Improving Door-to-Needle Time: EMS/Emergency Dept Stroke Care

10th Annual Cerebrovascular Symposium
Swedish Medical Center

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Swedish Medical Center

Cherry Hill Campus

> Neurosciences/Cardiovascular
> Comprehensive Stroke Center
> GWTG Stroke Gold Plus
> Emergency Department
  • Full service department
  • 15 beds
  • Approx 25k visits per year
  • “code strokes”, approx % tPA cases
  • Target Stroke Honor Roll Elite Plus
Rationale for Improving DTN Times

**Second leading cause of death globally behind heart disease**

> Fifth leading cause of death in the U.S.

- 129,000 deaths per year (one every 4 minutes)
- 795,000 strokes annually in the U.S. (one every 40 seconds)

**Leading cause of serious long term disability in the U.S.**

- National Stroke Association: 40% of patients w/ impairment requiring special care after discharge
- 10% will require nursing home level care, 14% will experience another stroke within the first year
- Estimated total cost of care $71.6 billion in 2012
- Projected to triple to $184 billion by 2030

(Mozaffarian et al, 2015)
Time is Brain

1.9 million neurons are lost per minute (Saver, 2006)
- 14 billion synapses, 7.5 miles of myelinated fiber per minute
- Equivalent of aging 3.6 years per hour without treatment

Every 15 min reduction in DTN estimated to add 1 month of disability free life (Meretoja et al., 2014)
- 1.8 days added per 1 min reduction in DTN time overall
- 0.6 days added for 80yo and NIHSS 20 | 0.9 days 80yo and NIHSS 4
- 2.7 days added for 50yo and NIHSS 20 | 3.5 days 50yo and NIHSS 4

Every 15 min reduction in DTN estimated to lower odds of mortality by 5% (Fonarow et al., 2011)
National Backdrop

1996: FDA approval of IV-tPA 0-3 hours onset

2003: AHA/ASA creation of Primary Stroke Center designation
   > Get With the Guidelines Stroke Registry created

2009: AHA/ASA recommendation of 4.5 hour IV-tPA window

*2010: Target Stroke Campaign initiated

2012: Comprehensive Stroke Center designation created

2015: AHA/ASA updated guidelines for endovascular treatment
Target Stroke

AHA/ASA national campaign to improve DTN times

> Campaign launched Jan 2010
  • Goal of DTN w/in 60min for at least 50% of patients
> Studies at the time reported less than 30% of patient receiving IV-tPA w/in 60min*
> 2010 national median DTN time of 78 minutes (GWTG Registry)
> Phase II started in 2015: DTN w/in 60min for 75% of patients, 45min for 50%

*(Fonarow et al, 2011)
### Results: Clinical Outcomes Pre- and Post-Target: Stroke

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre-Target: Stroke (n=27,319)</th>
<th>Post-Target: Stroke (n=43,850)</th>
<th>Difference Pre and Post</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Hospital Mortality</td>
<td>9.93%</td>
<td>8.25%</td>
<td>-1.68%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Discharge Home</td>
<td>37.6%</td>
<td>42.7%</td>
<td>+5.1%</td>
<td>&lt;0.0001</td>
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<tr>
<td>Ambulatory Status Independent</td>
<td>42.2%</td>
<td>45.4%</td>
<td>+3.2%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Symptomatic ICH</td>
<td>5.68%</td>
<td>4.68%</td>
<td>-1.00%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any tPA Complications</td>
<td>6.68%</td>
<td>5.50%</td>
<td>-1.18%</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Our Story

2010 Median DTN Time of 74 minutes (GWTG Registry)

> Stroke care very linear:

- EMS arrives and gives report
- Patient is moved to ED bed, weighed, placed on monitor, IV access, blood glucose, EKG, registered
- MD takes EMS report, interviews and examines patient, initiates Code Stroke, orders labs/CT, Neurology paged.
- Patient returns from CT, and is examined by Neurology.
- CT report from Radiology
- Labs reviewed
- Decision to give tPA made. Ordered. Mixed in Pharmacy and brought to the bedside.
How to Utilize Lean Principles at CH?

What part of the pathway is of actual value to the patient?

> How do we reduce or eliminate everything else
> How do we create flow?
> How do we reduce variability/outliers?
> How do we change a linear process to a parallel process?
> How do we maintain quality/safety?
Our Experience

Cherry Hill Door to IV Alteplase Times

*Data from Swedish GWTG Registry
General Concepts

Multi-departmental / multi-institutional effort

Successful models

• STEMI care, Trauma
• Swedish Denver, Helsinki University Central Hospital

Standardization

• Stroke Protocol and order-sets / STAT stroke labs and head CT
• Hospital-based Neurology service dedicated to stroke care
• Staff training and experience

How much can be done before rooming the patient?

