

## ESTABLISHING A STROKE RESPONSE TEAM IN A RURAL SETTING

Julie Sain Justice, RN, BSN MSN<sup>1</sup>  
 Linda A. Howe, PhD, APRN, BC<sup>2</sup>  
 Cathy Dyches, PhD, RN<sup>3</sup>  
 Barbara A. Heifferon, PhD<sup>4</sup>

<sup>1</sup>Student, [School of Nursing](#), Clemson University, [juliejustice@redfoxtv.tv](mailto:juliejustice@redfoxtv.tv)

<sup>2</sup>Associate Professor, [School of Nursing](#), Clemson University, [lhowe@clemson.edu](mailto:lhowe@clemson.edu)

<sup>3</sup>Assistant Professor, [School of Nursing](#), Clemson University, [cathyd@clemson.edu](mailto:cathyd@clemson.edu)

<sup>4</sup>Associate Professor, [College of Architecture, Arts and Humanities](#), Clemson University, [bheiffe@clemson.edu](mailto:bheiffe@clemson.edu)

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### ABSTRACT

Stroke, a substantial public health problem because of high incidence, prevalence, mortality and economic burden, is the leading cause of long-term disability and the third leading cause of death in the United States (National Institute of Health, 2005). Improvements have been made in the management of ischemic stroke, including the use of a fibrinolytic agent known as tissue plasminogen activator (tPA), and the utilization of stroke response teams. While larger hospitals have the capabilities of instituting improvements, rural hospitals still lack the resources and ability to offer this vital service. The organization of a stroke response team can vary depending on location. However, all such teams can facilitate rapid evaluation and treatment of patients with stroke, thus allowing hospital systems to respond in organized, efficient, and emergent ways. Such rapid responses prevent extensive disability: “time is brain.” This manuscript discusses the effectiveness of a stroke response team on tPA utilization and offers an algorithm for rural hospitals to follow.

### INTRODUCTION

Stroke, a substantial public health problem because of high incidence, prevalence, mortality and economic burden is the leading cause of long-term disability and the third leading cause of death in the United States (National Institute of Health, 2005). According to Harvey (2004), “every year approximately 700,000 Americans experience a new or recurrent stroke, and every three minutes someone dies from the event” (p. 1). One in every five people will be directly affected by stroke either as a victim, family member, or caregiver (Stark, 2002). Ischemic stroke accounts for approximately 80 percent of all strokes and it is important to understand stroke and the most effective treatments (National Institute of Neurological Disorders and Stroke (NINDS), 2004). An ischemic stroke occurs when an artery supplying the brain with blood becomes blocked. Cerebral ischemia describes the loss of oxygen and nutrients for brain cells and can eventually lead to infarction meaning the death of brain cells. Loss of blood flow to the brain results in a “brain attack”. The term “brain attack” is used to communicate the urgency and importance of promptly recognizing stroke warning signs in an effort to improve the chance for a full recovery. Using the term brain attack, like the term heart attack, can perhaps change the way people think about this common but debilitating

disease (Broderich & Landis, 2005). Goals for therapeutic management of the stroke patient are the preservation of life, prevention of additional brain damage, and reduction of disability (Harvey, 2004). Education of health care workers and the use of modern technology can help to achieve the goals of more effective therapeutic management.

## **LITERATURE REVIEW**

### ***Rural Hospitals***

Rural hospitals are generally nonprofit, smaller hospitals, many having 50 beds or less (National Rural Health Association [NRHA], 2005). Rural residents tend to have higher poverty rates, be elderly, have poorer health, fewer doctors, hospitals, and other health resources, thus making it more difficult to obtain effective health services (Agency for Healthcare Research and Quality [AHRQ], 1996). Rural hospitals face numerous challenges including declining public and private reimbursements, lack of staff, out-of-date technology, and increased dependence on public sources of funding (Serb, 2006). For many patients the rural hospital is the only source of health care, and improvement in stroke management in rural settings across the nation would be a significant achievement. One way to improve stroke management is through the appropriate use of tPA, thrombolytic therapy for acute, ischemic stroke.

