Telemedicine Across the Spectrum of Stroke Care: Improving Stroke Patient Outcomes

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Disclosures

- Boehringer Ingelheim (speaker’s bureau and clinical research)
- REACH Health Inc. (PSHMC telestroke vendor)
- Genentech (clinical research)
Objectives

- Highlight the use of telemedicine to optimize treatments and outcomes for all stroke patients.
- Highlight the development of regional stroke networks using telemedicine to bridge patient care gaps.
- Highlight the benefits of using telemedicine for acute, subacute, and chronic stroke care for local community hospital systems.
Why Telemedicine??

- Limited access to stroke-related expertise, particularly in rural settings.
  - Limited number of Neurologists, Neurosurgeons, Interventionalists, and Stroke Rehab Physicians
- Limited resources and finances.
- Distance/travel (patient/family, cost)
- Limited knowledge/training and comfort level with current acute ischemic and hemorrhagic stroke treatments, plus secondary stroke prevention and stroke recovery strategies.
  - Limited number of primary and comprehensive stroke centers throughout the US
  - Limited comfort level with IV tPA treatment
- Acute stroke treatments are time-sensitive, and require quick decision-making skills and treatment plans.
Stroke System of Care

1. Prevention
2. EMS Notification & Response
3. Acute Treatment
4. Sub-Acute Care & Secondary Prevention
5. Rehabilitation

Continuum of Care

Continuous Quality Improvement (CQI)
Telemedicine Locations

- Acute stroke treatment
  - Prehospital
  - ED
  - Inpatient
- Diagnostic Imaging Review
- Stroke Rehabilitation
- Clinics
  - Secondary stroke prevention; recovery
- Skilled nursing facilities
- Home
  - VNA and EMS
AHA Policy Statement

Recommendations for the Implementation of Telemedicine Within Stroke Systems of Care
A Policy Statement From the American Heart Association

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What is Telestroke?

- Evaluation, diagnosis, and treatment of stroke patients using telemedicine.
- Two-way audio-video technology platform.
  - Different systems available (REACH, In Touch, etc.)
  - Teleradiology component
- Immediate access to stroke experts at any participating community hospital, leading to timely diagnosis and treatment.
- Stroke expert guidance and support throughout the treatment process.
Comparison

- Telestroke vs. Telephone
  - Correct treatment decision 98% vs. 82%
  - 28% vs. 23% received IV tPA Rx (Meyer et al, Lancet Neurology 2008) - Stroke Doc Trial
  - Exam accuracy very good with telestroke
    - Accurate NIHSS assessment
### Table 1  Probability and cost inputs to decision analytic model

<table>
<thead>
<tr>
<th>General probability inputs</th>
<th>Telesstroke (range)</th>
<th>Usual care (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving tPA&lt;sup&gt;13-15&lt;/sup&gt;</td>
<td>0.27 (0.22–0.32)</td>
<td>0.03 (0–0.07)</td>
</tr>
<tr>
<td>Being transferred if received tPA&lt;sup&gt;15&lt;/sup&gt;</td>
<td>0.52 (0.28–0.68)</td>
<td>0.90 (0.80–1)</td>
</tr>
<tr>
<td>Being transferred if did not receive tPA</td>
<td>0.28 (0.22–0.35)</td>
<td>0.78 (0.66–0.90)</td>
</tr>
</tbody>
</table>
Telemedicine Components

- **Components:**
  - **Time**
    - Time commitment per consult
    - Ongoing periodic staff training (mock cases)
  - **Distance**
    - Transfer logistics
  - **Resources/Finances**
    - Infrastructural cost to set up and maintain
    - Various meetings
  - **Expertise**
    - Ongoing education and training

- **Involves:**
  - Providers
  - Hospital systems
  - Patient/Family
Teams Involved

- Administration
- Telestroke coordinators
- Stroke nurse manager
- Outside EMS and LifeLion systems
- MD network (transfer center)
- Physicians (ED, hospitalists, Neurology, Neurosurgery, neuro-interventionalists)
- Nursing
- IT
- Radiology/PACS
- Physician credentialing
- Legal (Contracts)
- Telestroke vendor (with technical support)
- Health information system (HIS)/medical records
- Billing
- Outpatient follow-up
- Rehab system
- Call schedules
- Database management/support
- Telestroke specific administrative assistants
- CME office

Ongoing reassessments of individuals/teams and systems at both hub and spoke hospital systems
Resources

- Spoke Site
  - Optimize pre-existing inpatient/outpatient resources and infrastructure.
  - Work within current construct (don’t replace or rebuild)
  - Identify leaders/champions
- Hub Site
  - Don’t overextend telestroke resources
  - Don’t over promise and under deliver/exceed limitations of telestroke service/program
TeleStroke Program Goals

