Stroke Systems of Care

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Why Stroke Systems?

- No. 4th cause of death in the U.S.
- No. 1 cause of adult disability
- Total annual stroke costs to the nation are about $38.6 billion
- Transport of stroke patients to the hospital results in faster treatment, yet one-third of stroke patients do not call 9-1-1 and use EMS to get to the hospital
- Gaps remain in the quality of care provided to acute stroke patients

Why Stroke Systems?

- A fully functional stroke system of care that reduces stroke related deaths by just 2% to 3% annually would translate into 20,000 fewer deaths in the United States alone and ≈400,000 fewer deaths worldwide.

- Post stroke disability would also be reduced, which would improve the quality of life, result in the more efficient use of healthcare resources, and reduce the financial burden.

Higashida, R et al. (2013). Heart Association/American Stroke Association Interactions Within Stroke Systems of Care: A Policy Statement From the American Stroke, Stroke. 44:2961-2984 Retrieved from doi: 10.1161/STR.0b013e3182a6d2b2
Stroke System of Care
Time Goals

DTN ≤60 min: the "golden hour" for evaluating and treating acute stroke

- T=0 Suspected stroke patient arrives at stroke unit
- ≤10 min Initial MD evaluation (including patient history, lab work initiation, & NIHSS)
- ≤15 min Stroke team notified (including neurologic expertise)
- ≤25 min CT scan initiated
- ≤45 min CT & labs interpreted
- ≤60 min rt-PA given if patient is eligible
### Guiding principles for field triage of patients with suspected acute stroke

<table>
<thead>
<tr>
<th>Patient with abnormal vital functions in need of acute resuscitation</th>
<th>Transport to nearest hospital for stabilization of vital signs</th>
<th>Once vital functions stabilized, transfer to nearest CSC (or PSC if long distances)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient with acute onset of stroke symptoms within 6-8 hours</td>
<td>Transport patient to closest PSC or CSC if &lt;15-20 minutes transport time</td>
<td>If PSC and/or CSC &gt;15-20 minutes away, go to closest ASRH</td>
</tr>
<tr>
<td>Patient with acute stroke and seen initially at an ASRH</td>
<td>ASRH might use telemedicine to help evaluate the patient and to make transfer recommendations</td>
<td>Transfer to nearest PSC or CSC based on stroke type, patient's medical condition, treatment options</td>
</tr>
</tbody>
</table>

**ASRH:** Acute Stroke Ready Hospital  
**PSC:** Primary Stroke Center  
**CSC:** Comprehensive Stroke Center
## Some Characteristics of Typical Acute Inpatient Stroke Care Facilities

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Non-Stroke Center</th>
<th>ASRH</th>
<th>PSC</th>
<th>CSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical bed count</td>
<td>20–50</td>
<td>30–100</td>
<td>100–400</td>
<td>400–1500</td>
</tr>
<tr>
<td>Annual stroke admissions</td>
<td>10–50</td>
<td>25–50</td>
<td>50–300</td>
<td>&gt;300</td>
</tr>
<tr>
<td>Rapid neuroimaging 24/7*</td>
<td>No</td>
<td>Performed and read within 45 min of order</td>
<td>Performed and read within 45 min of order</td>
<td>Performed and read within 45 min of order</td>
</tr>
<tr>
<td>IV tPA capability 24/7</td>
<td>No</td>
<td>60-min door-to-needle time</td>
<td>60-min door-to-needle time</td>
<td>60-min door-to-needle time</td>
</tr>
<tr>
<td>Acute stroke team available</td>
<td>No</td>
<td>At bedside within 15 min</td>
<td>At bedside within 15 min</td>
<td>At bedside within 15 min</td>
</tr>
<tr>
<td>Stroke unit</td>
<td>No</td>
<td>No†</td>
<td>Yes</td>
<td>Yes†</td>
</tr>
<tr>
<td>Neurocritical care unit</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes§</td>
</tr>
<tr>
<td>Access to neurosurgical services</td>
<td>No</td>
<td>Yes, within 3 h or by transfer‡</td>
<td>Yes, within 2 h, in-house or by transfer</td>
<td>Yes, 24/7 coverage and call schedule</td>
</tr>
</tbody>
</table>

ASRH indicates acute stroke–ready hospital; CSC, comprehensive stroke center; IV, intravenous; PSC, primary stroke center; tPA, tissue-type plasminogen activator; and 24/7, 24 hours per day, 7 days per week.

*24/7 Neurological expertise available through telemedicine, on site, or a combination.
†Some ASRHs may have the necessary resources on site or via telemedicine to support a stroke unit.
‡This may vary based on geographic and other considerations.
§Or a defined neurocritical care service operating within the context of a medical or surgical intensive care unit.

EMS

➤ FAST (face, arm, speech test) scale, LAPSS, or the Cincinnati Prehospital Stroke Scale (CPSS)

➤ ASRH, PSC, CSC in a well-defined geographic region and transportation times to reach another facility should be limited to no more than 15 to 20 minutes

➤ Protocols that include prehospital EMS notification that a stroke patient is en route should be used routinely
OC Hub and Spoke Hospital

From 2012 article in Stroke, Organization of a US County System for Acute Stroke Care.
Cartograph of United States by census region, and percentage of population covered by acute stroke EMS routing protocols in 2010.

