Best Practices in Stroke Quality Improvement

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Pre-quality era

July 21, 1888.

THE BRITISH MEDICAL JOURNAL

REMARKS ON
THE DIAGNOSIS AND TREATMENT
OF DISEASES OF THE BRAIN.

Delivered at a Meeting of the Worcestershire and Harfordsire, Bath and Bristol, and Gloucestershire Branches.

By J. HUGHLING JACKSON, M.D., F.R.C.P., LL.D., F.R.S.,
Physician to the Hospital for Epilepsy and Paralysis; and Physician to the London Hospital.

More generally, he who is treating by drugs hemiplegia owing to softening, however produced, or to clot, is treating a hole in the brain.

And if we had drugs which could annihilate the plug in the vessel (I know of none), they would have to do it with marvellous quickness, or the nerve tissue would be dead by starvation before circulation was re-established.
Proportion of patients living at home after the index stroke and cumulative difference between stroke unit and control subjects

Effect of Intravenous Alteplase is Time Dependent
2015- Highly Effective Reperfusion (ET)

Association Of Time From Symptom Onset To Start Of Endovascular Thrombectomy (Arterial Puncture) With Disability Levels At 3 Months In Endovascular (N = 633) Vs Medical Therapy (N = 645) Groups

**Table**

Effect of treatments on stroke population

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Proportion of patients with ischemic stroke applicable</th>
<th>Outcome</th>
<th>No. needed to treat to benefit</th>
<th>Estimated no. of patients with improved outcomes per 1,000 patients with ischemic stroke if intervention was given to all applicable patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke unit care</td>
<td>90%-100%</td>
<td>Death or long-term dependency</td>
<td>19</td>
<td>50</td>
</tr>
<tr>
<td>Thrombolysis</td>
<td>Up to 20%</td>
<td>Death or dependency</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>Thrombectomy</td>
<td>Uncertain, probably up to 10%</td>
<td>Dependency</td>
<td>3</td>
<td>33</td>
</tr>
</tbody>
</table>
Birth of Stroke Quality

- Richard Stuart Stevens (1912-1998) Stroke Unit Care
- First well-designed RCT
- First well-designed stroke registry

**A RANDOMIZED CONTROLLED TRIAL OF A STROKE REHABILITATION WARD**

*R. S. Stevens, N. R. Ambler, M. D. Warren*

*Age and Ageing, Volume 13, Issue 2, 1 March 1984, Pages 65-75, [https://doi.org/10.1093/ageing/13.2.65](https://doi.org/10.1093/ageing/13.2.65)*

*Published: 01 March 1984*

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**State of Stroke Care in 2000**

<table>
<thead>
<tr>
<th>Program or Service</th>
<th>Facilities</th>
<th>Proportion of Population, %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnostic tests</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brain CT scan</td>
<td>109</td>
<td>88</td>
</tr>
<tr>
<td>Carotid ultrasonography</td>
<td>102</td>
<td>82</td>
</tr>
<tr>
<td>Brain MRI scan</td>
<td>97</td>
<td>78</td>
</tr>
<tr>
<td>Transesophageal echocardiography</td>
<td>77</td>
<td>62</td>
</tr>
<tr>
<td>MR angiography</td>
<td>71</td>
<td>57</td>
</tr>
<tr>
<td>Transesophageal echocardiography</td>
<td>56</td>
<td>45</td>
</tr>
<tr>
<td>Cerebral angiography</td>
<td>48</td>
<td>38</td>
</tr>
<tr>
<td>CT angiography</td>
<td>44</td>
<td>35</td>
</tr>
<tr>
<td>Transcranial Doppler ultrasonography</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>Diffusion-weighted MRI</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department</td>
<td>110</td>
<td>88</td>
</tr>
<tr>
<td>Neurologist on staff</td>
<td>69</td>
<td>55</td>
</tr>
<tr>
<td>IPA protocol</td>
<td>54</td>
<td>43</td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td>54</td>
<td>43</td>
</tr>
<tr>
<td>Interventional radiology</td>
<td>29</td>
<td>23</td>
</tr>
<tr>
<td><strong>Programs’ organizational features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke-care map</td>
<td>42</td>
<td>34</td>
</tr>
<tr>
<td>Community awareness program</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>Inpatient rehabilitation</td>
<td>51</td>
<td>25</td>
</tr>
<tr>
<td>Stroke acute care unit or equivalent</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>Organized stroke team</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>Rapid patient identification program</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Anticoagulation clinic</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

