called (Wall et al., 2008).
People often wonder what first aid to give to a stroke victim. The best first aid is professional transport to a hospital, and getting an ambulance is the most important thing that a bystander can do for a stroke victim. When a person calls 911, the operator can give additional guidance for any other necessary first aid (AHA, 2005).

In addition, the one critical medical step that the public should know is how to control external bleeding. First aid providers should be taught to press on a bleeding area until the bleeding stops or an emergency medical services (EMS) team arrives.

### CALL 911 OR GO DIRECTLY TO THE HOSPITAL?

In an emergency, people feel that time is being lost by waiting for an EMS team to arrive, and family members or bystanders often hurriedly drive patients to the hospital. In fact, however, patients usually get to the appropriate hospital faster if they use the EMS system by calling 911. EMS teams are trained to choose the most appropriate hospital in the region, and this is not necessarily the closest hospital. In addition, the care and assessment that an EMS team gives a stroke victim shortens the time lag between the onset of stroke symptoms and the evaluation and treatment of the stroke.

### THE ROLE OF EMERGENCY RESPONSE

The medical care of stroke victims begins with the receipt of a 911 call. Strokes account for about 2% of all 911 calls, but those calls should set off a well-planned and speedy treatment protocol. Thrombolytic treatment of ischemic strokes must begin within a 4.5-hour window after the onset of symptoms, and strokes should be given the same priority of treatment as acute myocardial infarctions and trauma.

Besides stabilizing patients, dispatchers and EMS technicians make the first triage of potential stroke victims, collect critical background information, and expedite transport to the nearest hospital equipped to handle strokes. To plan for an effective response, directors of EMS units should:

- Have a stroke protocol written for their team.
- Divide the EMS unit's region into districts according to the nearest emergency department capable of treating acute strokes.
- Schedule regular training sessions that include such activities as having dispatchers and technicians practice using a standard screening test to determine the likelihood that a patient has had a stroke. (Crocco et al., 2007, 2009; Millin et al. 2007)

### EMS Dispatchers

In general, EMS telephone operators and dispatchers have these responsibilities:

- Choose, notify, and send the team of responders that is appropriate for each emergency.
- Advise the callers on possible first aid for the victim.
- Get critical background information about the victim.

Here are the additional responsibilities for calls about potential stroke victims:

### IDENTIFY POTENTIAL STROKE CALLS

When assigning response teams, EMS dispatchers need to assess the type and severity of the emergency. To make decisions for stroke victims, 911 operators should be taught how to identify likely stroke symptoms. When a dispatcher is able to flag a possible stroke victim, the EMS team can be given time to review and plan during their outbound trip.
Strokes account for 2% of all 911 calls, and this translates to only 4 to 10 stroke patients each year for the typical EMS team (Acker et al., 2007). The infrequency of stroke calls means that EMS operators will not have stroke questions at the tips of their tongues, so a written set of screening questions should be on each operator's desk.

### 911 OPERATOR QUESTIONS

Normally, the questions asked by a 911 operator include:

- Is the patient injured?
- Is the patient bleeding?
- Is the patient breathing normally?
- Is the patient unconscious?
- Is the patient awake and alert?  
  (NJ EMD Cards, 2004)

The victim may have had a stroke if any of the following problems have appeared in the course of a few hours or less:

- Loss of consciousness
- Change in level of consciousness
- Change in behavior
- Confusion or disorientation
- Dizziness, weakness, or vertigo
- Difficulty moving
- Difficulty using hands, arms, or legs
- Difficulty talking
- Difficulty understanding
- Difficulty seeing
- Severe headache

When the caller's description includes any of the preceding signs, the 911 operator asks 3 stroke questions:

- Does the patient have a new weakness of one side of the body?
- Does one side of the patient's face droop more than before?
- Is the patient's speech more slurred than before?

### ASSIGN POTENTIAL STROKES HIGH PRIORITY

911 dispatchers decide what type of response is appropriate for each emergency. They choose:

- The skill level and equipment of the EMS response team (basic life support (BLS) or advanced life support (ALS))
- The type of vehicle to send
- The initial speed requirement (e.g., sirens and flashing lights)

Acute strokes require the same level of emergency treatment as heart attacks and trauma. The current American Heart Association/American Stroke Association Guidelines recommend that potential strokes be given the highest level of priority and that EMS dispatchers send the highest level of emergency care available (Adams et
When available, an ALS team is sent "fully equipped with ventilation and oxygenation capabilities, including the ability to provide advanced airway maintenance, endotracheal tube checks, end-tidal CO\textsubscript{2} monitoring, and ECG monitoring. Ideally, there should be a minimum of 2 paramedics who are certified in AHA Advanced Cardiovascular Life Support (ACLS) and are prepared to administer all ACLS Class I and Class II interventions on each stroke response" (Acker et al., 2007).

