Proposal: A State-Wide Stroke System of Care for Mississippi

Executive Summary

The Department of Health regulates "systems of care" for the state. The model for such systems is the state Trauma Plan. Currently, DoH is developing a STEMI system. The following is a conceptual model for a state Stroke system of care.

Unlike Trauma and STEMI, where the emphasis is getting the patient to the specialist in the shortest amount of time, a Stroke system needs to get the specialist expertise to the patient in the shortest period of time. As such, a system would deliver the patient suffering symptoms of acute stroke to the nearest facility capable of an exam, laboratory work and a CT of the head. This information could then be transmitted to the neurology stroke specialist, preferably by telemedicine, to make the decision on therapy within the shortest timeframe. Such a scenario allows for initiation of treatment (thrombolytics) as quickly as possible consistent with national protocls. Subsequently, the patient would be transferred to a Stroke Center for additional care as indicated, including invasive procedures.

As a system, all care would be determined by protocol, hospitals certified as “Stroke-Ready” or “Stroke Center”, and stringent Performance Improvement would direct standards of care.

Introduction to the Clinical Problem

In 2007, Mississippi had an estimated population of 2.9 million people, with over 1.6 million living in a rural community (Rural Assistance Center, 2007). According to the Commonwealth Fund State Scorecard (2007), Mississippi ranked 50th in the nation for mortality amenable to health care (deaths per 100,000 population). Additionally, Mississippi had an overall ranking of 50 out of 50, with the majority of the indicators of health being in the bottom quartile. According to Albers (1996), Mississippi has the highest stroke-related death rate in the United States. Therefore it is critical that stroke care in Mississippi be a central focus for healthcare leaders.

In Mississippi, most of the specialty physicians, like neurologists, are located in select large medical centers; therefore, access to a stroke specialist is a primary concern in stroke care. This is important in following the latest evidence based practice guidelines related to stroke care. According to the American Stroke Association, from the NINDS rt-PA Stroke Trial (1997), timely intervention in acute ischemic stroke offers significant reductions in neurological deficits and disability. Most community hospitals do not have access to a neurologist and

lack the expertise found in a Stroke Center. Establishment of a stroke team in rural community hospitals is not feasible, due to physician shortage and financial constraints (Levin & Gorman, 1999). Unlike trauma and STEMI systems of care, where it is essential to get the patient to a specialty facility in the shortest amount of time, stroke care can be initiated at the rural facility in conjunction with input from the stroke specialist. A careful patient history and examination, together with a head CT can be done at Stroke-Ready hospitals, allowing the timely decision to treat before the patient is transferred to the Stroke Center ("drip-n-ship").

Objectives

Stroke patients should be recognized as quickly as possible to identify those eligible for thrombolytic therapy. Research has shown that both morbidity and mortality can be reduced by the approach of rapid interventional reperfusion soon after the onset of symptoms.

EMS personnel must be trained to recognize and transport stroke patients in a timely manner. The goal should be to:

- Recognize potential stroke patients in the field.
- Rapidly transport to a Stroke-Ready hospital or to a Stroke Center.

Every hospital providing care to stroke patients will have a recognized stroke plan that defines the optimal treatment pathways.

- Response systems, including optimal time frames, must be established, maintained, and monitored from EMS recognition to ED arrival to completion of specific laboratory data and head CT.
- Patients who meet thrombolytic criteria should have access to neurology expertise as quickly as possible.
- Establish a system to rapidly transfer stroke patients to a Stroke Center.
- Health professional training programs should be enhanced to include standards of stroke recognition and management.

System Components and Organization

The Stroke System is comprised of a number of separate components, which are organized, and work together, as a system. The individual components and elements are described below:

- Pre-Hospital Component – EMS units are an integral part of the Stroke System. All EMTs and Paramedics need to have a basic knowledge and awareness of the Stroke System elements and system function. Specifically, this knowledge refers to entry criteria (identification of a stroke), triage and destination guidelines, and communication procedures. On-line and Off-line medical control physicians will also need to be aware of the Stroke System elements and system function.

- Hospital Component – There are two possible categories for participating hospitals.

    1. Stroke-Ready hospitals – These facilities would have the ability to examine and perform diagnostic testing (laboratory and CT), but do not necessarily have neurology expertise present nor all of the treatment components for definitive stroke care.

    2. Stroke Centers – These include both Primary Stroke Centers and Comprehensive Stroke Centers. Capabilities would be determined by the Department of Health but would include characteristics as defined by the Brain Attack Coalition (*Stroke* 2005;36:1597-1618) for both non-invasive and invasive care, and include all phases of definitive stroke care, including acute and rehabilitative phases. See Appendix A.

