What is the Role of Telestroke in Stroke Systems of Care?

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Disclosures

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Outline

• The origins of telestroke
• Why not just use a telephone?
• The MCG/GHSU Experience
• What are the obstacles?
• Telestroke and Systems of Stroke Care
One Established Effective Therapy for Acute Stroke

• IV alteplase (recombinant t-PA) is approved for acute ischemic stroke within three hours of symptom onset
  – Recent evidence suggests benefit out to 4.5 hours
  – The only FDA approved pharmacologic therapy for acute stroke
  – ~2-3% of all ischemic stroke patients in the US receive IV rt-PA
Low Rates of Thrombolysis

• ED discomfort with acute ischemic stroke and thrombolysis

• Limited supply of the “willing” Neurologist
  – Geographically clustered at urban academic medical centers
  – 50% of US hospitals with <100 beds in rural, “frontier” locations
  – 137.5 million Americans live more than 60 minutes from a primary stroke center by ground transport
Comments, Opinions, and Reviews

"Telestroke"
The Application of Telemedicine for Stroke
Steven R. Levine, MD; Mark Gorman, MD

Remote Evaluation of Acute Ischemic Stroke in Rural Community Hospitals in Georgia
Sam Wang, MS; Hartmut Gross, MD; Sung Bae Lee, MD; Carol Pardue, BS, MSN; Jennifer Waller, PhD; Fenwick T. Nichols III, MD; Robert J. Adams, MD; David C. Hess, MD
Rural Stroke Care

- Patient presents to a rural hospital with a suspected stroke
- MCG Neurologist contacted
  - “blindly” deliver tPA
  - Transfer the patient
    - Loss of time (patient arrives too late or simply later for IV tPA)
    - Potential waste of resources [transfer was not necessary; alternative diagnosis (stroke mimic)]
Rural Georgia
Rural Stroke Care

• Rural hospitals are plentiful
• 5759 Hospitals in the United States
  – 4919 Community Hospitals
  – 2003 Rural Hospitals (AHA Hospital Statistics 2006)
  – 1464 Community Hospitals in a network
  – 2669 Hospitals in a system
The Geographic Penalty

• The quality of stroke care is dependent upon the hospital you go to

• If you live in a rural area or “underserved acute stroke care” area you will NEVER receive tPA

• There is a GEOGRAPHIC penalty for stroke care
The Geographic Penalty

- 4750 hospitals in the MEDPAR database
  - 495,186 ischemic stroke admissions 2005-7
  - 64% of hospitals had no reported treatments with rt-PA for ischemic stroke
Outline

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Mobile Cart in ED
Key Decision Making Components

• Obtain history from patient and/or family
  – Time of onset
• Receive vital signs (BP) and labs (INR)
• Two-way video for physical exam
• Review CT images
“A PICTURE IS WORTH A THOUSAND WORDS” … HOW MANY FOR A VIDEO?
Seeing the scan … yourself!
# Feasibility and Reliability of NIHSS via Telestroke

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
<td>Point-to-point ISDN lines</td>
<td>Web-based, Mobile consultant</td>
<td>Point-to-point*</td>
<td>Web-based, Mobile consultant</td>
</tr>
<tr>
<td><strong>Number of patients</strong></td>
<td>20</td>
<td>20</td>
<td>41 (ED)</td>
<td>25</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>Kappa $r=.97$</td>
<td>Pearson $r=.95$</td>
<td>Kappa $r=.85$ to $.99$</td>
<td>Kappa $r=.94$</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>9.70 min vs 6.55 min</td>
<td>9.11 min vs 6.24 min</td>
<td>11.4 min vs 10.8 min</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Comments</strong></td>
<td>Remote vs on site NIH all $\leq 3$</td>
<td>Remote vs on site NIH all $\leq 3$</td>
<td>Facial paresis least reliable</td>
<td>Modified NIHSS also reliable</td>
</tr>
</tbody>
</table>
234 acute stroke patients assessed in 4 community emergency departments.

