Effective Management of the Inpatient Stroke Process

Authors

• Erin Conahan, MSN, RN, ACNS-BC, CNRN
• Christy Franklin, BSN, MS, CNRN
• Alicia Harness, RN, BSN, CNRN, SCRN
Disclosures

• The authors have no actual or potential conflict of interest in relation to this presentation.

Objectives

• Discuss risk factors that pre-dispose patients to in-hospital strokes,
• Describe barriers to acute treatment of in-hospital stroke and
• Discuss the difference in outcomes between in-hospital and community onset stroke.
Incidence of In-Hospital Stroke

• Between 4 and 17% of all ischemic strokes have symptom onset during hospitalization
• 35,000 to 75,000 strokes occur annually in US hospitals

Pre-Disposing Factors

• Prothrombotic states
• Interruption of antithrombotic therapy
• Hypotension
• Post TIA
• Paradoxical embolism
• Plaque disruption from vascular manipulation
Pre-disposing factors

• Large proportion of in-hospital strokes occur in patients with pre-existing cardiac conditions or recent cardiac surgery:
  • Atrial fibrillation
  • Acute Myocardial Infarction
  • Bacterial endocarditis
  • Cardiac thrombus
  • Coronary Artery Bypass Graft
  • Implantation/removal of pacemaker
  • Aortic repair

Common Pre-Existing Risk Factors

In-hospital Stroke
• Atrial Fibrillation
• Congestive Heart Failure
• Coronary Artery Disease

Out-of-hospital Stroke
• Hypertension
• Smoking
• High Cholesterol
Benchmarks

ED-Based Care

- Door to physician ≤10 minutes
- Door to stroke team ≤15 minutes
- Door to CT initiation ≤25 minutes
- Door to CT interpretation ≤45 minutes
- Door to drug (≥80% compliance) ≤60 minutes
- Door to stroke unit admission ≤3 hours

Data SMMC – Admitting Diagnosis

<table>
<thead>
<tr>
<th>Year</th>
<th>Admitting Diagnosis:</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Cardiac</td>
<td>34</td>
<td>39.5%</td>
</tr>
<tr>
<td></td>
<td>MI, Chest Pain, abnormal rhythm, HF, BP issues, Syncope, etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulmonary</td>
<td>11</td>
<td>12.8%</td>
</tr>
<tr>
<td></td>
<td>COPD, Pneumonia, etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical</td>
<td>29</td>
<td>33.7%</td>
</tr>
<tr>
<td></td>
<td>UTI, AMS, Fever, Sepsis, GI bleed, TIA, Stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surgical/Trauma/Orthopedics</td>
<td>12</td>
<td>14.0%</td>
</tr>
<tr>
<td></td>
<td>Surgical procedure performed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>86</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Admitting Diagnosis:</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Cardiac</td>
<td>31</td>
<td>35.2%</td>
</tr>
<tr>
<td></td>
<td>MI, Chest Pain, abnormal rhythm, HF, BP issues, Syncope, etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulmonary</td>
<td>13</td>
<td>14.8%</td>
</tr>
<tr>
<td></td>
<td>COPD, Pneumonia, etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical</td>
<td>35</td>
<td>39.8%</td>
</tr>
<tr>
<td></td>
<td>UTI, AMS, Fever, Sepsis, GI bleed, dizziness, TIA, stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surgical/Trauma/Orthopedics</td>
<td>9</td>
<td>10.2%</td>
</tr>
<tr>
<td></td>
<td>Surgical procedure performed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>88</td>
<td></td>
</tr>
</tbody>
</table>
Inpatient Data SMMC

Onset to SA notification

<table>
<thead>
<tr>
<th>FY 2013</th>
<th>FY 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.58</td>
<td>1.35</td>
</tr>
</tbody>
</table>

ED Door to Stroke Team Notification, Minutes

<table>
<thead>
<tr>
<th>1Q 14</th>
<th>2Q 14</th>
<th>3Q 14</th>
<th>4Q 14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Goal

Mean
Data SMMC

Avg time SA to CT result

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2013</td>
<td>0.57</td>
</tr>
<tr>
<td>FY 2014</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Door to CT Scan Results Available ≤ 45 minutes