- Create a true partnership between community hospitals and an academic comprehensive stroke center.
- Provide stroke expertise for all stroke types (acute ischemic stroke, TIA, ICH, SAH) across the continuum of care, using evidence-based standards and guidelines.
- Provide support and guidance throughout the spectrum of stroke care. Create a more uniform stroke care treatment model.
- Provide pathways, protocols, and educational programs to enhance community hospital system’s comfort level for all aspects of stroke care. Community hospital should work towards becoming a primary stroke center.
- Increase the use of intravenous t-PA therapy for appropriate acute ischemic stroke patients. Optimize earliest door-to-needle treatment time.
- Transfer appropriate high risk patients in a timely efficient manner. Keep majority of acute stroke patients at outside hospital facility, if appropriate. Efficient use of local and regional stroke treatment resources.
- Ultimate goal is to improve patient outcome and patient/family satisfaction, whether the patient is transferred or not.
- High level of outside hospital staff satisfaction with the use of telestroke program.
- Integrate telestroke system into existing community inpatient/outpatient stroke treatment process (local physician involvement).
- Provide optimal cost-effective stroke care.
TeleStroke Program Goals

- Optimize IV tPA Rx for all acute ischemic stroke patients.
  - Increase door-to-needle times (DTN) <60 minutes.
  - Minimize post-tPA and stroke-related complications.
  - Keep majority of post-tPA Rx patients at outside hospital (hospitalist involvement)
- Identify potential acute endovascular/neuro-interventional stroke patients.
- Optimally transfer select acute stroke patients.
  - Fastest safest route
Types of Stroke Care Hospitals

- Acute stroke ready hospital (with telemedicine support)
- Primary stroke center (with telemedicine support)
- Primary stroke center with advanced intervention capabilities (+/- telemedicine support)
- Comprehensive stroke center (most complex stroke patient care, all patient types)
LionNet Telestroke

- Multi-party Audio-Video Conference
- Dual Monitors - Front & Back
  - One Facing the Patient to see the Consult physician
  - One facing ED Clinician & Patient Family
- Remotely Operated Camera
  - Pan, Tilt, and Zoom ability
- Medical Imaging Access to CT, ECG
- Electronic Clinical Documentation
- Consult Reporting between partners
TeleStroke Application

Telemedicine system for stroke patients.

- **Onset Summary**
  - Last Known Well: 13:40 2 Oct 2011
  - In ER Door: 14:10 2 Oct 2011
  - ER Doc Seen: 14:15 2 Oct 2011
  - Sent to CT: 14:17 2 Oct 2011
  - CT Read: 14:30 2 Oct 2011
- **Chief Complaint**: Patient not able to see

**Vitals**
- BP (mm/Hg): 155/102
- HR (bpm): 57
- RR (bpm): 16
- VS O2 Sat(%): 96.4
- CBG: 117 mg/dL
- Weight: 86.8 kg
- Temp: 96.9 F

**Labs**
- Hgb: 16.4 g/dL
- Hct (%): 48.6
- WBC: 8.7 K/mm³
- PLT: 270 K/mm³

**Medications & Allergies**

**Notes**

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Neuroscience Institute

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TeleStroke Application
TeleStroke Application

Stroke - Urgent Consult Note

CONSULT BACKGROUND AND SUMMARY

Patient Demographic Information
Patient: Chesterfield, Paul G
DOB: 22 Jun 1943 (68y)
Race: White
Gender: Male

Consultant Information
Grant Kohler

Hospital Information

Reason Consult Requested:
Patient presented with a CC of not being able to see in the leftward direction and a slight headache. Denies dysarthria, weakness or numbness.

Requesting Physician:
Marc Watson

Treating Physician:
Marc Watson
IPA Recommended: Yes

Times and Targets

| In ER Door | ER Doc Seen | CT Read | Time IPA Given |

Door To Needle: Unknown
Door To CT Start: 07min
Door To CT Read: 20min
Consult Started: 14:35 2 Oct 2011
Consult Ended:
Site Telestroke Role

- Activate telestroke cart as soon as possible (? pre-ED).
- Promptly call for formal telestroke consult as soon as possible.
  - Only pre-requisites are telestroke consult placed in cart and non-contrast CT(brain) completed/ready for review (ICH vs. non-ICH).
  - Lab results not required to call for consult.
- Brief ED/hospitalist physician interaction (minutes) at beginning and end of the consult.
- Nursing presence for approx. 30-60 minutes of telestroke consult.
  - Assist with tele-presentation/exam.
Telestroke Consultant Role

● Provide timely diagnosis and acute treatment plan.
  ■ 10-15 minutes to consult initiation.
  ■ 15-30 minutes to treatment decision.
● Prompt decision on IV tPA treatment, when applicable.
● Decision on need for hospital transfer and route.
● Provide consult recommendations for patients not transferred, to optimally care for the patient for the next 24 hours (until seen by local Neurologist/Neurosurgeon).
  ■ Discuss case with hospitalist, if necessary, prior to end of the telestroke consult.
● Available for follow-up telestroke consultation at any time after the initial consult (guidance and support throughout entire care process). Can review additional brain/vascular imaging studies, if necessary.

