Timely Treatment of Stroke Symptoms in the Emergency Department May Improve Outcomes

ABSTRACT

PA-PSRS has received reports involving the use of thrombolytic therapy for the treatment of a suspected stroke in the emergency department. Delays in treatment occurred because staff were unaware of stroke protocols, the protocols or printed orders were missing, medication was administered in the absence of the written protocol; communication handoffs were lacking among caregivers; or staff were not knowledgeable about the limited time to treat with thrombolytic therapy. Given the narrow therapeutic windows for treatment of acute ischemic stroke, timely evaluation and diagnosis is critical to avoid significant harm and even death. This article will review the challenges in confirming the diagnosis of stroke quickly and discuss risk reduction strategies that include establishing stroke teams; using stroke scales during initial physical examination, when indicated; administering recombinant tissue plasminogen activator in a timely manner; obtaining certification as a primary or comprehensive stroke center; and educating providers and patients. (Pa Patient Saf Advis 2008 Mar;5[1]:19-23.)

There were 29 reports involving the use of thrombolytic therapy for the treatment of a suspected stroke in the emergency department (ED) reported to PA-PSRS from January 2006 through December 2007. Eleven of the reports involved the absence of, delay in implementation of, or deviation from facility stroke protocols, which impacted the administration of thrombolytics within time frames set forth by the American Heart Association.1 The following are some deidentified examples:

Patient [presented] to ED with stroke-like symptoms. Patient was a John Doe. Stroke orders entered, but not initiated during the patient’s stay in the ED. No tPA was given.

Patient was admitted to ED with possible CVA [cerebrovascular accident] diagnosis. Stroke protocol was started, but there was a delay in neurologist response. Neurologist said that he ordered [tissue plasminogen activator (tPA)], but there was no tPA order in chart nor a consent form signed for tPA.

Patient was triaged at 3:25 p.m. and sent back to the waiting room. . . . The ED primary nurse took patient to an exam room at 4:40 p.m. The patient was seen by the ED physician at 5 p.m. The ED physician identified the patient as an acute stroke candidate and initiated the Neuro Alert protocol. A CT demonstrated a left parietal occipital infarct. The delay in triage resulted in a delay in care outside the three-hour window or tPA infusion for embolic stroke. . . .

ED delays in the treatment of a possible stroke occurred because staff were not aware of the stroke protocol; the protocols or printed orders were missing; medication was administered in the absence of the written protocol; communication handoffs were lacking among caregivers; or there was a lack of knowledge about the time sensitivity associated with administration of thrombolytic therapy.

Solutions to these delays include using tools to identify strokes immediately upon triage, establishing a stroke team to facilitate mobilization of appropriate specialists, and educating providers about the importance of delivering appropriate care as rapidly as possible.

Stroke is the third leading cause of death in American men and women.2 Each year, approximately 700,000 people have a new or recurrent stroke. A stroke happens when the blood flow to the brain is disrupted because of either a blood clot (i.e., an ischemic stroke) or a ruptured blood vessel (i.e., a hemorrhagic stroke). The emergency care for patients experiencing stroke changed in 1995 when investigators demonstrated that the use of thrombolytic therapy within three hours after the onset of ischemic stroke symptoms significantly reduced mortality and disability.3 In other words, the longer the delay between the onset of stroke symptoms and treatment, the lower the chance of restoring blood flow and the higher the risk for hemorrhagic complications. Therefore, thrombolytic therapy is indicated for stroke patients only if it is administered within three hours after the onset of symptoms. (Refer to “Table. Stroke Chain of Survival.”)