### ***Tissue Plasminogen Activator***

The only approved thrombolytic therapy for acute ischemic stroke is tPA, and only 3% of patients with stroke receive tPA nationally (Albers, 2005). This fibrinolytic agent is made with recombinant DNA technology from human melanoma cells that was initially approved in 1996 to treat acute ischemic stroke. Given intravenously, it binds to fibrin in a clot and converts plasminogen to plasmin breaking down fibrin and resulting in systemic fibrinolysis, and has a half-life of less than five minutes with a plasma clearance of 380-570 ml/min. Clearance is mediated primarily by the liver. (Murphy, 2003).

To receive tPA, a patient must be definitively diagnosed with ischemic stroke while meeting specific criteria within a three-hour time frame. The inclusion criteria for receiving tPA are: (a) age 18 or older, (b) clinical diagnosis of acute ischemic stroke with a measurable neurologic deficit, and (c) well established time of the onset of symptoms that is less than 3-hours. Exclusion criteria are: (a) evidence or suspicion of intracranial hemorrhage, (b) acute bleeding risk such as low platelet count, heparin administration in previous 48 hours, or a prothrombin time greater than 15 seconds, (c) head injury, head or spinal surgery, or previous stroke within the last 3-months, (d) history of aneurysm, (e) seizure witnessed at time of onset of symptoms, and (f) repeated blood pressure measurements greater than 185 systolic and 110 diastolic. Other contraindications and precautions include acute myocardial infarction within the previous 3-months, minor or rapidly improving signs of stroke, and a blood glucose of less than 50 mg/dl or greater than 400mg/dl (Elmore & Miller, 2005). Table 1.

According to Elmore & Miller (2005), administration of tPA within the first 3-hours of symptom onset may reopen the occluded cerebral artery, reduce the amount of

Table 1

*Criteria for tPA Administration*

<b><i>Inclusion Criteria</i></b>	<b><i>Exclusion Criteria</i></b>
Age 18 or older  Dx of acute ischemic stroke  Symptom onset of < 3-hours	Evidence/suspicion of ICH  Bleeding risk: ↓ platelets, heparin in previous 48-hours, prothrombin time >15seconds  Head injury, head or spinal surgery, stroke within previous 3-months  History of aneurysm  Seizure at time of onset  Repeated BP readings >185/110

NOTE: Use precaution: myocardial infarction in previous 3-months, improving signs of stroke, blood glucose < 50 mg/dl or > 400 mg/dl

brain tissue threatened by ischemia, and improve long-term outcomes. However, if tPA is administered after the initial 3-hours of symptom onset, the occluded vessel may open causing revascularization of the necrotic tissue resulting in possible cerebral edema and hemorrhage (Elmore & Miller, 2005). The dosage of tPA is weight based with the recommended dosage being 0.9mg/kg and the maximum dose of 90mg. The infusion should be completed within one hour. Clot lysis may be seen in 60 to 90 minutes and symptom improvement may be seen for up to 3 months (Elmore & Miller, 2005). Although this paper does not examine stroke outcomes, numerous studies have shown that using tPA in the recommended 3-hour time frame reduces stroke related disability (Hemmen, 2002).

***Determining Stroke Status***

Making the diagnosis of acute ischemic stroke can be difficult because the history or symptoms may be vague (Fulgham, Ingall, Stead, Cloft, Wijdicks, & Flemming, 2004). To evaluate stroke severity, the healthcare team may utilize several tools: two such tools include a checklist called the seven D's of stroke care and the National Institute of Health Stroke Scale (NIHSS). The "seven D's" describes a process that should be carried out to facilitate quick and definitive treatment: detection, dispatch, delivery, door, data, decision, and drug (Elmore & Miller, 2005). Detection is promptly recognizing the signs and symptoms of stroke and determining the onset time. Dispatch

requires notifying emergency medical care and transporting the patient to the nearest stroke center or hospital for rapid triage in the emergency department. Data is collected about the patient's history, lab work, physical assessment, imaging studies, and the time of onset and symptoms. A non-contrast CT should be done within 25 minutes and interpreted within 45 minutes of arrival of the stroke patient. Next, a decision concerning the use of tPA must be made using the exclusion and inclusion criteria for tPA therapy, and, if all criteria are met, the drug is started (Elmore & Miller, 2005). Table 2.