- Hospitals may participate in the Stroke System on a voluntary basis. Each hospital will be able to determine whether they are on-line (have resources available and receive patients based on system protocols) or off-line (do not have resources and do not receive patients per the Stroke System). Participating hospitals may go on/off-line as resources dictate.

- The decision to participate must be made jointly by both the hospital administration and medical staff. A written commitment in the form of a resolution passed by the appropriate quorum of the governing authority of the hospital, and co-signed by the director of the medical staff, signifies the hospital's desire to participate in the system.

- Each Stroke Center must have an Emergency Physician and Neurologist (co-directors) responsible for oversight of the stroke program.

    - Stroke program co-directors are responsible for developing and maintaining basic stroke care protocols for the hospital.

    - Stroke program co-directors also have oversight responsibility for the stroke component of the hospital PI program.

- Communication Component – Communications are critical to the function of the Stroke System. Communications provide 1) essential knowledge of the overall status of pre-hospital stroke activities and hospital resource availability on a continual basis; 2) access to system organization and function protocols whenever such information is requested by pre-hospital or hospital-based personnel; 3) a link between the Stroke-Ready hospital and the Stroke Center, preferably by Telemedicine (See Appendix B); and 4) collection of uniform system-wide data for PI activities and development of a statewide stroke database. Providing all of these functions to an entire system on a continuous basis requires a centralized

communications infrastructure, capable of directly linking pre-hospital providers and Stroke-Ready hospitals with participating Stroke Centers. At present, the only organization capable of providing this level of service is MedCom located at UMMC. (Note: For the purposes of this plan, MedCom [Medical Communication Center] will be used as a generic term for the system communications component.)

- Performance Improvement (PI) Component – This component is essential to the Stroke System to document continuing function and allows the implementation of improvements in a system where patients may not have the ability to make their own personal care choices, and depend on the system for appropriateness of care. The efficacy of the initial care in stroke patients plays a pivotal role in determining their outcomes. Therefore, there is a requirement to evaluate the system on a continual basis to determine the effectiveness of stroke care and system performance.

    1. This component uses the American Heart Association's "Get with the Guidelines" database, which provides an overall look at stroke emergencies, care and outcomes, provides information for use in determining and developing stroke teaching programs, and provides information for potential research studies.

    2. The PI process involves specific steps at each level of care within the system. System-wide evaluation will be the responsibility of the Stroke Sub-committee of the State PI Committee. In hospitals, a multi-disciplinary peer review process must occur and must review both medical care and Stroke Center function. Pre-hospital evaluation will normally be conducted by the EMS provider. A more detailed outline of the PI Program is contained in Appendix C.

- Stroke System Advisory Committee (SSAC) – The SSAC will be established by the Mississippi Board of Health. This committee will have the responsibility for system guidance and governance, which will occur through regulatory development. Detailed information on the SSAC is contained in Appendix D.

System Function

General function of the system will follow the scenario of:

- Stroke event occurs or warning signs/symptoms are present; 9-1-1 is called.

- Field triage is conducted by EMS personnel, who determine if the patient meets system entry criteria based on history and physical exam. When a patient meets system entry criteria, MedCom will be contacted.

- Communication is established with MedCom and basic information is provided on all stroke patients to be transported to a hospital.

- MedCom will use a Stroke Center resource tracking tool (SMARTT or similar program) and patient location to determine the appropriate initial care for the patient.

- A direct patched communication link between the EMS unit and the destination Stroke-Ready hospital or Stroke Center is established and any orders of the physician are passed to EMS personnel.

- Patient is transported to the Stroke-Ready hospital; which initiates their response protocol.

- Patient undergoes history, physical exam and head CT. Laboratory tests including blood glucose, CBC with platelet count, and PT/PTT/INR are initiated before CT. Stroke-Ready hospital communicates link with neurology specialist, preferably via Telemedicine.

- Stroke-Ready hospital reports history and physical exam, laboratory results and CT findings. Preferably the stroke specialist evaluates the patient via a Telemedicine system, allowing exam, calculation of NIH Stroke Scale and access to CT scan images.

- Decision to treat with thrombolytics made by stroke specialist and administered immediately if indicated.

- Patient is transferred to Stroke Center.

System Operations

System operations refer to the activities that occur after it is determined that a patient meets system entry criteria and communications has been established within the system.