Challenges in Confirming Diagnosis

Given the narrow therapeutic window for treatment of acute ischemic stroke, timely evaluation and diagnosis is critical.4 A patient with acute stroke must be identified quickly and appropriately.
### Table. Stroke Chain of Survival

<table>
<thead>
<tr>
<th>DETECTION</th>
<th>Recognition of stroke signs and symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISPATCH</td>
<td>Call 9-1-1 and priority emergency medical services dispatch</td>
</tr>
<tr>
<td>DELIVERY</td>
<td>Prompt transport and prehospital notification to hospital</td>
</tr>
<tr>
<td>DOOR</td>
<td>Immediate emergency department (ED) triage</td>
</tr>
<tr>
<td>DATA</td>
<td>ED evaluation, prompt laboratory studies, and computed tomography imaging</td>
</tr>
<tr>
<td>DECISION</td>
<td>Diagnosis and decision about appropriate therapy</td>
</tr>
<tr>
<td>DRUG</td>
<td>Administration of appropriate drugs or other interventions</td>
</tr>
</tbody>
</table>


EDs must create efficient pathways and processes to rapidly move through these four steps. Steps 1, 2, and 3 should be performed concurrently.

Before any decision can be made as to whether thrombolytic therapy is appropriate treatment for the patient’s presenting symptoms, quick and careful assessment must be done to answer the following two basic questions:

1. What type of stroke is the patient having—ischemic or hemorrhagic?
2. How long has it been since the onset of symptoms?

### What Type of Stroke is It?

Approximately 80% of all strokes are of the ischemic type, caused by the blockage of a large or small blood vessel to the brain. The remaining 20% of strokes are hemorrhagic, caused by the rupture of a blood vessel in the brain. Upon their arrival, patients must be carefully and quickly evaluated before the initiation of treatment. This diagnostic process includes a CT scan. A CT scan of the brain is essential to definitively establish that the mechanism of the stroke is ischemic. Thrombolytics are contraindicated in hemorrhagic stroke. The noncontrast brain CT must be completed to rule out hemorrhage as the primary cause of a patient’s presenting illness. This study accurately identifies intracranial hemorrhage approximately 90% of the time. Within the first 24 hours after stroke onset, ischemia is not generally visible on CT scan; therefore, this study simply rules out intracerebral hemorrhage and does not confirm clinical suspicion for cerebral ischemia. The ideal time goals for all hospitals that treat patients with acute stroke include 25 minutes from arrival to CT scan and 60 minutes from arrival to treatment. Ideally, patients would have to arrive in the ED less than 2 hours after symptom onset to be assessed and treated with thrombolytic therapy.

### How Long has it Been Since the Onset of Symptoms?

The time from the onset of stroke symptoms to the patients’ arrival in the ED is often referred to as patient delay and can vary widely across studies; however, most researchers report median delays from three to six hours. Notably, an estimated 19% to 60% of stroke patients present within 3 hours of stroke, and 14% to 32% of those arrive within 2 hours of symptom onset. If the patient arrives to the ED in sufficient time, systems must be in place to move them quickly through to diagnosis and treatment. In one study, Kothari et al. evaluated the ability of an ED to comply with consensus panel recommendations. They determined that workup and treatment of acute stroke was faster if the patient activated the 9-1-1 system. But even for patients using 9-1-1, only 37% saw a physician within 10 minutes after arrival to the ED, and only 17% proceeded to CT scan within the 25-minute recommended time window.

### Risk Reduction Strategies

#### Establishment of Stroke Teams

Despite successes in delivering effective new therapies, significant obstacles remain in ensuring that scientific advances are consistently translated into clinical practice. In many instances, these obstacles can be related to a fragmentation of stroke-related care caused by inadequate integration of the various facilities, agencies, and professionals that should closely collaborate in providing stroke care. One critical element of the multidisciplinary stroke system is the hospital-based acute stroke team. This is the component of the stroke system that is prepared to handle the hyperacute phase of diagnosis and treatment of acute stroke events. The availability of providers capable of diagnosing and treating all aspects of acute stroke remains critical. The composition and responsibilities of the team will vary as appropriate for specific facilities. The use of acute stroke teams improves stroke care and increases the appropriate use of stroke therapies through established protocols. Acute stroke teams facilitate the rapid evaluation and treatment of acute stroke patients that result in improved patient outcomes. The lack of acute stroke teams is associated with less frequent use of known effective stroke therapies and may compromise stroke care.
stroke teams help to coordinate stroke care from the moment the patient arrives at the ED or after notification from prehospital personnel. Rapid identification of acute stroke patients enables the early administration of effective and appropriate stroke therapies. Providers who triage potential stroke patients can be trained to identify acute stroke symptoms. Providers might be physicians, nurses, or physician assistants, if appropriate training and treatment protocols have been implemented.10