Discuss case with ED or hospitalist physician either via phone or in-person, prior to treatment and transfer decisions!!
Telestroke Consultant Roles

- Acute stroke treatment decisions, plus transfer (and route) decision.
- Review brain imaging studies.
- Stroke patient assessment and plan/guidance at any point in the patient’s stroke/neurological care, and until local Neurologist/Neurosurgeon can evaluate and further manage the patient.
Telestroke Consultant Role

- Direct interaction generally lasts **30-60 minutes** for most patients.
- Review data (including vital signs/changes) and interact with the patient/family/hospital staff throughout this period.
- Extra set of “eyes/ears” during this time period, more so in busy ED departments, to optimize patient care.
Partner Infrastructure

Cart Presence

Consistent relationships and uniform processes are key elements.

Cart Usage

This is more than technology!!
Patient Case

- 21 year-old right-handed WF (PSU student/senior, biology major), with acute abrupt onset left hemiparesis, when stooping over to tie her shoe at 2130. Promptly brought to ED by EMS (911) at 2200 for further evaluation and management.
- Telestroke consult subsequently initiated. CT(brain) negative. NIHSS 7 (severe left UE paresis).
- Received IV tPA at 2355, without subsequent clinical change/improvement. Recheck NIHSS 9 (notable left-sided neurological neglect). Intracranial CTA was emergently done and revealed a distal right M1 MCA occlusion with distal decreased perfusion.
- Emergently transferred to PSHMC, and underwent emergent IA mechanical thrombectomy procedure.
MRI (brain) DWI 24 hours later
Intracranial MRA 24 hours later
Discharged home 5 days later, on low-dose aspirin.

No residual neurological/stroke deficits (NIHSS 0 and MRS 0).

Stroke etiology still undetermined.
Case 2

- 75 year-old right-handed WF with witnessed acute onset left arm/hand weakness at 2PM while eating lunch with her friend. Friend called 911, and promptly brought to ED by 1430. Some improvement on ED arrival. Initial non-contrast CT(brain) was negative. NIHSS 2 (left facial droop, left arm drift). No contraindications to IV tPA therapy.
- IV tPA Rx - yes or no ???
Case 3

88 year-old right-handed WM, with acute onset modest gait dysfunction/ataxia after getting off his lawn mower at 430PM. Waited until after dinner, but symptoms persisted, thus he came to ED at 545PM. Non-contrast CT(brain) was negative. NIHSS 1 (left LE dystaxia). No specific contraindications to IV tPA Rx.

IV tPA Rx - yes or no ???
CT(brain) - 2 hours of symptom onset

Not an IV tPA Rx candidate (on therapeutic Xarelto Rx)
CT(brain) - 7 hours from symptom onset
CT(brain) - 24 hours later
Penn State Hershey Medical Center

Stroke Center

- 563 bed University Hospital & Children’s Hospital
- Joint Commission Comprehensive Stroke Center 2013
- Approx. 800 Stroke Admissions Per Year
- Currently approx. 150 Telestroke Consults per Month
- Currently 13 telestroke partner hospitals, within 2 hour driving radius in south central PA
CY 2014 Data

Total consults = 1141
Active partners = 12
IV tPA treatment rate = 25%
Transfer rate = 16%

PSHMC Telestroke Program Database
## Ischemic Stroke Treatment Rates

<table>
<thead>
<tr>
<th>Treatment</th>
<th>2014 n=483</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV tPA - HMC</td>
<td>53 (17%) n=318</td>
</tr>
<tr>
<td>IV tPA - OSH → HMC</td>
<td>50 (30%) n=165</td>
</tr>
<tr>
<td>IA Intervention</td>
<td>15 (3%) 10 - OSH 5 - HMC</td>
</tr>
<tr>
<td>IV, then IA Intervention</td>
<td>12 (2.5%) 8 - OSH 3 - HMC</td>
</tr>
<tr>
<td>Total Treatment Rate</td>
<td>130 (27%)</td>
</tr>
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PSHMC Stroke Program Database
Telestroke Partner Data

