Telemedicine

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Disclosures

• Consultant
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Objectives

• Clinical problem
• Description of telestroke networks and models
• Clinical outcomes and effectiveness
• Review of Ochsner’s telestroke network
Burden of stroke

- US has ~ 4 neurologists per 100,000 persons
  - Caring for more than 795,000 strokes per year
- Many parts of US are without access to acute services entirely
- Neurologists across the country are opting out of call coverage for stroke and other neurologic emergencies
- Direct and indirect costs of stroke are estimated to be $62.7 billion annually in the US
Burden of stroke

• Rapid recognition and accurate diagnosis are critical
• Many conditions can mimic stroke
• Misdiagnosis rate by primary care and emergency physicians may be as high as 30%
• Delays in diagnosis and misdiagnosis limit the use of proven therapies
• Evidence concerning litigation involving stroke therapy with IV rtPA indicates liability is predominantly associated with failure to provide treatment rather than adverse events
Stroke/TIA Mimickers

- Seizure
- Migraine
- Hypoglycemia
- Bell’s Palsy
- Vestibulopathy
- Tumor
- Multiple sclerosis
- Encephalitis
- Intracranial (e.g., subdural or epidural) hematoma
- Intoxication or other encephalopathy
- Conversion disorder
Options for Patients Experiencing an Ischemic Stroke

**IV tPA**
Gold-standard in ischemic stroke care. Drug is designed to break apart the clot.

**Medical Management**
Monitor vitals and provide secondary stroke prevention.

**Endovascular Clot Removal**
Mechanical disruption or removal of the clot using standard endovascular approaches.

**Bridging Therapy**
Meta-analysis Shows a Strong Correlation Between Revascularization and Good Patient Outcomes


*Differences in sICH were not statistically significant between the revascularized and non-revascularized groups.

Good Outcome (mRS 0-2):
- Revascularized: 58.1%
- Non-revascularized: 24.8%

90-Day Mortality:
- Revascularized: 41.6%
- Non-revascularized: 14.4%

SICH:
- Revascularized: 13.7%
- Non-revascularized: 12.5%*
IV tPA, the “Gold Standard”

- Systemic “Clot Buster”

- FDA Approved for the treatment of AIS in 1996

- Only 8% of ischemic stroke patients are eligible for IV tPA
  - Narrow time window
  - Risk of cerebral and systemic hemorrhage

- Achieves early reperfusion in only 13-50% of large vessel occlusions


Treatment window

• Treatment within the first 3 hours only
  – IV t-PA

• Treatment within the first 4.5 hours
  – IV t-PA

Figure 3: Model estimating odds ratio for favourable outcome at 3 months in rt-PA-treated patients compared with controls by OTT

Adjusted for age, baseline glucose concentration, baseline NIHSS measurement, baseline diastolic blood pressure, previous hypertension, and interaction between age and baseline NIHSS measurement.
Number of patients who benefit and are harmed per 100 patients treated with t-PA in each time window

- **0-90 minutes**: Benefit 27.8, Harm 1.5
- **91-180 minutes**: Benefit 23.1, Harm 2.6
- **181-270 minutes**: Benefit 16.9, Harm 3.4
- **271-360 minutes**: Benefit 5.2, Harm 7.3
t-PA For Acute Stroke
Contraindications

• Suspected SAH
• Recent significant head trauma (3 mos) or stroke (3 mos)
• Recent intracranial or intraspinal surgery
• History of intracranial hemorrhage
• Heparin w/in 48 hrs and elevated PTT
• INR > 1.7
• PLT count <100,000
• Direct thrombin inhibitor or direct factor Xa inhibitor within 2 days
• Glucose < 50mg/dL
• Intracranial neoplasm, AVM or aneurysm
• Uncontrolled hypertension (>185/110)
• Multilobar hypodensity on CT (> 1/3 hemisphere)
• Active internal bleeding
• Arterial puncture at non-compressible site in previous 7 days
• Relative exclusion criteria
  – Only mild or rapidly improving symptoms
  – Seizure with postictal impairment
  – Pregnancy
  – Major surgery or serious trauma within previous 14 days
  – Recent GI or GU bleed (within 21 days)
  – Recent MI (within 3 mos)

Jauch et al. Stroke 2013;44
Selected, Updated tPA Guidelines  
(Class IIb; LOE C)