Use of Stroke Scales during Initial Physical Examination

There are several acute stroke assessment scales that are currently in use in many EDs.11 Prehospital stroke assessment scales, those used by emergency response teams in the field, most commonly include either the Cincinnati Stroke Scale or the Los Angeles Prehospital Stroke Screen. The National Institutes of Health Stroke Scale (available online at http://www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf) is the most commonly used scale for rapidly evaluating and quantifying stroke severity. This scale assigns numeric scores to each portion of the neurologic examination. Scores can range from 0, representing a normal neurological examination, to 42, which indicates profound disability. The goal of the neurologic examination is to confirm the clinical suspicion of stroke and localize the ischemic territory involved. Treatments are then targeted toward the clinical findings.4

Timely Infusion of rt-PA, if Indicated

Once all risks and benefits have been assessed and recombinant tissue plasminogen activator (rt-PA) is recommended, the dose for intravenous (IV) rt-PA is calculated based on weight (0.9 mg/kg with a maximum dose of 90 mg). The first 10% of the total dose is given as a bolus over one minute followed immediately by the remainder of the dose, administered via IV infusion for one hour. Proton pump inhibitors or 

H$_2$ blockers should be administered simultaneously with the thrombolytic agent for gastrointestinal protection. Blood pressure and neurologic examination should be closely monitored during the infusion.5

The American Academy of Neurology and the Stroke Council of the American Heart Association recommend that patients treated with rt-PA for stroke receive neurological assessments and blood pressure monitoring for the first 24 hours in the following intervals: every 15 minutes for 2 hours, every 30 minutes for 6 hours, and every 60 minutes after starting treatment.11 Pathophysiological considerations and observational studies indicate that hypotension and cardiac arrhythmias in the acute phase of ischemic stroke may aggravate brain damage and worsen outcomes.14 Any change in neurologic status prompts discontinuation of the medication, followed immediately by CT scan to rule out treatment-related hemorrhage.

Certification as a Primary or Comprehensive Stroke Center

Recognition as a primary or comprehensive stroke center indicates that the facility makes exceptional efforts to foster better outcomes for stroke care. Achieving certification signifies that the services provided to patients have the critical elements to achieve long-term success in improving outcomes and demonstrates compliance with national standards and performance measurement expectations in stroke care. The Joint Commission’s Primary Stroke Center Certification program15 was developed in collaboration with the American Stroke Association. The consensus statements conclude that there are a number of key elements supported by evidence-based medicine that are important for a primary stroke center and its ability to deliver the wide variety of specialized care needed by patients with serious cerebrovascular disease. These elements include: (1) healthcare personnel with specific expertise in a number of disciplines, including neurosurgery and vascular neurology; (2) advanced neuroimaging capabilities such as MRI and various types of cerebral angiography; (3) neurosurgical techniques, including clipping and coiling of intracranial aneurysms, carotid endarterectomy, and intra-arterial thrombolytic therapy; and (4) other specific infrastructure and programmatic elements such as an intensive care unit and a stroke registry. Integration of these elements into a coordinated hospital-based program or system is likely to improve outcomes of patients with strokes and complex cerebrovascular disease who require the services of a comprehensive stroke center.16

Improve Education about Acute Stroke

Education about stroke can be managed on two levels. Patient education is vital for quick identification of symptoms that prompt patients to go to the ED, and provider education is critical for rapid identification and treatment of the stroke once the patient arrives.