Randomly assigned to telephone-only versus telemedicine:

- Telephone only
  - 23% receive IV tPA
  - Correct treatment decision: 82%

- Telemedicine
  - 28% receive IV tPA
  - Correct treatment decision: 98%*
What telephone only misses?

- Distinguish between isolated aphasia and encephalopathy
- Determine severity of symptoms
- Distinguish between organic weakness and functional weakness (conversion disorder)
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Feasibility

- 364 patients treated with tPA
- Mean age 67; 57% women; 37% African American
- Mean NIHSS 13; median 12
- Mean door to needle: 80 min
- 43% treated < 2 hrs
- sICH 3.7% (7/188) NINDS;
  - 2.1% (4/188) SITS MOST
Speed of Treatment

<table>
<thead>
<tr>
<th>System</th>
<th>OTT</th>
<th>&lt;90 min (%)</th>
<th>&lt; 2 hr (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>REACH Telestroke (N=50)</td>
<td>128</td>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td>MCG ED (n=26)</td>
<td>146</td>
<td>19</td>
<td>35</td>
</tr>
<tr>
<td>Published stroke systems</td>
<td>148</td>
<td>&lt;5-10</td>
<td>28</td>
</tr>
</tbody>
</table>

Enrollment in Clinical Trials

Table 1. Characteristics of Enrolled Subjects Identified Through a Telesstroke Network and Those Presenting Directly to the Hub

<table>
<thead>
<tr>
<th>Variable</th>
<th>Telestroke</th>
<th>Direct</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects, No. (percentage, 95% CI)</td>
<td>19 (68%; 48, 84)</td>
<td>9 (32%; 16, 52)</td>
<td>0.09</td>
</tr>
<tr>
<td>Age, y (median, 95% CI)</td>
<td>70 (50, 76)</td>
<td>63 (51, 80)</td>
<td>0.77</td>
</tr>
<tr>
<td>Male</td>
<td>58%</td>
<td>67%</td>
<td>1.00</td>
</tr>
<tr>
<td>Black</td>
<td>42%</td>
<td>56%</td>
<td>0.69</td>
</tr>
<tr>
<td>OTH, min (median, 95% CI)</td>
<td>207 (145, 255)</td>
<td>80 (55, 142)</td>
<td>0.00002</td>
</tr>
<tr>
<td>HTI, min (median, 95% CI)</td>
<td>71 (62, 104)</td>
<td>140 (94, 188)</td>
<td>0.002</td>
</tr>
<tr>
<td>OTI, min (median, 95% CI)</td>
<td>298 (218, 352)</td>
<td>225 (147, 330)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Stroke 2010; 41: 566-9
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• **What are the obstacles?**
• Telestroke and Systems of Stroke Care
Obstacles

• Licensure
• Credentialing/privileging
• Federal Anti-kickback Statute
• Privacy
• Liability
• Reimbursement
• Financial Sustainability
• Transfers
• Physician/staff education and “buy-in”
Credentialing and Privileging

- Paperwork burden
- Effective July 2, 2011, CMS offers small and critical access hospitals the option to streamline credentialing and privileging for telemedicine
  - allows the small hospital to accept the “credentialing and privileging decisions made by the distant-site telemedicine entity” for physicians asked to provide telemedicine services
Credentialing and Privileging

• Privileging roadblocks
  – Emergency physician as stroke specialist
  – Telestroke experience versus stroke experience

• May be necessary to provide the number of tPA treatments and outcomes/complication rates
Legal Issues

• Federal Anti-kickback Statute
  – Whether the provision of subsidized or free telemedicine equipment violates the Medicare-Medicaid Patient Protection Act
  – Makes illegal any arrangement where one purpose is to offer, solicit, or pay anything of value in return for a referral for treatment
  – There exists an incentive for telemedicine partners to refer to each other by virtue of their interconnectedness
  – To the extent that the host shoulders most of the costs, and to the extent that access to the host by remote physicians (and vice versa) results in referrals, an anti-kickback remuneration problem arises
Legal Issues