- Treatment of patients with non-disabling symptoms w/in 3 hours may be considered
- Treatment of moderate to severe stroke in pregnancy may be considered
- Treatment of carefully selected patients who have undergone major surgery w/in 14 days may be considered
- Treatment of selected patients with recent trauma (<14 days) may be carefully considered
- Treatment of patients with aneurysms <10mm is reasonable
- Treatment of patients with severe stroke and unruptured AVM may be considered

Demaerschalk et al. Stroke 2016
Goal of treatment

• 60 yo female
• Presentation NIHSS = 18
• Puncture ~ 5 hours from LKN
• TICI 3 in 31 minutes
• Discharge NIHSS = 0 → home
Goal of treatment 2

• 74 yo male
• Presentation NIHSS = 22
• Puncture ~ 15 hours from LKN
• TICI 3 in 20 minutes
• Discharge NIHSS = 2 → rehab
Selected 2015 Endovascular Guidelines

• Criteria for endovascular therapy with a stent retriever (Class I; Level of Evidence A)
  – Prestroke mRS score 0 to 1
  – Receiving tPA within 4.5 hrs
  – Causative occlusion of ICA or proximal MCA (M1)
  – ≥18 yrs of age
  – NIHSS ≥ 6
  – ASPECTS ≥ 6
  – Treatment initiated within 6 hrs of symptom onset

• Effectiveness of treatment beyond 6 hrs is uncertain (Class IIb; Level of Evidence C)

Powers et al. Stroke 2015
Selected 2015 Endovascular Guidelines

- Endovascular therapy within 6 hrs in carefully selected patients with contraindications to tPA is reasonable; inadequate data to determine efficacy *(Class IIb; Level of Evidence C)*

- Treatment within 6 hours of patients with M2 or M3, ACA, VA, basilar, or PCA is reasonable although benefits uncertain *(Class IIb; Level of Evidence C)*
Challenges in acute stroke care

• Intravenous thrombolysis reduces long-term disability and is cost-effective in acute ischemic stroke (AIS)
• Intravenous thrombolysis must be delivered within a narrow time window in order for the treatment to be effective
• Lack of stroke specialists and lack of access to endovascular revascularization therapies, especially in rural areas, account for low utilization of intravenous thrombolysis
  – Rate of intravenous thrombolysis is < 5% of AIS cases
POSSIBLE SOLUTION?
Telestroke
The dawn of telestroke
The dawn of telestroke…
The dawn of telestroke…
The dawn of telestroke…
Telemedicine

• Defined as the use of telecommunications technologies to provide medical information and services

• First reported to be used for stroke in early 1990’s
  – Term telestroke first used in 1999
Telestroke

• Interactive videoconferencing by bidirectional audiovisual systems
  – Characterized by dedicated, high-quality, interactive equipment
• Coupled with the use of teleradiology for remote review of brain images
• Allows for patient and/or family and both the bedside and distant healthcare provider to see and hear each other in full color
Quality requirements

• > 20 frames per second of bidirectional synchronized audio and video at a resolution capable of being displayed on monitors of ≥ 13”

• Teleradiology is the ability to obtain radiographic images at 1 location and transmit them remotely to another location for diagnostic and consultative purposes

Telestroke advantages

- Helps solve shortage of neurologists and radiologists
- Allows hospitals to become “acute stroke ready”
- Enhances stroke diagnosis
- Increases IV thrombolysis administration rates
- Overcomes geographic barriers to acute stroke care
- Improves long-term outcomes
- A study published in 2011 found that hub-and-spoke telestroke networks were cost-effective in the long term from a societal perspective

Telestroke models

• Hub-and-spoke model
  – Hub
    □ Usually a Comprehensive Stroke Center
      = Primary Stroke Center with advanced neurological capabilities
    □ 24 x 7 support with in-house neurology providers
  – Spoke¹
    □ Typically smaller hospitals with less extensive neurology coverage
    □ Underserved hospitals in rural or sub-urban areas

• Third party provider
  – Spoke hospital contracts with a third party provider for neurologist coverage
    □ Third-party provider employs neurologists to be on call to provide telestroke services²
    □ Spoke hospitals transfer more complicated patients to a tertiary hospital²

Telestroke Models

Patient flow in hub & spoke network

- **Hub**
  - No changes in patient flow

- **Spoke**
  - Fewer patients transferred out
  - More patients receiving IV thrombolysis and/or endovascular therapy