If a choice has to be made, however, speed of transport to a stroke center is the first consideration. Therefore, if an ALS team is not immediately available, a BLS team should be dispatched.

When stroke victims are more than one-hour's travel time by ambulance from a hospital that is equipped to treat acute strokes, then air transport (i.e., helicopters) should be considered. Helicopters can be used to take the EMS team to the victim and then to transport the patient and the EMS team to a stroke center. Helicopters can also be used for secondary transport of patients from a remote receiving emergency department (ED) to a stroke center.

COLLECT CRITICAL INFORMATION

When an EMS operator suspects that a call concerns a stroke victim, the operator begins collecting critical background information. For strokes, dispatchers should make a special effort to get an estimate of the time since any potential stroke symptoms first appeared (Acker et al., 2007; Crocco et al., 2007; Millin et al., 2007).

<table>
<thead>
<tr>
<th>CRITICAL BACKGROUND INFORMATION ABOUT POTENTIAL STROKE VICTIMS</th>
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<tbody>
<tr>
<td>The patient's <strong>medical history</strong>, asking specifically about:</td>
</tr>
<tr>
<td>- past strokes</td>
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<tr>
<td>- TIAs (transient ischemic attacks)</td>
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<tr>
<td>- hypertension</td>
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<tr>
<td>- diabetes</td>
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<tr>
<td>- myocardial infarction and other heart problems</td>
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<tr>
<td>- atherosclerosis and peripheral artery disease</td>
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<tr>
<td>- bleeding disorders</td>
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<tr>
<td>- recent surgeries</td>
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<tr>
<td>- liver disease</td>
</tr>
<tr>
<td>The patient's <strong>current medications</strong>, asking specifically about:</td>
</tr>
<tr>
<td>- aspirin, anticoagulants, and antiplatelet agents</td>
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<tr>
<td>- insulin</td>
</tr>
<tr>
<td>- antihypertensives</td>
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<tr>
<td>- cocaine, amphetamine, and other street drugs</td>
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<tr>
<td>- excess alcohol intake</td>
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<tr>
<td>The <strong>time</strong> when the symptoms first appeared and the last time that the patient did not have the symptoms</td>
</tr>
<tr>
<td>Whether the patient has recently been <strong>injured</strong>, asking specifically about head trauma</td>
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</table>
FORWARD A WRITTEN REPORT TO THE EMERGENCY DEPARTMENT

Written records of the information collected during the first contact with the patient can be critical for doctors when they are making decisions about treatment. EMS operators should have a blank checklist that can be filled in with essential background information. This document, along with the results of stroke screening questions, is then faxed or sent by computer to the ED who is receiving the patient.

NURSE EDUCATORS FOR EMS TEAMS

Nurse educators are often responsible for teaching first response techniques for strokes to the local emergency medical technicians (AHA, 2008). The basic information to be covered is found in chapter 9 of the American Heart Association's ACLS provider manual (AHA, 2006). Nurse educators should emphasize:

- Strokes need immediate care in specialized emergency departments.
- Strokes are given the same priority as myocardial infarcts.
- EMS teams need written checklists and protocols prepared in advance.
- Simple stroke assessments, such as the Cincinnati Prehospital Stroke Scale, should be done quickly in the field.
- Information needed from the patient or bystanders includes the time of onset of neurological symptoms or the last time the patient was without neurological symptoms.
- EMS teams need to know the closest acute care stroke hospitals.
- EMS responders should alert the destination emergency department and then stay in touch with the staff for advice.

As an EMS instructor, a nurse needs to be able to tailor the emergency response protocols to the local region. First, the nurse must know which medical techniques can be performed by paramedics and emergency medical technicians under local regulations. Second, the nurse must learn which area hospitals are equipped and staffed for treating acute strokes.

A typical EMS responder deals with only 4–10 stroke patients a year, and it has been estimated that emergency personnel forget about 1/2 the stroke care details by 12 months after a training session. Moreover, the needs of a community, the availability of acute stroke care, and the recommended prehospital assessments and care protocols continue to change. Therefore, refresher courses should be taught twice each year (Summers et al., 2009).

EMS Responders

When they reach the victim, members of the EMS response team follow the standard protocol by assessing the situation and stabilizing the patient. In cases in which there is a question of stroke, paramedics then determine the likelihood of stroke and collect critical background information. Speed is important, so the EMS team should provide as much of the patient care as possible while en route to the hospital (Tirschwell et al., 2002; Acker et al., 2007; Crocco et al., 2007; Millin et al., 2007).