Table 2

*D's of Stroke Care*

Detection
Dispatch
Delivery
Door
Data
Decision
Drug

As part of the seven Ds, a detailed assessment includes the use of the NIHSS. The NIHSS was developed to provide a conscious cranial nerve assessment in 3 to 8 minutes, while providing insight into the location of vascular lesions related to symptoms (Stark, 2002). The patient's level of consciousness is evaluated by asking specific questions and by giving simple commands. Visual fields and gaze are tested by assessing horizontal eye movements and visual clarity. Facial movements such as smiling, teeth clenching, and eye closure are evaluated along with arm and leg motor function. Limb ataxia is also evaluated to note the smoothness and accuracy of movements. Evaluating sensory response can assess for hemisensory loss; a stuporous or aphasic patient will grimace or pull away from the stimulus. Practitioners can evaluate language and articulation for aphasia and slurring by asking patients to read or repeat a sentence and identify particular objects or people. Extinction and inattention can be assessed by observing if patients ignore an area of their body (Elmore & Miller, 2005). Each area of the NIHSS is scored with a score greater than 22 indicating a large area of brain damage. High scores mean patients have a high risk for hemorrhage if tPA is used thus making them ineligible for the fibrinolytic agent (Meadows, 2005). NIHSS assessment scores strongly correlate with patient outcomes (Schlegel, Tanne, Demchuck, Levine, & Kasner, 2004). However, the NIHSS and the seven D's are ineffective without a professionally trained health care team to expedite the process for rapid evaluation and treatment of stroke patients. This necessitated the creation of stroke response teams. A proposed algorithm for use in rural hospitals has been developed.

### *The Stroke Response Team*

The stroke response team is a 24-hour/ 7-day a week multidisciplinary team developed for rapid evaluation and treatment of patients with stroke. While most current stroke teams are part of stroke centers, they are also appropriate for rural settings. Joint Commission recognizes Primary Stroke Centers as focusing the services on “critical elements to achieve long term success in improving outcomes” (Joint Commission, 2006). The Brain Attack Coalition, a group of professional, voluntary, and government entities dedicated to reducing the occurrence, disability, and death associated with stroke, has issued guidelines for the certification of primary stroke centers (Warren & Emr, 2000). The members on the team may vary depending on the needs of the individual hospital, although one or more neurologists and a nurse are always included (Lutsep & Clark, 2005). In a rural setting a team that is being used as a rapid response team could be utilized for the code stroke team. The team members should be the most appropriate, such as: Emergency Department (ED), Intensive Care Unit (ICU), Neuro ICU, or Coronary Care Unit (CCU) nurses and be readily available. The role of the nurse is critical including triaging, monitoring vital signs, expediting studies, and coordinating communication between physicians and families. A neurologist must be available around the clock to evaluate the patient within 15 minutes, and the hospital has to be capable of providing neurosurgical services. The neurologist who is on call is responsible for clinical decisions with the stroke team functioning in a consultative role (Saiki & Wojner, 2004).

After activating the stroke response team via phone or pager, the stroke team responds and begins using the seven D’s (discussed earlier), using the stroke pathway that is best customized with the hospital’s resources. The role of a stroke team is to facilitate care by identifying patients who are candidates for tPA (Bratina, Greenberg, Pasteur, & Grotta, 1995). Lutsep and Clark (p. 2, 2005) state that “to achieve maximal efficiency, the team must integrate itself with all services involved in the care of patients with acute stroke, which include the local community, emergency medical services, the emergency department, CT scanning, and pharmacy.”