- **Research study conducted in 2012 assessed costeffectiveness of telestroke networks from individual hospitals’ perspectives**
  - **Study population**
    - Telestroke network with 1 hub and 7 spoke hospitals
    - Total of 1,112 unique AIS patients presenting to the emergency departments in the network hospitals per year
  - **Clinical outcomes**
    - About 114 fewer AIS patients would be admitted to the hub hospital each year, whereas approximately 16 more patients would be admitted to each spoke hospital compared with a no network setting
    - 45 more patients would be treated with IV thrombolysis & 20 more with endovascular stroke therapy in a telestroke network per year

Barriers to telestroke

- Infrastructure funding
- Regulatory changes to promote development of acute stroke-capable or PSC’s
- Reimbursement for services
- Promoting physician adoption and participation
- Physician licensure and credentialing
- Technology assessment and deployment
- Medical liability
- Compliance with privacy and security laws
Best practices

- A program leader to champion the effort
- Support from emergency departments (ED) at spoke hospitals
- On-site visits between hub leaders and spoke sites
- Standardized protocols at all sites throughout the network (hub and spoke)
- Availability of Activase
- Personnel trained in Activase administration
- Spoke hospital training
- Transfer agreements in place
- Ongoing educational planning for hub and spoke personnel

ASSERT: Acute Stroke System for Emergent Regional Telestroke

Ochsner Tele-stroke Network
Ochsner telestroke numbers

• Total # TPA administrations (as of 12.31.2015) - 812
  – 68 doses in 2011
  – 125 doses in 2012 (842 consults) → 15%
  – 153 doses in 2013 (956 consults) → 16%
  – 190 doses in 2014 (1267 consults) → 15%
  – 216 doses in 2015 (1817 consults) → 12%
2015 TeleStroke Consult Volume

- Total Consults: 1815
- Acute Ischemic Stroke: 875
- Transient Ischemic Attack: 235
- Intracerebral Hemorrhage: 18
- Mimic: 605
- Other: 82

Total: 1815
TeleStroke Network Outcomes

Reporting period: August 2009 – March 2016
- Total consults: 6,254
- Diagnosis of AIS: 3,178

**tPA Utilization**

- Non-PSC: 5%
- PSC: 8%
- Ochsner TeleStroke: 27%

**Bleeding Complications for IV tPA**

- National Average: 8%
- Ochsner TeleStroke: 3.6%

**Door to TeleStroke Initiation**

- 2012: 65
- 2013: 60
- 2014: 55
- 2015: 50

**Door to Needle**

- 2012: 100
- 2013: 95
- 2014: 90
- 2015: 85
Disposition by Hospital Type

- 70% of Patients Stay Local

![Bar chart showing disposition by hospital type](chart.png)

- Pre-Telestroke:
  - CAH: 0%
  - Community: 35%
  - Sub-Hubs: 75%

- Post-Telestroke:
  - CAH: 64%
  - Community: 77%
  - Sub-Hubs: 89%

Pre-Telestroke • Post-Telestroke
Increase in use of tPA
ASSERT Telestroke Network

- 31 sites currently
- Projected 45 sites by late 2016
- 1815 total telemedicine consults in 2015
- IV tPA initiations in 216 patients in 2015
  - 283 total doses initiated by our team
- Site expansion:
  - Mississippi & Alabama
  - Future proposed sites: Saudi Arabia & Caribbean
- Transfer rate ~30%
Transfers to OMC

• Goal: Patients stay local when possible
• Goal: Make appropriate level of care available for all stroke related patients
• Who is transferred to OMC-NOLA?
  – Critical care patients
  – High complexity
  – Endovascular candidates
• How are patients transferred?
  – Distance and weather dependent
  – Ochsner Flight Care (helicopter/fixed wing)
  – Critical Care ground transport
Summary

- Telestroke can satisfy requirements for around-the-clock acute stroke coverage and allow for highly efficient dissemination of expertise to neighboring and distant communities for acute stroke treatment and education.
Benefits of telestroke

- Optimization of the use of IV rtPA
- Decrease in time to initiate IV rtPA
- Providing treatment with similar safety as Primary Stroke Centers
- Immediate access to specialty consultation
- Reliable neurologic exams and NIHSS scores
- High use rates of IV rtPA without increase in complications or hemorrhages