- Hospital operations

    - Hospital stroke management is an essential part of any stroke system. This phase of stroke care requires adequate resources (equipment and facilities) and personnel with training and commitment to carry out rapid initial assessment, stabilization, and initial care.

    - Hospital destination will be determined by the closest available hospital or the patient's choice. Hospital status will be determined by MedCom using the Stroke System resource tracking tool. For simplicity, hospitals will be assigned the following status: green (active), yellow (conditional), red (inactive).

        - Green status means the hospital has initial assessment resources available and may receive stroke patients. Resources that are available include Emergency Department (ED), laboratory capabilities and 16 slice CT.

        - Red status indicates that one or more of the primary stroke assessment services is not actively available and the hospital is unable to receive stroke patients.

    - In the event a patient or family member requests transport to a specific facility that does not meet system destination guidelines, EMS, MedCom, and/or on-line Medical Control will make a reasonable effort to convince the patient to avail themselves of the Stroke System plan. However, the patient's wishes will ultimately determine the receiving destination.

    - If the patient is unstable (inadequate spontaneous ventilations without a secured airway or in cardiac arrest), the patient should be transported to the nearest hospital. A secured airway includes any airway device that allows adequate ventilation and oxygenation.

- Inter-facility transfers – In the event a stroke patient is received by a non-Stroke Center hospital, or a Stroke-Ready hospital without current capacity for the patient, MedCom will assist with arranging an inter-facility transfer to a hospital with stroke capabilities. Any hospital participating in the Stroke System which is Stroke-Ready (green status), agrees to accept stroke inter-facility transfers upon MedCom's request.

- Pre-hospital activities

    - Pre-hospital care will be carried out in compliance with the Mississippi Model Protocols and the EMS provider's medical direction plan.

    - Stroke patients are best served by rapid transport to the most appropriate facility. Field time should be kept to a minimum; however, pre-hospital care should not be sacrificed for less time on scene.

Appendix A: Stroke Center Standards

- Hospital Organization
    - Stroke service line or equivalent
    - Stroke Service Director
    - Departments/Sections
        - Neurology, Neurosurgery, Interventional Radiology
        - Emergency Department
        - Stroke Unit or beds set aside (scatter bed) for Stroke patients
    - Stroke treatment protocols
- Clinical Capabilities
    - Specialty availability (contact made with patient and care plan determined):
        - Emergency Medicine – 10 minutes
        - Neurology - 30 minutes after notification by Emergency Physician, or in accordance with hospital Stroke plan
        - Intervention Lab (with intervention capability) – 30 minutes after notification by Interventionalist.
    - Consultants availability (on-call in accordance with hospital Stroke Plan):
        - Internal Medicine
        - Neuroimaging
- Facilities and Resources
    - Emergency Department
        - Personnel
            - Designated physician Director
            - Emergency Medicine specialists present

- Nursing personnel with expertise to provide continuous monitoring to stroke patients until admission to a hospital unit or transfer

- Equipment
  - Airway control and ventilation equipment
  - Pulse oximetry
  - End-tidal CO2 determination
  - Suction devices
  - 12 lead ECG
  - Cardiac marker capability to collect and read
  - Intravenous fluid administration equipment
  - Sterile sets for percutaneous vascular access (venous and arterial)
  - Gastric decompression
  - Drugs necessary for emergency stroke care
  - Two-way communication capability with EMS

- Intensive Care Unit for Stroke patients
  - Personnel
    - Designated medical director
    - Specialists with privileges in critical care (in-house or immediately [within 30 minutes] available)
  - Equipment: Appropriate monitoring equipment

- Interventional Laboratory
  - In-house technical personnel capable of assisting in all phases of intervention and clot retrieval and appropriate invasive technologies

- Rehabilitation

        - Protocol for stroke patients
        - Full in-house service or transfer agreement with stroke rehabilitation facility
    - Laboratory Services
        - Standard analyses of blood, urine, etc.
        - Blood typing and cross-matching
        - Comprehensive blood bank or access to equivalent facility
        - Blood gases and pH determinations
        - Comprehensive coagulation testing
        - Cardiac marker testing
- Continuing Education: Formal programs on Acute Stroke for:
    - Staff physicians
    - Nurses
    - Allied health personnel
    - Community physicians

Appendix B

A Statewide TeleStroke System

Stroke Ready hospitals will be in 24 hour need of Neurological expertise. The neurologist will need access to the patient's physical exam, laboratory data and CT scan to guide treatment decisions before transport in order to provide drug at the earliest and, therefore, safest time.