- IV tPA Rx
  - Approximately 25%
- Transfers
  - Approximately 15-20%
- Complications
  - Very low. Rare (<1%) intracranial ICH post-tPA Rx
Communication and Feedback Structure

- Communicate regularly on transferred patients to each of the site coordinators or project managers
- Monthly data reports are shared and reviewed with coordinators or project leaders
- Attend partner site stroke committee meetings
- Bimonthly coordinator network meetings (review/analyze network data and share best practices)
- Quarterly site visits by telestroke director/coordinator to review data (in-person, at spoke site), to discuss their data and address program/process changes (highlight new data/findings).
- All staff ongoing education [pre-hospital/EMS, ED, inpatient, outpatient; physicians (including hospitalists and specialists), nurses, other staff].
- Annual telestroke conference with CME (at PSHMC)
LionNet Process Improvement

- Reviewed network data
- Reviewed Benchmarks and Evidence
- Consensus: Telemedicine link in 30 minutes
- Shared best practices among partners
**Door to Needle Goal, 60 minutes**

<table>
<thead>
<tr>
<th>FY2014 Qtr4</th>
<th>FY2014 Qtr4</th>
<th>FY2014 Qtr4</th>
<th>FY2015 Qtr1</th>
<th>FY2015 Qtr2</th>
<th>FY2015 Qtr2</th>
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<tr>
<td>LS</td>
<td>WL</td>
<td>EH</td>
<td>MD</td>
<td>GH</td>
<td>SH</td>
<td></td>
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<tr>
<td>LKW</td>
<td>-72</td>
<td>-82</td>
<td>-65</td>
<td>-37</td>
<td>-87</td>
<td>0</td>
</tr>
<tr>
<td>Door to Reg</td>
<td>18</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>49</td>
<td>5</td>
</tr>
<tr>
<td>Reg to Call</td>
<td>2</td>
<td>29</td>
<td>5</td>
<td>49</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Call to Join</td>
<td>10</td>
<td>22</td>
<td>7</td>
<td>6</td>
<td>49</td>
<td>8</td>
</tr>
<tr>
<td>Join to Decision</td>
<td>36</td>
<td>20</td>
<td>59</td>
<td>45</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Decision to Needle</td>
<td>30</td>
<td>17</td>
<td>117</td>
<td>4</td>
<td>29</td>
<td>48</td>
</tr>
</tbody>
</table>

**PSHMC Telestroke Program Database**
Maintaining Momentum

- Partners will go through the “Ups and Downs”
  Common Causes:
  - Physician turnover
  - Nursing turnover
  - Challenges in the technology
  - The “newness” wears off…

- Need to maintain ongoing:
  - Site visits
  - Feedback (physician, nursing, EMS, radiology)
  - Data sharing
  - New education, practice opportunities, and research

Promptly address problems to avoid escalation!!
Stroke Alert Activation

- Anyone can activate a “stroke alert” process.
  - Nursing and EMS usually at beginning of process
- No penalty for activation regardless of final conclusion.
- Time = brain, and earlier activation can lead to better patient outcomes.
Acute Ischemic Stroke Rx

- IVFs (NSS)
  - Fluid bolus, then MIVFs
- Optimal BP management
  - Keep MAPs > 80-100
  - Aim for BPs < 180-200/100-110
  - Early HTN Rx intervention if potential IV tPA candidate
- Optimal glucose management
  - Aim for glucose < 140-180.

Important pre and post IV tPA Rx
“STAT” Call

- **Stroke severity**
  - Moderate-severe

- **Time**
  - Up to 12 hours (longer with posterior circulation)
  - CT(brain) findings

- **Age**
  - <60, 60-80, >80 years old

- **Treatment and transfer**
  - IV tPA Rx
  - Emergent transfer decision
  - Potential endovascular Rx candidate

If uncertain, better to call than not call for additional advice/guidance
Treatment Determinants

- Time from symptom onset
- Stroke severity/deficits
  - Can the Patient Live with the Deficit??
  - Complete neurological exam prior to deciding against IV tPA therapy
  - Don’t rely only on NIHSS score
- Medical Comorbidities
  - Recent surgeries or interventions
  - Bleeding issues
- Radiographic Findings
  - Non-contrast CT(brain)
  - CT/CTA/CT perfusion
  - MRI/MRA/MR perfusion
Tele-Rehab

- Dedicated scheduled time for consult.
- Multidisciplinary team
  - Physicians (with imaging review)
  - Nursing
  - Various Rx
  - Care coordinator/case management
- Consult duration approx. 30-45 minutes
- Formal summary document created
Stroke Rehab Goals