• Unlikely that the Office of the Inspector General would impose “anti-kickback” sanctions
  – Department of Health and Human Services (Re: OIG Advisory Opinion 11-12)\(^1\)
    • No requirement to refer or transfer patients
      – No specified volume of referrals
    • No EM physician compensation
    • Goal is to reduce transfers
    • Patients benefit from treatment that might otherwise not be provided
    • Participating hospitals benefit from education/training
    • Unlikely to increase cost to Federal health care programs

\(^1\)http://oig.hhs.gov/fraud/docs/advisoryopinions/2011/AdvOpn11-12.
Legal Issues

• Malpractice
  – Little precedent
  – Spoke/ED perspective
    • Most malpractice claims in acute stroke are related to loss of opportunity to administer tPA
    • By providing remote expertise, improving diagnosis and communication, telestroke (and associated systems of care) reduce the overall risk
  – Consultant perspective
    • Duty of care
      – Assume the same responsibilities and obligations as an in person physician-patient relationship

\[^1\text{Roush v. Southern Arizona Ear, Nose & Throat (Ariz. App. Div.2)}\]
Reimbursement

• CMS requires that the originating site (where the beneficiary is located) must be in either a rural health professional shortage area or a county that is not included in a MSA
   – two-way, real-time interactive communication required
   – Medicare reimbursements are at the same level as if the service was in person (telemedicine modifier code)

• A consulting physician providing telemedicine consultations would bill the appropriate CPT
   – Effective as of July 1, 2008, the AMA has approved two new Category III codes (remote critical care billing)
   – Coverage and payment for CPT 0188T and 0189T may vary by public and commercial payers
   – Some payers may not recognize the new Category III CPT codes
Reimbursement

- The use of thrombolytic roughly doubles the MS-DRG payment for the admitting hospital

<table>
<thead>
<tr>
<th>2011 MS-DRG</th>
<th>Description</th>
<th>Relative Weight</th>
<th>2011 Average Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>Acute Ischemic Stroke w/lytic w/Major Complication or Co morbidity</td>
<td>2.9568</td>
<td>$16,511</td>
</tr>
<tr>
<td>62</td>
<td>Acute Ischemic Stroke w/lytic w/Complication or Co morbidity</td>
<td>1.9479</td>
<td>$10,877</td>
</tr>
<tr>
<td>63</td>
<td>Acute Ischemic Stroke w/lytic w/o Major Complication or Co morbidity</td>
<td>1.5251</td>
<td>$8,516</td>
</tr>
<tr>
<td>64</td>
<td>Intracranial Hemorrhage or Acute Ischemic Stroke w/Major Complication or Co morbidity</td>
<td>1.8764</td>
<td>$10,428</td>
</tr>
<tr>
<td>65</td>
<td>Intracranial Hemorrhage or Acute Ischemic Stroke w/Major Complication or Co morbidity</td>
<td>1.1667</td>
<td>$6,515</td>
</tr>
<tr>
<td>66</td>
<td>Intracranial Hemorrhage or Acute Ischemic Stroke w/Major Complication or Co morbidity</td>
<td>0.8198</td>
<td>$4,578</td>
</tr>
</tbody>
</table>

- **With “drip and ship” the admitting hospital receives a non-lytic DRG payment**
Financial Sustainability

The cost-effectiveness of telestroke in the treatment of acute ischemic stroke

• Societal Perspective¹
  – ICER $108K/QALY over 90 day horizon
  – ICER $2.4K/QALY over lifetime horizon
  – Sensitive to number of spokes, number of patients per spoke and transfer costs