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Goal</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Q 14</td>
<td>45</td>
<td>27</td>
</tr>
<tr>
<td>2Q 14</td>
<td>45</td>
<td>27</td>
</tr>
<tr>
<td>3Q 14</td>
<td>45</td>
<td>28</td>
</tr>
<tr>
<td>4Q 14</td>
<td>45</td>
<td>28</td>
</tr>
</tbody>
</table>
Difference in Treatment Outcomes

- Safety and 90 day outcomes are similar for thrombolysis of stroke patients whether in ED or in-hospital

### Table 3. Outcomes

<table>
<thead>
<tr>
<th></th>
<th>In-Hospital Strokes (N=21340)</th>
<th>Community-Inset Strokes (N=50888)</th>
<th>PValue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional status- independent ambulation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On discharge- n responding, missing (%)</td>
<td>15703 (75.4%)</td>
<td>754867 (18.7%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>n (%)</td>
<td>4862 (31.0%)</td>
<td>350457 (50.4%)</td>
<td></td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharged home- n responding</td>
<td>19425 (99.9%)</td>
<td>3733093 (99.9%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>n (%)</td>
<td>9229 (77.7%)</td>
<td>435526 (49.9%)</td>
<td></td>
</tr>
<tr>
<td>In-hospital mortality- n responding</td>
<td>21166 (13.9%)</td>
<td>924963 (5.0%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>n (%)</td>
<td>2949 (13.9%)</td>
<td>46043 (5.0%)</td>
<td></td>
</tr>
</tbody>
</table>

### Complications of IV t-PA

<table>
<thead>
<tr>
<th></th>
<th>In-Hospital Strokes (N=21340)</th>
<th>Community-Inset Strokes (N=50888)</th>
<th>PValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptomatic ICH- n eligible, missing (%)</td>
<td>2312 (1.1%)</td>
<td>502545 (2.0%)</td>
<td>0.0986</td>
</tr>
<tr>
<td>n (%)</td>
<td>105 (4.5%)</td>
<td>32026 (5.3%)</td>
<td></td>
</tr>
<tr>
<td>Serious bleeding- n eligible, missing (%)</td>
<td>2312 (1.1%)</td>
<td>502545 (2.0%)</td>
<td>0.0671</td>
</tr>
<tr>
<td>n (%)</td>
<td>38 (1.6%)</td>
<td>741 (1.2%)</td>
<td></td>
</tr>
<tr>
<td>Other serious complications- n eligible, missing (%)</td>
<td>2312 (1.1%)</td>
<td>502545 (2.0%)</td>
<td>0.0238</td>
</tr>
<tr>
<td>n (%)</td>
<td>75 (3.3%)</td>
<td>1515 (2.5%)</td>
<td></td>
</tr>
</tbody>
</table>

ICH indicates intracerebral hemorrhage; and t-PA, tissue plasminogen activator.

Cumber et al 2014
Morbidity and Mortality

- Prognosis is worse for in-hospital strokes
  - Stroke severity higher
  - Longer hospital stays
  - Functional outcome worse
  - Less likely to return “home”
  - Mortality higher
    - In-hospital mortality 15-19%
    - Community stroke 2-7%
- Death more often due to co-morbidities and complications
  - Higher complication rates (DVT, Pneumonia)
  - Infection
  - Respiratory

In-Patient Characteristics

- Admission reason
  - Cardiac: surgery or percutaneous procedure, MI, CHF
    - New Afib post procedure
  - Neuro: neurosurgical procedures, TIA
  - Surgery: orthopedic, abdominal, vascular
    - Reducing length of time antithrombotic therapy is held before
    - Early post-operative resumption
  - Medical: sepsis, pneumonia, anemia
- Past medical history
  - MI
  - CHF
- Higher pre-morbid mRS
In-Patient Stroke

- Large vessel occlusions - **HIGHER NIHSS**
  - Cardioembolism
    - Iatrogenic
    - Disease related
  - Active cancer
- Anterior circulation
- Multiple locations
Barriers to Acute Treatment

• Evaluation times for stroke alerts have been found to be significantly longer for hospitalized patients compared to those seen in Emergency Departments.
• Leads to greater in-hospital delays to thrombolytic treatment
• In-hospital strokes have been found to have lower rates of cerebral vasculature imaging and lower rates of lipid panel measurement
• Multiple concurrent acute illnesses create conflicting care priorities