Despite numerous efforts to increase awareness, overall knowledge among the public remains poor with regard to stroke risk factors, the signs and symptoms of stroke, and the availability of a time-sensitive therapy, especially among groups at the highest risk for stroke.17 Improving the public’s knowledge of the risk factors, signs, and symptoms of stroke is critical to improving the quality of stroke care. Without organized, coordinated, and comprehensive approaches to educate the public, the full potential of proven therapies for prevention or acute intervention will not be realized. Increased awareness of the risk factors and common warning signs of stroke may increase the appropriate use of emergency response numbers such as 9-1-1, resulting in timely presentation to the ED.18 Ensuring that all members of the ED staff are familiar with the standards and guidelines for treating a patient that presents with stroke symptoms is a lofty objective for many facilities, especially in light of staffing shortages and overcrowded EDs. Many institutions have
undertaken provider education by using the American Heart Association/American Stroke Association’s “Get with the Guidelines” (GWTG) program aimed at educating staff about the treatment options for acute stroke. Using the GWTG program empowers healthcare provider teams to consistently treat stroke patients according to the most up-to-date guidelines. The implementation steps within the GWTG program include many risk reduction strategies discussed here, including developing a primary stroke center, identifying a champion(s) and building a team, assessing facility treatment rates, and evaluating baseline data to identify areas for improvement.  

**Conclusion**

Analysis of PA-PSRS reports found that delays in the treatment of a possible stroke occurred due to a lack of awareness of protocols in place to manage acute stroke symptoms quickly and efficiently in the ED. Given the narrow therapeutic windows for treatment of acute ischemic stroke, timely evaluation and diagnosis of ischemic stroke is critical. The answers to two basic questions are required before deciding on treatment: (1) what type of stroke is the patient having, and (2) how long has it been since the onset of symptoms? The reversal or reduction of stroke disability depends on timely triage, assessment, and treatment beginning before the patient arrives, continuing in the ED, and during the acute care phase of treatment. Rarely will patients be admitted to an ED with sufficient time remaining in the treatment window. And even if time is not an immediate factor, any added delay of treatment could increase the likelihood of disability. To meet the need for timely care, stroke team members can begin their assessment immediately, even while the patient is en route to the ED if possible. Risk reduction strategies for improving acute stroke care in the ED and patient outcomes include using a stroke assessment scale during initial physical examination; establishing stroke teams; administering rt-PA in a timely manner; achieving accreditation as a primary or comprehensive stroke center; and educating patients and providers about the symptoms of acute stroke.

Providing rapid acute stroke care to the patient with an acute ischemic stroke can be a challenge to many healthcare systems. Provision of the latest, cutting edge management strategies requires a multidisciplinary and cohesive approach. Knowledge of available therapies and management techniques allows care to be individualized for each patient. Rapid response to this devastating emergency can make the critical difference between independence and disability for the patient.  

**Notes**


Self-Assessment Questions

The following questions about this article may be useful for internal education and assessment. You may use the following examples or come up with your own.

1. A computed tomography scan is the most common diagnostic test used to rule out the presence of a hemorrhagic stroke.
   a. True
   b. False

2. Before a decision can be made as to whether thrombolytic therapy is appropriate treatment, there are two questions that need to be answered. The first question that needs to be answered is what type of stroke the patient is having. The other question that needs to be answered is
   a. how long has it been since the onset of symptoms.
   b. when did the patient last eat.
   c. does the patient have a family member with them.
   d. is the patient aphasic.

3. Recombinant tissue plasminogen activator (rtPA) should be administered within how many hours of the onset of symptoms?
   a. Within 6 hours
   b. Within 4 hours
   c. Within 3 hours
   d. Within 12 hours

4. The four risk reduction strategies that can be employed in the emergency department to manage acute stroke include all EXCEPT which of the following?
   a. Obtaining certification as a primary stroke center
   b. Establishing stroke teams
   c. Using a standardized stroke scale during initial physical examination
   d. Having access to a rehabilitation center specializing in strokes for patient discharge
   e. Improving education among providers and patients about acute stroke
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