Multidisciplinary

- Case management
- Emergency medicine
- Educators
- EMS
- Hospital administration
- Hospitalists
- Internal med/cardiology
- Lab
- NP’s, PA’s
- Neurocritical care
- Neuroendovascular
- Neurology/vascular
- Neuroradiology
- Neurosurgery
- Nursing
- Nutrition
- Palliative
- Pharmacy
- Rehab services (OT, PT, Speech)
- Respiratory therapy
- Social work
- Stroke systems administration
- Telemedicine support
Care Transitions

Hyperacute Patient - Ischemic Stroke
- ED Care
- Emergent Imaging
- Dx and Rx
- Possible IV tPA

Transfer to Stroke Unit
- Continue evaluation
- Monitoring for progression and bleeding

Transfer to Floor
- Begin prevention measures
- Prepare for rehabilitation

Hyperacute Patient - Large Ischemic Stroke
- ED Care
- Dx and Rx
- Advanced Imaging
- Possible IV tPA

Transfer to Endovascular Suite
- IV tPA
- Endovascular Therapy
- Anesthesia support

Transfer to NICU
- Ongoing Care
- Monitor for Complications

Hyperacute Patient with ICH/SAH
- ED Dx and Care
- Begin imaging
- Control/reverse bleeding

Transfer to OR for surgery
- Hematoma removal
- Aneurysm clipping
- Hemicraniectomy

Transfer to NICU
- Post-op care
- Monitor for complications
Stroke Protocols and Pathways

Consolidates Volumes of Evidence
Organized Stroke Care Improves Outcomes Impact of Stroke Units and Pathway Utilization outcomes at 1 year

Protocol Adherence May Improve tPA Outcomes
The Cleveland Clinic Health System Experience

Katzan, et al. Stroke. 2003;34:799-800
## Quality Improvement Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Population</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of EMS patients triaged to an ASRH, PSC, or CSC</td>
<td>Patients call EMS via 9–1–1 for suspected stroke</td>
<td>Improve presentation times to a stroke center, increase use of acute fibrinolytic therapy</td>
</tr>
<tr>
<td>% of IV tPA–treated patients with a door to needle time of ≤60 min</td>
<td>Patients with acute ischemic stroke eligible for IV tPA therapy</td>
<td>Improve use of IV tPA</td>
</tr>
<tr>
<td>Median time to acute reversal of anticoagulation in patients with ICH or SAH</td>
<td>Patients with hemorrhagic stroke and receiving therapeutic anticoagulation</td>
<td>Reduce times to anticoagulation reversal</td>
</tr>
<tr>
<td>Median time to establish a telemedicine link</td>
<td>Patients at a non–stroke center</td>
<td>Improve the efficiency of telemedicine care and expedite stabilization and transfer</td>
</tr>
<tr>
<td>Median time from ED arrival to second hospital arrival among transferred patients</td>
<td>Patients at remote facilities who are transferred to a PSC or CSC</td>
<td>Reduce transportation times and improve acute care</td>
</tr>
<tr>
<td>System-wide risk-adjusted hospital mortality for ICH</td>
<td>All ICH patients (ICD-9 431) admitted via the ED</td>
<td>Measure and improve ICH survival</td>
</tr>
</tbody>
</table>
Follow-up Care

A stroke system of care should ensure that all patients have access to poststroke care.

- Financial resources
- Stroke education
- Stroke f/u
- Respite care
- Psychosocial (depression) screening
- Rehab services
- Skilled nursing
- Hospice
Forecasting Stroke

- Because the population is aging and the risk of stroke more than doubles for each successive decade after the age of 55 years, these costs are anticipated to rise dramatically.

- A recent study predicted that obesity rates in the United States will increase by 33% between 2010 and 2030.

- Hypertension rates in every state are currently >20%, whereas only 37 states had such rates 20 years ago.

- Diabetes mellitus rates have doubled in 10 states over the past 15 years, and 42 states have diabetes mellitus rates >7%.

Ovbiagele, B. (2013). Forecasting the Future of Stroke in the United States A Policy Statement From the American Heart Association and American Stroke Association
Stroke Systems of Care Must Include Prevention! Up to 80 Percent of Strokes can be Prevented

About 78 million U.S. adults have high blood pressure. That’s about 33 percent. About 75 percent of those are using antihypertensive medication, but only 53 of those have their condition controlled.

High Blood Pressure, U.S. breakdown by race and gender:
- 47 percent of African-American women have high blood pressure.
- 43 percent of African-American men have high blood pressure.
- 33 percent of white men have high blood pressure.
- 31 percent of white women have high blood pressure.
- 30 percent of Mexican-American men have high blood pressure.
- 29 percent of Mexican-American women have high blood pressure.
Obesity

From the CDC:

1990

2000

2010

Measurement - BMI >30 ~ 30 lbs. overweight for 5'4" person
Stroke Continuum of Care

- Primary Stroke Prevention/Education
- Secondary Stroke Prevention
- Post Stroke Care
- Stroke Rehab
- Stroke routing-EMS
- Stroke Primary Hospital
- Comprehensive Stroke Hospital
Thank You!