¹Neurology. 2011;77:1590–1598
Financial Sustainability

• Hub/spoke perspective\(^1\)
  – Compared to no network, a network model with 1 hub and 7 spokes resulted in 45 more patients treated with IV thrombolysis and 20 more with endovascular stroke therapies per year
    • 5.49 more home discharges per 1,000 AIS patients
  – Across a span of transfer rates from 0% to 100%, incremental costs ranged (negative costs reflecting savings)
    • -$556,000 to -$6,000 for the network
    • $1,485,000 to -$3,428,000 for the hub
    • -$292,000 to $489,000 for each spoke

• Key factors
  • tPA administration
  • Transfer rate
  • Endovascular neuro-interventions

\(^1\)Submitted to the AAN annual meeting; sponsored by Genentech
Sensitivity analysis of incremental costs by changing transfer rates

Patients transferred to hub hospital (%)
(For both IV tPA and non-IV tPA patients)
Drip & Ship vs. Drip & Keep

Stroke Patient

4.5 hour window

TPA ORIP

(100 bed facility)

(200 bed facility)

High NIH stroke scale score?
Large MCA stroke?
ICH with IVH?

YES?
NO?

KEEP

HUB (600+ bed facility)

Tele-consult from 3rd location
Transfers

• Transfer rate dictated by spoke and patient characteristics

• Spoke size/characteristics
  – 100+ bed spoke, neurologist/neurohospitalist, ICU
    • <10%
  – <100 bed spoke, no neurologist/neurohospitalist, no ICU
    • Up to 50%
Transfers

- Patient characteristics that might indicate need for transfer
  - Endovascular Revascularization Therapy
    - Intra-arterial thrombolysis
    - Intra-arterial Mechanical thrombectomy
  - Hemicraniectomy for malignant MCA Edema
  - Carotid endarterectomy/angioplasty stenting
  - Surgical hematoma evacuation
    - Cerebellar hemorrhage
  - Ventricular drainage
    - Intraventricular hemorrhage
  - Clipping or coiling of aneurysms
  - Embolization or surgery for AVM
Getting buy-in from clinicians and providers

**SPOKE**
- 1-800 phone number
- 24/7/365 availability
- Easy criteria
- Direct connection
- Quick response time
- Don’t tie up the doctor
- Say “Yes” to consult
- Evaluate urgently
- Collaborate
- Communicate
- Document
- Facilitate transfer if requested

**HUB**
- Incentives
- Salary
- On-call stipend
- Time compensation
- Technology
- New skills
- Research trials
- Publications
- Media opportunities
Educating staff

- Needs assessment
- Tailor presentations
- General overviews
- Specific skills
- NIHSS assessment
- Technical trouble shooting
- Brevity
- Guidelines
- Algorithms
- Order sets / Pathways
- Re-education

- EMS education
- Emergency education
- Nursing education
- Hospitalist education
- Technical education
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Beyond the Rural Hospital

• In 2005, JC begins certifying PSC coverage
• Most urban/suburban hospitals lack 24/7 acute stroke coverage
  – Many Neurologists abandoning Emergency Department call
  – In 2010-11 only 67 Fellows in approved Vascular Neurology Fellowships in U.S.
    • By comparison, 2497 Fellows in Cardiology Fellowships and 297 in interventional fellowships in U.S.
Beyond the Rural Hospital

• Solution?
  – Hybrid of telestroke and neurohospitalist/community neurologist(s)
  – Telestroke coverage at nights/week-ends with local neurologist on site for follow-up evaluation and treatment
Models of Stroke Hospital Care

• Acute Stroke Ready Hospital – Rural, <100 beds; telestroke-link to a Comprehensive Stroke Center; “drip and ship”; keep minor strokes (lacunes), TIAs, etc.

• Primary Stroke Center – Community, 100-300 beds; telestroke and local neurology/neurohospitalalist hybrid; “drip and keep”; most strokes can stay

• Comprehensive Stroke Center - Urban/Tertiary, >300 beds – vascular neurology Services, endovascular neurosurgery