In-House Stroke Alert Process at SMMC

• Stroke Alert will be initiated for patients exhibiting acute onset of stroke symptoms by overhead page
• If stroke symptoms are not obvious or nurse is uncertain, RRT may be called and the RRT nurse can make decision to call stroke alert if necessary
• CT tech clearing table for stroke alert patient
• Pharmacy IV room on alert for potential need of IV thrombolitic
• Patient care coordinator assessing status of ICU beds in anticipation of transfer if patient to receive acute stroke treatment
In-House Stroke Alert Process at SMMC

Floor nurse will:

• Establish time of onset (if time not known determine when last seen normal) and report to responding stroke team RN upon arrival
• Perform finger stick blood sugar as soon as possible and report result to responding stroke team RN
• Obtain vital signs including O2 sat and report to responding stroke team RN
  • Don’t treat hypertension at this time unless cleared with neurologist
  • Lowering BP can worsen brain ischemia
  • Administer oxygen if O2 saturation is less than 95%

Stroke Team RN will:

• Respond with “stroke alert” packet
• Expected to respond within 10 minutes of notification
• Perform NIH Stroke Scale Assessment
• Review inclusion/exclusion criteria with unit RN and facilitate completion of appropriate forms
• Notify Neurologist on call with results of NIHSS and history
• Notify CT technician of NIHSS score and neurologist’s recommendations
• Handoff all information gathered to the unit RN prior to returning to home unit

In-House Stroke Alert Process at SMMC

• Transport patient to Radiology for CT as quickly as possible, and stay with the patient until results are reported
• Communicate with neurologist regarding treatment eligibility
• Immediately fax TPA order “STAT” to pharmacy and follow up with a phone call if patient is a candidate for IV thrombolysis
  • Pharmacy will prepare a bag with the infusion dose and a syringe with bolus dose and deliver drug to the unit
• Patient MUST be transferred to ICU for TPA infusion and monitoring
In-patient stroke LVHN

- Any change in neuro status/suspected stroke called to RRT
- RRT response: hospitalist, ICU RN, respiratory therapist
- If patient meets stroke alert criteria (focal neuro deficit, last known well <6hrs) stroke alert called
  - Call placed to Neurologist cell phone
  - Same work-up and time parameters as ED
  - ICU RN able to initiate tPA/vasoactive medications outside of ICU environment if bed is not immediately available. ICU RNs also trained on NIHSS and documentation required during acute stroke alert.
  - Staff RN to accompany patient on transports as well as give handoff communication to receiving RN

Predictor of Good Outcome

- Younger age
- Admitted for TIA
- Low NIHSS
- Early referral for specialist management
Case Review 1

- 76 year old female admitted to Cardiovascular step-down for hypertensive emergency, flash pulmonary edema, and NSTEMI

- Previous Medical History: Hypertension, Diabetes, Hyperlipidemia, CAD/CABG, obesity

- Hospital Day 3 patient developed Right gaze preference, Left hemiparesis, and inability to speak: NIHSS 17

Case Review 1: Timeline

- Last known normal: 2200
- Symptoms discovered: 2345
- Stroke Team contacted: 2353
- Head CT: 0003
- Head CT reviewed: 0015
- Tpa administered: 0102

- Time of discovery to treatment= 77 minutes
Case Review 1: Results

• MRI showed large Right MCA infarct

• Patient required Peg tube, Tracheostomy

• Patient discharged to Long Term Acute Care facility 21 days later, Modified Rankin score 5

Case Review 2

• 76 year old male scheduled for elective carotid stent

• Previous Medical History: Hypertension, Diabetes, Stroke, ESRD on HD

• Patient became unresponsive during the case and developed agonal breathing

• NIHSS 35

• Sheath in place: IR team to cath lab
Case Review 2: Timeline

- Last Known Normal: 0859
- Stroke alert initiated: 0910
- NIR contacted: 0920
- Cerebral angio complete/discussed: 0925
- Decision to treat: 0927
- Team arrival: 0935
- First pass: 1004
- Case complete: 1030

Case Review 2: Results

- Extubated the following day
- NIHSS 4 (left side arm and leg weakness)
- +troponin spill during stay
- Resumed hemodialysis schedule
- Discharged to acute rehab Day 7
- 90 day mRS 0
References


References: continued