• Coordination with Seattle Medic One / local EMS
• Door-to-CT Pilot Project

Continuous QI and refinement of processes / PDSA Model
EMS Standards:

- 9-1-1 Dispatch within 90 sec of receiving call
- EMS response time within 8 minutes
- On-scene time less than 15 minutes
- Rapid transport to nearest designated stroke center (PSC vs CSC)
- Currently drip and ship model (Pervez et al, 2010)

Pre-Hospital Activation and care

- “the key is to do as little as possible after the patient has arrived in the emergency room and as much as possible before that” (Meretoja 2012)

Experimental

- MSTUs
- Neuroprotective agents – animal studies have not translated to benefit in human trials yet (e.g., FAST-MAG)
EMS (cont)

Door-to-CT Project:
- Met with Seattle Medic One and other local EMS stakeholders
- Model of successful STEMI system
- King County EMS stroke training and education revamp in 2015-16

Prehospital Assessment
- LKN
- FAST: sensitivity 79-85%, specificity 68%, misses 38% posterior strokes (Nor et al, 2004; Purrucker et al., 2015; Harbison et al., 2003)
PreHospital Assessment (cont)

> LAMS: new Seattle protocol for late 2016
  • sensitivity 81%, specificity 85% for LVO with score of 4 or higher (7 fold higher risk)

> Comparable with sNIHSS (Naziel et al., 2008; Llanes et al., 2004)
Pre-Hospital

Pre-notification of Code Stroke
- LKN and ETA
- Witness contact info/cell phone (or transport with patient)

ALS ambulances (Medic One, unstable patients)
- Blood glucose
- Attempt at IV placement (not to delay transport)
- EKG/rhythm strip (not to delay transport)

BLS ambulances (local agencies, majority of incoming strokes)
- Blood glucose

ED:
- CT notified to keep scanner clear
- ED weight bed and monitor parked in Radiology
- Team assembles in Ambulance Bay
Pre-ED Room

Avoid rooming patient if stable
- Patient met in Ambulance Bay
- Expedited MD assessment, ABC*
- Blood glucose (tech)*
- ID Band (registration)*
- One attempt at IV line (RN)

EMS takes patient to CT
- Weight obtained
- CT scan reviewed right away by ED MD / Neurology
- Pharmacy called to pre-mix tPA
- Neurology contacts witnesses/family
ED Room

Value Added Time

- Patient assessed by Neurology upon return
- Two lines placed (RN)
- EKG performed if not done already (tech)
- Consent process
- Safety pause and IV-tPA administration
- Post-tPA protocol initiated

Post-tPA

- Admission to ICU or taken to Radiology by Neurology for Code IR
Continuous Process

Quality review

• Continuous staff education
• Debriefs with staff/EMS
• Data reviewed monthly
• Protocols refined based on feedback, outlier cases (e.g., BP management protocol implemented)

Results

• 30-40min reduction in DTN times
• No increase in symptomatic hemorrhage
No Increase in Symptomatic Hemorrhage

Cherry Hill Symptomatic Hemorrhagic Complication w/in 36 hrs of IV Alteplase
(Data from tPA Registry)

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>2014 (n=57)</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>2015 (n=55)</td>
<td>4%</td>
<td></td>
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<tr>
<td>2016 Jan-Feb (n=8)</td>
<td>0%</td>
<td></td>
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Cherry Hill Symptomatic Hemorrhagic Complication w/in 36 hrs of IV Alteplase
(Data from GWTG)

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<td>2015 (n=39)</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>2016 (n=3)</td>
<td>0%</td>
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Future Considerations

**Code IR**
- Protocol for MRI/MRA changed to default of CTA/P
- CTA upfront had previously led to delays in DTN times
- CT relocated to same level as ED in spring 2016
- CTA upfront? tPA in CT?

**Misc**
- POC Testing
- Where should tPA be mixed?
- Patient weight
Summary

2010: Median DTN Time of 74 minutes (GWTG Registry)
- Internal goal of 45 minutes
- Standardization of stroke protocol, order-sets
- Dedicated stroke service expansion
- Telestroke to reduce response time for after hours cases

2013-2014: Next Phase
- Door-to-CT Pilot Project initiated
- Meetings and coordination with local EMS, Radiology, Pharmacy and other stakeholders to revamp stroke protocols
- BP protocol, pre-mixing tpa, ED review of Imaging

2016: 30 minute reduction in DTN times
- Continuous refinement
- Better integration of Code IR with arrival of new CT scanner
References