Here are more specifics about the EMS responders' protocol for likely stroke victims (modified from NHTSA, 2002):

**ORIENT THE PATIENT**

Responders first state their name and tell the patient that they are part of the emergency team that has come to help.
Manage airway, breathing, and circulation. Ischemic strokes—the most common strokes—tend to leave the patient responsive and breathing autonomously. Hemorrhagic strokes, however, can worsen quickly and deteriorate into stupor or coma with respiratory depression or breathing irregularities. Therefore, even when a potential stroke victim appears to need no airway care, the EMS response team must be alert to the sudden appearance of breathing problems.

**DETERMINE THE LIKELIHOOD OF A STROKE**

After stabilizing the patient, EMS responders assess the patient's level of consciousness, document any signs of stroke, and collect critical background information. It is essential to use a standardized screening test for stroke. In one study, without a screening test, trained paramedics recognized 61–72% of strokes, but using a standardized test, paramedics recognized >90% of strokes (Crocco et al., 2007).

Therefore, first characterize the level of consciousness—A, V, P, or U:

- Alert
- Responds to Verbal stimuli
- Responds to Painful stimuli
- Unresponsive (no gag or cough)

Second, determine the likelihood that the patient has had a stroke using the Cincinnati Prehospital Stroke Scale (see below).

**EMS STROKE ASSESSMENT:
THE CINCINNATI PREHOSPITAL STROKE SCALE**

One of the simplest and most widely used stroke assessment tools is the Cincinnati Prehospital Stroke Scale (CPSS), developed by Kothari et al. (1999). This is the recommended tool for EMS assessment.

In the CPSS, the patient is asked to perform three actions. An abnormal response to any of the three indicates that it is likely that the patient is having or has recently had a stroke. The actions and the range of stroke and nonstroke responses are:

1. "Can you show me your teeth?"
   - Stroke likely = the sides of the face look different
   - Stroke less likely = the sides of the face look the same
2. "Please hold both arms out in front of you?"
   - Stroke likely = one arm drifts more or one arm doesn't move
   - Stroke less likely = both arms move the same or both arms do not move at all
3. "Please repeat this sentence, 'The sky is blue in Cincinnati.'"
   - Stroke likely = no speech, incorrect words, or slurring
   - Stroke less likely = correct words are repeated without slurring

**"PLEASE SMILE" OR "SHOW ME YOUR TEETH"?**

A stroke that affects the motor system can cause weakness in the muscles of only one side of
the face. The request "Please smile" is an attempt to gauge whether the facial muscles contract with equal strength on the right and left sides; to make this assessment, some health professionals ask potential stroke victims to try to smile. However, the normal smile of a healthy person is often asymmetric, and an asymmetric smile in a patient can be the result of habit rather than a sign of a stroke.

Instead of asking for a smile, neurologists ask potential stroke victims to "show me your teeth" while demonstrating a grin that bares both sides of their upper teeth. This task requires the patient to strongly contract facial muscles on both the right and the left sides of the mouth. Weakness on one side produces a lopsided grin that reveals more upper teeth on the stronger side.

The public is often told to use "Please smile" because its use requires less explanation, but "Show me your teeth" is the preferred stroke test.

COLLECT CRITICAL BACKGROUND INFORMATION

Regardless of the information already collected by the 911 dispatcher, paramedics should attempt to collect essential information about the patient. (See the "Critical Background Information about Potential Stroke Victims" box above.)

Because time is of the essence, responders gather telephone numbers of relatives and witnesses. If knowledgeable acquaintances are available, they are asked to meet responders at the receiving hospital, or, if necessary, to travel with responders. For emergency treatments, it will be helpful if next-of-kin are immediately available for consent.

Written records should be made and then passed on to the medical team at the receiving hospital. Ideally, EMS teams will have pre-prepared checklists with the essential questions and with blank spaces available for all the critical information.

TRANSPORT THE PATIENT

Maintaining airway, breathing, and circulation are the first priorities. For strokes, keeping the head flat (i.e., supine or 0° elevation) usually offers better brain circulation than keeping the head elevated, when the flat position does not impair the ABCs.

After stabilizing the patient, time is paramount. As soon as possible, begin transporting the patient to the appropriate ED and continue the rest of the pre-hospital care en route.

Each EMS unit should be provided with maps showing the nearest appropriate ED for stroke victims in any area (Adams et al., 2007; Crocco et al., 2007).

As they work, members of the EMS team should make contact with the destination ED. Simply notifying the receiving hospital that a potential acute stroke will be arriving has been shown to shorten the eventual time between delivery to the hospital and receipt of treatment. Describing the patient's condition, time of onset of symptoms, and medical history allows the mobilized doctors, nurses, imaging specialists, and pharmacists of the acute stroke team to begin planning.