- Optimize stroke recovery (integrate patient back into their environment with residual neurological deficits)
  - Treat every patient like it’s you/your family!!!
  - Optimize adaptive resources/techniques over time
- Prevent post-stroke related complications
- Optimize secondary stroke prevention
- Closely observe for any recurrent TIA/stroke events
- Optimal stroke-related education for the patient and family
- Provide stability and support regarding transition from inpatient to outpatient settings
- Cutting-edge research
- Evidence/guidelines-based treatment approach
Stroke Recovery

- Acute Inpatient Neuro-rehab
- Home Health Therapies
- Home
- Standard Outpatient Therapies
- Optimal
- Stroke
- Patient
- Recovery
- LTAC
- SNF, TCU
- Outpatient Intensive Day Program
- OVR, Driver’s Evaluation, Adaptive Resources

Optimal Stroke Recovery Patient Recovery

HOME

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SNF Use

- Time and transfer issues
  - Several hours to transfer individuals to/from patient clinic visits and additional diagnostic testing, plus additional nursing time/coverage issues
  - Transport costs to/from facility
- Can decrease admission/readmission rates and complications
Outpatient Clinics

- Provide post-stroke discharge follow-up care.
  - 30 day, 90 day, and 1 year follow-up at HMC
  - Optimize post-acute care Rx, secondary stroke prevention, and stroke recovery Rx
  - Stroke outcomes measures (NIHSS, MRS, readmissions, complications)
- Could be provided by trained/qualified physician extenders, if necessary, on both sides.
Non-Emergent Use

- Scheduled visits
  - Build into standard workflow schedule
  - Teleconsultant schedule
- Telepresenter and organized process/plan
  - Process and expectations known by all parties involved
  - Approx. ½-1 hour encounter
  - Summary document created
- Ongoing staff education and updates
Future Plans

- Pre-hospital/EMS telestroke care (direct/manage stroke care prior to ED/stroke center arrival).
- More mobile stroke units (with CT scans), particularly in rural areas.
- Additional public education, with emphasis that earlier acute stroke Rx can lead to improved clinical outcomes.
Documentation

- Different formats
  - Concurrent (acute)
  - Delayed
- EHR compatibility
  - Within facility
  - Sharing between facilities and various services
- HIPPA compliance
Certification

- American Telemedicine Association (ATA)
- The Joint Commission
- State Requirements

- Physician and staff credentialing
Training Programs

- Being developed
  - Videos
  - SIM labs
  - On hands training

- Individuals
  - Teleconsultants
    - Physicians/Fellows and Extenders
  - Telepresenters
Finances

- **Billing**
  - Limited reimbursement at present
    - Medicare and Medicaid
    - Private insurances (contract negotiations)
  - Time vs. consult codes
  - Face-to-face encounter

- **Program costs**
  - Infrastructure/equipment and staff cost
    - On-call physician payment
  - Extend revenue beyond the telestroke program
  - Downstream revenue for 1 year
Stroke Centers and Telestroke

Stroke Centers and Telestroke

Given the narrow therapeutic window for treatment of acute ischemic stroke, timely evaluation and diagnosis are critical.

- American Heart Association/American Stroke Association (AHASA) and the Brain Attack Coalition (BAC) recommend the development of stroke centers for the rapid evaluation and assessment of patients, and for the timely administration of the appropriate stroke therapies. 
- In addition, the AHASA recommends the use of telemedicine, or telestroke, to improve stroke care in rural, remote, or underserved areas.

Learn more about stroke centers and telestroke by clicking one of the following links:

- **Stroke Centers**
  - Discover the importance of stroke centers and related information about certification and best practices.

- **Telestroke Networks**
  - Learn how telemedicine technology can provide improved stroke care to patients in underserved areas.

[www.activase.com/telestroke](http://www.activase.com/telestroke)
References

References


Telesstroke Conclusions

- A successful telesstroke program is a true partnership between the community hospital system and the academic stroke center.
- Increased acute stroke treatment rates, particularly the use of intravenous t-PA therapy, and better overall stroke patient outcomes do occur with the addition of telesstroke programs to hospital systems.
- Time is brain, and every effort should be made to make the quickest possible acute treatment and transfer decisions.
- Ongoing analysis of the telesstroke program data is critical to further improve pathways, protocols, treatments, and outcomes.
Conclusions

- Telemedicine throughout the continuum of stroke care is valuable to optimize patient outcomes, provided it is properly established, used, and maintained over time.
- Telestroke allows for stroke expertise and care to be disseminated to many additional hospital systems/groups, that have limited stroke resources and capabilities.