Substantial Opportunity to Improve Timeliness of IV alteplase in Ischemic Stroke

![Bar graph showing percent treated within DTN benchmark of 60 minutes from 2005 to 2009]

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History of Stroke Centers

- 2000 - The Brain Attack Coalition (BAC) published:
  - “Recommendations for the Establishment of Primary Stroke Centers” (JAMA, June 21, 2000)
- Identified:
  - 66% of hospitals did not have stroke protocols
  - 82% did not have rapid identification for patients experiencing acute stroke
- Recommended the development of primary stroke centers (PSC) and defined the elements of a PSC
History of Stroke Centers

- 2003 - PSC certification program launched by the Joint Commission (TJC)
- 2005 - BAC published recommendations for Comprehensive Stroke Centers (CSC)
- 2012 - CSC certification launched by TJC
- 2013 - Acute Stroke-Ready Hospital (ASRH) recommendations were published
- 2015 - ASRH certification launched by TJC
- 2018 - TSC certification launched by TJC

TARGET: STROKE PHASE I

- Target: Stroke was initiated by the AHA/ASA as a national collaborative comprising a broad alliance of hospitals and clinicians.
- The goal of Target: Stroke was for GWTG participating hospitals to treat at least 50% of alteplase treated acute ischemic stroke patients within 60 minutes of hospital arrival.
- An expert working group performed a literature review to identify 10 key evidence-based strategies associated with timely alteplase administration that could be most rapidly and feasibly adopted by hospitals.
TARGET: STROKE
10 KEY BEST PRACTICE STRATEGIES

1. Hospital pre-notification by Emergency Medical Services
2. Rapid triage protocol and stroke team notification
3. Single call/paging activation system for entire stroke team
4. Use of a stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale and other stroke tools
5. Rapid acquisition and interpretation of brain imaging
6. Rapid Laboratory Testing (including point-of-care testing) if indicated
7. Pre-mixing alteplase medication ahead of time for high likelihood candidates
8. Rapid access to intravenous alteplase in the ED/brain imaging area
9. Team-based approach
10. Rapid data feedback to stroke team on each patient’s DTN time and other performance data
TARGET: STROKE PHASE II

NATIONAL GOAL:
- Achieve DTN times within 60 minutes for 75% of eligible patients
- Achieve DTN times within 45 minutes for 50% of eligible patients

ADDITIONAL HOSPITAL RECOGNITION
- Target: Stroke Honor Roll: existing criteria
- Target: Stroke Honor Roll Elite: DTN ≤ 60 minutes in 75% of eligible patients
- Target: Stroke Honor Roll Elite-Plus: DTN ≤ 60 minutes in 75% of eligible patients and DTN ≤ 45 minutes in 50% of patients

ADDITIONAL TARGET: STROKE RESOURCES
- Updated time tracker and new tools
- Additional strategies (transfer patient directly to CT, timer or clock at bedside) and evidence
- New educational resources

1. Hospital pre-notification by Emergency Medical Services
2. Rapid triage protocol and stroke team notification
3. Single call/paging activation system for entire stroke team
4. Use of a stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale and other stroke tools
5. Timer or clock attached to chart, clipboard, or bed
6. Transfer directly to CT/MRI scanner
7. Rapid acquisition and interpretation of brain imaging
8. Rapid Laboratory Testing (including point-of-care testing) if indicated
9. Pre-mixing alteplase medication ahead of time for high likelihood candidates
10. Rapid access to intravenous alteplase in the ED/brain imaging area
11. Team-based approach
12. Rapid data feedback to stroke team on each patient’s DTN time and other performance data

TARGET: STROKE PHASE III NATIONAL GOALS

PRIMARY GOALS:
- Achieve door-to-needle times within 60 minutes in 85% or more of acute ischemic stroke patients treated with IV thrombolytics.
- Achieve door-to-device times (arrival to first pass of thrombectomy device) in 50% or more of eligible acute ischemic stroke patients within 90 minutes (for direct arriving patients) and within 60 minutes (for transfer patients) treated with endovascular therapy (EVT).

