Stroke Systems of Care

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What do we know?

Stroke: Time is Brain

Shorter onset to treatment times associated with:
• Improved functional outcomes
• Lower complications

Every minute of a large-vein stroke, the average patient loses 1.9 million neurons

In patients eligible for intravenous rtPA, benefit of therapy is time dependent, and treatment should be initiated as quickly as possible. The door-to-needle time (time of bolus administration) should be within 60 minutes from hospital arrival.
Stroke in NC
South eastern NC is located in the buckle of the “Stroke Belt”
=> highest stroke incidence and mortality rates in the country
~ 1,200 Stroke and TIA Admissions in 2016

Stroke 5th leading cause of death in the United States.
(CDC Stats)

Implementing the Science
Treatment of Stroke

Target Stroke
- Known time to tPA matters for over a decade
- Early studies showed only 30% of patients treated within 60 minutes
- Up to 53% in 2013
**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

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**Best Practices:**

- **Published Target Stroke and Helsinki**
  - EMS pre-notification to the hospital
  - Rapid triage and stroke team notification, single call activation
  - Orders entered prior to pt arrival
  - No delay in CT reads (stroke physician reads in real time)
  - Premix tPA
  - tPA given in CT
  - CT available in ED
  - Point of care INR
  - Reduced advanced imaging
  - Team based approach to stroke care
  - Prompt specific feedback to teams
Is this realistic?
Can tPA be given under 60 minutes consistently? What about 45?

N=130  N=12751  N=1879

NHRMC Stroke Center 2016-2017

Bleeding Complications

N=134  N=83208  N=2351

2016-2017
How’d we get here?

• 2010 treated 8 patients with tPA...
• Admitted around 800
• Identified a need for:
  • Coordinated response process, as treatment with tPA was rare
  • Clinical pathways
  • Dedicated stroke leaders
  • Dedicated stroke unit
  • Data monitoring and PI

Development of Stroke Program

• Created multiple evidence based order sets
• Opened Stroke Unit (7th floor)
• Create Code Stroke response team
• Collecting data
• Ongoing PI
• Community education
• Staff education

Code Stroke Implementation

Go Live May, 2011
Code Stroke Response

• Goal of Code Stroke
  1. Identify all patients eligible for treatment with thrombolytics or endovascular therapy (increase rate)
  2. Increase the speed of treatment

• Multidisciplinary team
  • EMS, ED, Pharmacy, Neurology & Stroke RNs
  • Specified patient criteria & standard work

Code Stroke Response

• Activation of Code Stroke
  • EMS, Emergency Department Physician or Stroke RN (for in-house acute strokes)

• Criteria for Code Stroke
  (Must have all of below)
  1. Positive MEND exam with focal symptoms
  2. Blood glucose > 50
  3. Symptom onset < 8 hours or woke with symptoms
Problem: Door to Needle (tPA) times > 60 minutes

- 27% D2N < 60 minutes
- Median D2N 69 minutes

Countermeasures

- Develop Countermeasures
  1. Modify neurologists call back process
  2. Develop standard work for roles/ responsibilities
  3. 90 day pilot pre-hospital Code Stroke activation

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Lean A3
Countermeasures

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Results

Data:
- 27% D2N < 60 minutes
- Median D2N 69 minutes
- n=27 (tPA cases)
- 81% < 60 minutes
- Median 45 minutes
- n=22 (tPA cases)

2017 Code Stroke System

Code Stroke Team

- EMS
- ED team
- Response team:
  - Neurologist
  - Pharmacist
  - Stroke RN
  - Radiology
Pre-hospital Code Stroke Activation

Key System Elements:

- Stroke team in CT
- Neurologists reads images real time
- tPA given in CT
- CTA obtained if needed

Key System Elements: Pit Stop and Handoff

- EMS draws labs & pre-activates system
- Procedure in place for EMS transfer straight to CT
  - "Pit Stop"
    - Receive report from EMS
    - Rapid assessment ABCs
    - Handle any quick registration requirements
    - Hand-off blood drawn by EMS, or draw labs if needed
    - Begin neuro exam as patient is moved to CT

Key System Elements: Weekly Stroke Huddle

- Discuss cases from the previous week and performance around Code Stroke and ELVO
- Allows for real-time action plans and follow up to prevent continual issues
- Celebrate successes
What about thrombectomy?