Unfortunately, many hospitals have not yet set up stroke teams. One study shows that 66% of the hospitals surveyed did not have stroke protocols and 82% did not have rapid response for patients experiencing acute stroke (Alberts et al., 2000). The study does not indicate hospital size. Likewise, the American Heart Association published a study measuring changes in stroke services over a five-year period. In that 2003 study, a one-page questionnaire completed by 128 state facilities in North Carolina was compared with results from a 1998 study. Although there was an increase in the availability of technologies, hospital investments in stroke related programs such as organized stroke teams, acute care stroke units, and community awareness programs had not significantly increased (Camilo & Goldstein, 2003).

Historically stroke teams have been shown to be effective and that is validated by a retrospective study of eight hospitals conducted in Houston, Texas that examined delays and deficiencies in recognition and management of stroke patients, while implementing a stroke team and examining the before and after results. The variables included were time from stroke onset to triage, examination by a physician, neurological evaluation, computed tomography (CT), and other tests, vital signs, and treatments.

Before the stroke team was introduced, the average time from emergency department arrival to examination by a physician and CT scan was 28 and 100 minutes respectively. The stroke team shortened the time to examination by a physician and to CT by 13 and 63 minutes respectively (Bratina, Greenberg, Pasteur, & Grotta, 1995).

Researchers concluded that establishment of primary stroke centers would increase the number of ischemic stroke patients treated with thrombolytic therapy through a comprehensive retrospective review of medical records (Lattimore et al. 2003). The study consisted of an on-call stroke emergency response team and all eligible patients were treated with tPA. During the 12 months prior to establishment of the stroke center 1.5% of ischemic stroke patients were treated with tPA, and 10.5 % received tPA during the two-year period after instituting the center, demonstrating the beneficial impact of a stroke response team on tPA utilization. Obviously, multidisciplinary stroke teams facilitate expedited evaluation. The team approach has shown a reduction in the length of time between the patient's arrival to the emergency department and completion of the evaluation, brain CT, and possible initiation of thrombolytic therapy (Fulgham et al., 2004).

In a retrospective cohort study by Katzan, Hammer, Hixson, Furlan, Abou-Chebl, and Nadzam (2004), potentially eligible patients who received tPA were compared with those who did not. A chart review was performed on all patients admitted with a diagnosis of ischemic stroke over a one-year period, and identified patients who arrived within three hours of symptom onset. Common exclusions for receiving tPA among this population included mild neurological impairment and rapidly improving symptoms. However, only 15% of ischemic stroke patients arrived within the 3-hour window of opportunity for tPA, which was the primary reason patients were ineligible to received tPA.

According to Dr. Brett Meyer at the University of California San Diego Medical Center, thrombolytics have the potential to be used more often with a stroke team in place (cited in Hemmen, Hayes, McLean, & Lyden, 2002). Meyer conducted a study comparing tPA use during a two-year period at the San Diego Medical Center; during the first year of the study a stroke team was not in place. Neurologists and physicians were specially trained in stroke treatment and evaluation and tPA was given 12 times in the year. With the stroke team in place, tPA therapy increased to 25 times in the second year. The volume of patients during either year is not given in this study. According to Dr. Edgar Kenton, chairman of the American Stroke Association advisory committee, this study concludes "dedicated stroke teams are viewed as a crucial link in the chain of survival for acute stroke victims, because of their ability to respond rapidly with assessment and treatment to potentially minimize disability" (cited in Hemmen et al., p.1, 2002). Continuous review of the stroke team system by investigating delays and outcomes help to improve the overall functioning of the team (Lutsep & Clark, 2005).

## **IMPLICATIONS FOR NURSING PRACTICE IN A RURAL SETTING**

At present, the recommendation for rural hospitals without acute stroke guidelines consists of transferring the patient to regional hospitals by helicopter and ground transport. However, critical time can be lost during transfer due to factors such as long

distances, mountainous terrain, etc., thus, making it even more important for the establishment of acute stroke guidelines in all facilities.