Information goes both ways between the EMS team and the ED stroke team. The hospital stroke team can tell the paramedics about the size and placement of the IV access that will be needed, and hospital specialists can advise the paramedics about managing complications, such as severe hypertension, hyperglycemia, or cardiac dysfunction.

ADDITIONAL PREHOSPITAL CARE
Oxygen. Strokes are crises of insufficient oxygen delivery to the brain, so it is important to keep the patient's blood oxygen saturation at normal levels. Attach a pulse oximeter and treat hypoxemia (in this case, oxygen saturation <95%) with supplemental $O_2$. Currently, there is no indication that supplemental oxygen will benefit a patient who already has a normal blood oxygen saturation.

IV access. When acute resuscitation is needed, insert an IV line immediately. Otherwise, consider starting an IV en route after consulting the destination ED. Some key brain imaging studies require large bore IV lines that must be inserted proximally (i.e., no more distal than the antecubital fossa). If the receiving hospital will need a specialized IV line, time can be saved by having the appropriate line in place in advance.

IV fluids. Treat shock or significant dehydration with balanced salt solutions (isotonic crystalloids, such as normal saline). Otherwise, saline lock the IV or set the IV to drip the minimum amount of balanced salt solution to keep the line open. In general, the goal is to add only a minimal amount of extra fluid, because overhydration can cause cerebral edema. (Another concern is hyperglycemia, which can worsen the injury in a stroke. Therefore, do not use dextrose solutions unless you are correcting hypoglycemia.)

Blood glucose level. Hypoglycemia produces symptoms that look like stroke, and persistent hypoglycemia will cause brain injury. Therefore, as soon as possible, check the patient's capillary blood glucose level and treat hypoglycemia with glucose.

ECG. Attach a 3-lead ECG and monitor the patient's heart continuously with two specific objectives:

1. Watch for serious cardiac consequences. The brain's reaction to stroke includes an increase in the body's sympathetic tone, and this predisposes a person to arrhythmias and myocardial infarctions.
2. Screen for cardiac causes. Strokes can be caused by preexisting atrial fibrillation or by atherosclerosis, which can already have caused heart damage that can be seen in ECG recordings.

Hypertension management. Hypertension is a common finding in acute stroke. However, blood pressure management is an art in stroke victims, and the choice of treatment depends on a detailed diagnosis that can only be made in a hospital. Therefore, current recommendations are that EMS personnel not attempt to treat high blood pressure.

SUMMARY

Strokes, also called cerebrovascular accidents (CVAs), result from limitations in cerebral perfusion, most commonly due to clots. Occasionally, the reductions in perfusion are accompanied by intracranial bleeding.

Symptomatically, all strokes appear as acute impairments in brain functioning. Victims may suddenly have difficulty walking, seeing, speaking, or understanding. With severe hemorrhagic strokes, the victim may lose consciousness. A common presentation of a stroke is the sudden loss of sensation or movement on one side of the body or face. Most ischemic strokes are painless, although hemorrhagic strokes can produce severe headache.

An acute ischemic stroke is a medical emergency, much like a myocardial infarction: a brain attack needs fast, organized care just as does a heart attack. The acute treatments are also similar. Both strokes and myocardial infarctions can be caused by clots obstructing arteries, both can leave some tissue underperfused, and in both, underperfused tissue can sometimes be revived if local circulation can be reestablished within a critical time window.

Early recognition of a stroke is facilitated by using standardized tests, such as the Cincinnati Prehospital Stroke Scale, which can be administered in 3 to 5 minutes using no special equipment. Such standardized diagnostic tools give accurate and reproducible predictions of the likelihood that a person has had an acute stroke. It has been shown that 911 operators can even administer the Cincinnati Prehospital Stroke Scale over the phone with the help of cooperative bystanders.

Like the treatment for an acute myocardial infarction, treatment for an acute stroke is given high priority by EMS teams and emergency room personnel. For a stroke, there is a 4.5-hour interval after the onset of symptoms in which thrombolytic therapy (i.e., intravenous administration of rtPA) has a chance at reopening clogged cerebral arteries and saving some of the underperfused brain tissue. Given this time constraint, EMS
teams have the goal of getting potential stroke victims stabilized, evaluated, and to a primary stroke center in less than an hour.

RESOURCES

American Stroke Association (A Division of American Heart Association)  
http://www.strokeassociation.org

Brain Aneurysm Foundation  
http://www.bafound.org

Brain Attack Coalition  
http://www.stroke-site.org

Internet Stroke Center  
http://www.strokecenter.org

National Aphasia Association  
http://www.aphasia.org

National Institute of Neurologic Disorders and Stroke  

National Stroke Association  
http://www.stroke.org

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Crocco TJ, et al. (2007). EMS management of acute stroke—Prehospital triage (Resource document to NAEMSP position