SECONDARY GOALS:
- Achieve door-to-needle times within 45 minutes in 75% or more of acute ischemic stroke patients treated with IV thrombolytics.
- Achieve door-to-needle times within 30 minutes in 50% or more of acute ischemic stroke patients treated with IV thrombolytics.
Target: Stroke Phase III Door-to-Device Time Key
Best Practice Strategies

1. Rapid Administration of Alteplase
2. Rapid Acquisition and Interpretation of CT/MR Angiography
3. Rapid Acquisition and Interpretation of Additional Imaging
4. Pre-Notification and Rapid Activation of the Neurointerventional Team
5. Rapid Availability of the Neurointerventional Team
6. Timer or Clock Attached to Chart, Clip Board, or Bed
7. Transfer Directly to Neuroangiography Suite
8. Transfer Directly from Brain Imaging Suite to Neuroangiography Suite
9. Endovascular Therapy Ready Neuroangiography Suite
10. Team Based Approach
11. Anesthesia Access and Protocols
12. Prompt Data Feedback

Current JC Stroke Centers

<table>
<thead>
<tr>
<th>Stroke Centers</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Stroke-ready Centers</td>
<td>80</td>
<td>101</td>
</tr>
<tr>
<td>Primary Stroke Centers</td>
<td>1185</td>
<td>1149</td>
</tr>
<tr>
<td>Advanced Comprehensive Stroke Centers</td>
<td>179</td>
<td>190</td>
</tr>
<tr>
<td>Thrombectomy-capable Stroke Centers</td>
<td>14</td>
<td>45</td>
</tr>
</tbody>
</table>
TSC/CSCs and stroke mortality

ASRH/PSCs and stroke mortality
Free Standing Emergency Departments (Equivalent to Acute Stroke Ready Hospitals) within the Henry Ford Health System

Comprehensive Stroke Center and Primary Stroke Centers within the Henry Ford Health System in Metro Detroit
### RECOGNITION CRITERIA

<table>
<thead>
<tr>
<th>Honor Roll</th>
<th>Target: Stroke Phase II</th>
<th>Target: Stroke Phase III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Honor Roll</strong></td>
<td>Time to thrombolytic therapy within 60 minutes in 50% or more of acute ischemic stroke patients treated with IV tPA</td>
<td>DTN times within 60 minutes for at least 75% of applicable patients are required.</td>
</tr>
<tr>
<td><strong>Honor Roll Elite</strong></td>
<td>Time to thrombolytic therapy within 60 minutes in 75% or more of acute ischemic stroke patients treated with IV tPA</td>
<td>DTN times within 60 minutes for at least 85% of applicable patients are required.</td>
</tr>
<tr>
<td><strong>Honor Roll Elite Plus</strong></td>
<td>Time to thrombolytic therapy within 60 minutes in 75% or more of acute ischemic stroke patients treated with IV tPA and time to thrombolytic therapy within 45 minutes in 50% of acute ischemic stroke patients treated with IV tPA</td>
<td>DTN times within 45 minutes for at least 75% of applicable patients and DTN times within 30 minutes for at least 50% of applicable patients.</td>
</tr>
<tr>
<td><strong>Honor Roll Advanced Therapy</strong></td>
<td>-</td>
<td>DTD times in at least 50% of applicable patients within 90 minutes for direct arriving and within 60 minutes for transfers</td>
</tr>
</tbody>
</table>
Median Time from HFH Door to First Pass, Direct-Arriving Patients vs. Transfer Patients
2016 - 2019

Target:
≤ 90 min - Direct-Arriving
≤ 60 min - Transfers

<table>
<thead>
<tr>
<th>Year</th>
<th>Median Time - Direct Arriving Patients</th>
<th>Volume - Direct Arriving Patients</th>
<th>Median Time - Transfer Patients</th>
<th>Volume - Transfer Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>166.0</td>
<td>7</td>
<td>117.0</td>
<td>17</td>
</tr>
<tr>
<td>2017</td>
<td>144.0</td>
<td>26</td>
<td>69.0</td>
<td>40</td>
</tr>
<tr>
<td>2018</td>
<td>150.0</td>
<td>20</td>
<td>69.0</td>
<td>40</td>
</tr>
<tr>
<td>2019</td>
<td>117.0</td>
<td>17</td>
<td>69.5</td>
<td>40</td>
</tr>
</tbody>
</table>

Minutes
Volume
Percent of Acute Ischemic Stroke Patients Receiving IV Alteplase Therapy at Henry Ford Hospital Main Campus Who Have A Door-to-Needle Time of 45 Minutes or Less, 2005 - 2018

Percent of Acute Ischemic Stroke Patients Receiving IV Alteplase Therapy at Henry Ford Hospital Main Campus Who Have a Door-to-Needle Time of 60 Minutes or Less, 2005 - 2018
QUALITY CHALLENGES

- How to prepare for growth and maintain quality?
- How to offer stroke care as close to where the patients are?
- How to leverage informatics?
- How to incorporate advanced imaging and artificial intelligence
- How to integrate stroke care at a system/regional/state/national level?
THANK YOU