Public health outcomes are significantly impacted by the successful management of ischemic stroke. The primary goal is to limit or reverse the brain injury so that the patient can recover as much as possible. Attempting to meet this goal means that all healthcare personnel and the public must learn to recognize stroke as a medical emergency, i.e. “brain attack.” In addition, stroke teams should also be developed in these rural facilities.

Management in the rural hospital setting would include the development of a stroke team to perform rapid evaluations and to initiate the most advanced treatment and technologies. As the stroke team continues to evolve, stroke team nurses would be encouraged to examine their practice and generate new knowledge to support the care of patients during each phase of stroke management and recovery. Subsequently, the opportunity for nurses to expand their roles would require commitment to “ensure timely, expert care delivery, and ongoing performance improvement” (Saiki & Wojner, 2004). The nurses’ role within the stroke team is multifaceted beyond physical assessment, including facilitation of testing, completion of CT scan, data collection, and coordination of care. The stroke team provides an employment opportunity for Advanced Practice Nurses (APN) in a rural setting. The University of Texas-Houston stroke team has an APN who functions in a role similar to a stroke attending physician or fellow. The APN is responsible for higher level decision-making, has supervisory authority, and provides formal education to support improved stroke care (Saiki & Wojner, 2004). Once again the role of each member of the team is defined by the individual hospital’s needs and requirements. Thus, rural hospitals need to evaluate resources and staffing availability to form the stroke response team best suited for their unique situation. Suggestions include selecting a group of nurses from the ED and (ICU) to obtain certification to perform the NIHSS. Also, all ED physicians and ED staff need to be educated to recognize the signs and symptoms of a stroke, and when and how to activate the stroke response team.

Although tPA is readily available, rural hospitals do not typically have neurologists on standby to perform an examination for determining treatment. To address this need, the Remote Evaluation for Acute Ischemic Stroke (REACH) program was developed by the Medical College of Georgia to facilitate rapid evaluation of the stroke patient (Wang, Gross, Sung, Pardue, Waller, Nichols, Adams, & Hess, 2004). REACH enables a neurologist to review a patient video, perform an NIHSS, review the CT scans in real time, and to make a recommendation on tPA use (Hess, Wang, Hamilton, Lee, Pardue, Waller, Gross, Nichols, Hall, & Adams, 2005). The on-call neurologist is paged and then logs onto the REACH website to complete the consult using two-way audio and one-way video. The costs include \$6000 for the technology to provide connection (Hess et al., 2005), a small expense considering possible outcomes improvement for patients. Prior to the Medical College of Georgia’s institution of REACH within eight hospitals, only one had formal acute stroke care guidelines and two had tPA available in the pharmacy. REACH has permitted the use of tPA in rural hospitals where it was not previously used and provides the rural hospital with a 24-hour stroke team.

The availability of a dedicated stroke team helps to achieve maximal efficiency with the ischemic stroke patient. Integration with all services is an important part of the

function of the stroke team, emphasizing that all members must have a strong common interest in treatment of acute stroke. Thus, awareness of the stroke team throughout the hospital is a pertinent part of utilizing this team correctly and efficiently. Recommendations to achieve maximal awareness include continuing educational programs for all disciplines directly and indirectly involved.

## CONCLUSION

The major concept to remember is that “Time is Brain” (Stark, 2002), meaning that there needs to be a quick response from the general public in recognizing stroke symptoms along with an equally quick response from the health care system from initial point of patient contact to achieve the most effective treatment of brain attack. To improve stroke treatment in the rural setting, health care workers must be trained to understand the urgency of early evaluation and treatment. Ideally, stroke teams and the appropriate use of tPA could be put into place in these rural facilities. Education is key to improving outcomes and “starting treatment as soon as possible is and will continue to be a driving force in emergent stroke care” (Adams, 1998).

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