Telemedicine provides all such information with a direct link from the Stroke Center to the Stroke Ready Hospital. Numerous such regional systems already exist and are proved safe and effective. Mississippi has a limited number of stroke specialists available. A TeleStroke coverage schedule could include participating neurologists from the Stroke Centers. Given estimated volumes, it would be appropriate that each Stroke Center would cover calls for a given 24 hour period. Five Stroke Centers would mean each is on call every 5 days, but then each neurology group could rotate that call among them. As an example, a four-member group would require each stroke specialist to be on call once every 20 days.

Via a statewide telemedicine network, a Stroke Ready hospital with a potential patient contacts the system and the neurologist is given approximately a 30 minute warning as data are collected. The network could include stations at the Stroke Center as well as at the home of the stroke specialist.

Once all data are collected, the stroke specialist is connected to the patient at the Stroke Ready Hospital and clinical evaluation is made. The patient can be treated and transferred (Drip and Ship), transferred without specific treatment at the time or remain at the hospital for further care and evaluation. If transferred, the patient would go to the nearest Stroke Center capable of the treatment needed and not necessarily to the Center on call. If invasive treatment is indicated, the patient would potentially bypass the nearest Stroke Center for the hospital with greater capability.

Most large hospitals already have the capability to link with the system. States such as Arkansas partner with Medicaid to fund their system. Avoiding the devastating effects of stroke and the lifelong care needed and potentially avoided has made it cost effective.

Appendix C: Performance Improvement (PI)

Performance Improvement is a vital part of the Stroke System. It is used to document continuing proper function of the system and evaluation of that function to implement improvements in system operation and Stroke patient management. In a Stroke system, patients have virtually no time to make specific choices regarding acute and critical medical care. Therefore, the system has a moral obligation to perform evaluation functions to assure that the highest level of care is being provided, and that improvements are implemented whenever possible in a timely manner.

The PI program will be system-wide. Every participating organization or facility is required to participate in the system PI process. The appropriateness, quality, and quantity of all activities of the Stroke system must be continuously evaluated.

- The Stroke PI Sub-committee of the State PI Committee will be responsible for the PI oversight of the Stroke System.
    - The Stroke PI Sub-committee will be chaired by a neurologist participating in the Stroke System.
    - An Emergency Medicine physician will serve as vice chair of the committee.
    - Each Stroke Center will be authorized a representative on the Stroke PI Sub-committee.

    - Stroke ready hospitals may participate in the Stroke PI Sub-committee. The number of representatives will be determined by the permanent members of the sub-committee.

    - Three EMS representatives will be authorized; one each from a hospital-based EMS provider, a non-hospital based EMS provider, and public/government EMS provider.

- Specific audit filters will be established by the Stroke PI Sub-committee.

In general, the following processes should be performed by each agency or organization. The results of these reviews will be reported to the Stroke PI Sub-committee.

- Each organization assigns a PI person to oversee the process
- Standards established
- Determine audit filters
- Collect data
- Evaluate data
- Determine PI issues present
- Develop corrective action plan (CAP)
- Re-evaluation to document results/effectiveness of CAP

Specific items for evaluation:

- Pre-hospital:
    - Accuracy of patient assessment
    - Protocol adherence
    - Procedures initiated/completed
    - Medical control interaction
    - Transport mode (air/ground)
    - Record/documentation
    - Inter-facility care/transport
- Hospital:

    - Protocol adherence
    - Outcome review
        - Complications
        - Deaths
    - Achievement of time sensitive goals, i.e., door to drug time
- Regional system:
    - Communications/notifications
    - Triage
    - Protocol adherence

Appendix D: Stroke System Advisory Committee (SSAC)

The Stroke System Advisory Committee (SSAC) will be established by the Mississippi State Board of Health for the purpose of providing guidance and direction to the Department in the implementation and execution of the state Stroke Plan.

- The committee will be co-chaired by a Neurologist and Emergency Medicine physician participating in the Stroke System.
- Committee membership will be comprised of at least one (1) representative from the following groups:
    - Emergency Medicine physician
    - Emergency Nursing
    - Hospital Administration
    - Neurology
    - Invasive Neurology/Radiology
    - Stroke Nursing
    - Stroke Registry personnel
    - EMS Provider (ALS)
    - EMS Provider (BLS)

- EMS Administration

The term of membership is three (3) years with staggered terms for the Co-Chairmen. Optimally, there will be 18-24 members of the SSAC.

The SSAC will meet quarterly, or as required. Meetings of the SSAC may be independent or may be combined with other advisory committees such as MTAC and EMSAC.