New standard of care for treating ischemic stroke (large vessel occlusions)

- 5 major trials in 2014 & 2015 showed significant benefit in the percentage of stroke patients with LVO who had a good outcome (mRS 0-2)
- 2015 Guidelines endovascular therapy is Class I indication

- We recognized the need in our community & invested in development of endovascular program
**Stroke: Time is Brain**

*Thrombectomy*

**Outcomes Best if Done within 2.5 Hours**
- Reperfusion within 2.5 hours => 91% functionally independent
- Additional hour delay => 10% lower likelihood of functional independence
- Every 60 minute delay after 3.5 hours is 20% lower likelihood of functional independence.

**SWIFT PRIME Sub analysis**

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**Code ELVO (Emergent Large Vessel Occlusion)**

- Organization identified the need for the community
- Process layered onto Code Stroke
  - Built upon strong infrastructure
  - CTA ordered suspected LVO
  - Procedure done in Interventional Radiology
  - STICU for post procedure care

**Goal:** Door to Revascularization <120 min

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**Implementation:**
- Hiring Interventionalist (Dr. Doss)
- Developing Code ELVO processes, order sets, changes in Epic, etc.
- Training staff
- Education to physician groups
- Validate all areas were ready
ELVO Data

- Began January 2017
- 72 Code ELVOS
- Treated 52 at NHRMC in IR
- Transferred out 15
- Median door to revascularization 81 minutes

What’s Next?
World of Stroke and at NHRMC
**Stroke System of Care for ALL Stroke Patients**

- **EMS Walk-in**
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- **Comprehensive Stroke Center (CSC) Or invn capable**
- **Transfer to Comprehensive Stroke Centers? Consider transfer of patients with potential large vessel occlusion (LVO) to a CSC**

**Prehospital Stroke LVO Scales**
- RACE
- GFAST
- LAMS
- CPSSS
- PASS
- FAST ED

**Destination Plans: Stroke**
- **Transfer acute stroke patients to stroke capable hospitals**
  - Even if drip and ship to larger stroke center
- **Transfer to Comprehensive Stroke Centers?**
  - Consider transfer of patients with potential large vessel occlusion (LVO) to a CSC

**Mobile Stroke Units**
- **Ambulance:**
  - CT scanner
  - point-of-care lab
  - Telemedicine connection
  - Dispatch stroke algorithm
  - Pre-hospital stroke team
- **Thrombolytics started before transport to hospitals**
NHRMC Stroke Program 2018

- 100% interventional coverage
- Dr Beecher joining the team
- Treatment of aneurysms
- Pre-hospital LVO scales
- IMPROVE Stroke
  - Regional system of care implementation
- COMPASS – post acute care coordination & readmission reduction
- Continual improvement

DAWN Trial

- Current standard of care for EVT for patients with symptoms 0-6 hours
- DAWN trial studied symptom onset 6-24 hours
  ⇒ 73% Reduction in disability in stroke patients treated up to 24 hours
- Awaiting full publications
  - Modification to system? Expanding inclusion window.

Elements of Continuous Improvement

- Data collection and analysis
  - Set benchmark goals for each step in the process
- Feedback to team – internal and external
- Multidisciplinary Case Review and Steering Committees
- Education
- Standard terminology
- Standardized roles/responsibilities
- Share success stories

Why it matters

Leading Our Community to Outstanding Health

- March 1, 2017
- 46 y/o f ran off road while driving in Brunswick Co. around 2pm
- Left side paralysis, facial droop, partial gaze palsy
- BEMS on scene 6 minutes
- Prehospital Code Stroke
Team arrived in ED prior to patient arrival
• Pit stops NIHSS 14
  • Left side paralysis, facial droop, partial gaze palsy
• Door to CT completed in 17 minutes from arrival
• Door to tPA in 26 minutes
• CTA
• Code Stroke -> Code ELVO

Why it matters
Leading Our Community to Outstanding Health

Revascularization in 79 mins (national goal 120)
• NIHSS 14 -> 0 on discharge (day 3)

Thank you