Stroke Severity and Routing

“Does anyone know where we’re going?”

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EMS System Medical Director
Wichita/Sedgwick County Kansas

November 3rd, 2017
• Conflicts:
  – None but looking
Perspective...
Objective

• Discuss routing of EMS stroke patient and the relationship with symptom severity

• Review EMS system design components needed for systems based care
My REAL Objective

• Lets talk logistics…and from the patient’s perspective.

Amateurs talk strategy. Professionals talk logistics.

— Omar N. Bradley —
The Issues

• What’s this story about? Has it got any sports in it?
  – Are you kidding? *Fencing, fighting, torture, revenge, giants, monsters, chases, escapes, true love, miracles.*

• Doesn’t sound too bad. I’ll try to stay awake.
Fencing, fighting, torture, revenge, giants, monsters, chases, escapes, true love, miracles
Who’s Hungry?
A “System of Care” approach

• Basically, we’ve finally realized that none of our individual programs can get the job done alone...

...and we need to work together.
A “System of Care” approach

• It’s the whole collection of what our programs do to meet the patient’s needs
So, as it pertains to stroke…

what is the role of EMS in meeting the patient’s needs?
Right Patient

Right Hospital

Right Treatment
Right Patient
Sort patients correctly

Right Hospital
Get patients to facilities that can provide the care that they need

Right Treatment
Deliver treatments that create better outcomes
The Game Changer

- TPA vs Retrievers
tPA success rates by location

Saqqur et al, Neurology 2008
Positive Endovascular Stroke Trials 2015

<table>
<thead>
<tr>
<th>Trial</th>
<th>Endovascular</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR CLEAN</td>
<td>33%</td>
<td>19%</td>
</tr>
<tr>
<td>REVASCAT</td>
<td>44%</td>
<td>28%</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>53%</td>
<td>29%</td>
</tr>
<tr>
<td>SWIFT PRIME</td>
<td>60%</td>
<td>36%</td>
</tr>
<tr>
<td>EXTEND-IA</td>
<td>71%</td>
<td>40%</td>
</tr>
<tr>
<td>THERAPY NS</td>
<td>38%</td>
<td>30%</td>
</tr>
</tbody>
</table>
Two hospitals (Competitors)

2.5 miles apart (7 minutes)

One Primary
One Comprehensive
The theory…

- Patients with a large vessel occlusion that are identified in the field can be preferentially routed to a center capable of performing endovascular therapy and will result in better outcomes.

...well, I’m gonna need some things.
<table>
<thead>
<tr>
<th></th>
<th>LAMS</th>
<th>3ISS</th>
<th>RACE</th>
<th>C-STAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication Year</td>
<td>2001</td>
<td>2005</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td>Derivation n</td>
<td>119</td>
<td>171</td>
<td>654</td>
<td>624</td>
</tr>
<tr>
<td>Goal of scale</td>
<td>LVO</td>
<td>LVO</td>
<td>LVO</td>
<td>Severe Stoke LVO</td>
</tr>
<tr>
<td>Independently Validated</td>
<td>Yes (Abstract)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Validation n</td>
<td></td>
<td>357</td>
<td>650</td>
<td></td>
</tr>
<tr>
<td># of items scored</td>
<td>3</td>
<td>3</td>
<td>5-6</td>
<td>4</td>
</tr>
<tr>
<td>Time to complete</td>
<td>20-30 second</td>
<td>20-30 second</td>
<td>Variable</td>
<td>&lt; 60 seconds</td>
</tr>
<tr>
<td>Sensitivity/specificity</td>
<td>NIHSS 14 86%/95%</td>
<td>N/A</td>
<td>NIHSS 15 89%/72%</td>
<td>NIHSS 10 79%/89%</td>
</tr>
<tr>
<td>Severe stroke</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity/specificity</td>
<td>81%/89%</td>
<td>67%/92%</td>
<td>85%/65%</td>
<td>83%/40%</td>
</tr>
<tr>
<td>LVO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluated -- prehospital</td>
<td>Yes (FAST-MAG)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>setting</td>
<td></td>
<td></td>
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</tbody>
</table>
Parallel Workflow

A. Linear process
- Arrival at scene
- Basic Tx CPSS
- Telemetry Alert ED
- Arrival to ED
- ED Doctor evaluation
- Imaging evaluation
- Hold patient in ED
- Transfer to IR Suite
- Groin Puncture
- NIR fellow alert
- IAT decision
- NIR team activation
- Setup suite
- Anesthesia activation

B. Parallel process
- Arrival at scene
- Basic Tx RACE
- Facetime Neuro Doc
- Clinical evaluation
- NIR fellow alert
- IAT decision
- NIR team activation
- Setup suite
- Anesthesia activation
- Transfer to suite
- Groin puncture

Time saved
Stroke Alert

Date: 2/19/2016
Gender: M  Age: 66
Chief Complaint: Difficulty speaking, R weakness
LKW time: 1845

Sudden onset at home difficulty speaking and R weakness. Hx a fib, AVR and back surgery 2 day prior. NIHSS 15 (aphasia R side flaccid) CTA showed complete occlusion L M1 MCA. Successful intervention with retrieval of the fibrin plug extending from the L carotid T into L MCA M1 segment using both suction and stent retriever procedure. Day 3 NIHSS 3 for mild aphasia and mild R arm weakness. DC Dispo Home.
Door to Puncture time exceptional at 66 min. Excellent teamwork and recognition of LVO by EMS.

EMS: SCEMS M39
R.A.C.E.: 7
The theory…

- Patients with a large vessel occlusion that are identified in the field can be preferentially routed to a center capable of performing endovascular therapy and will result in better outcomes.

…this all sounds good, but how does it work in the real world?
<table>
<thead>
<tr>
<th></th>
<th>RACE Score 5+</th>
<th>RACE Score 0-4</th>
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<tbody>
<tr>
<td><strong>LVO positive</strong></td>
<td>27 (a)</td>
<td>7 (b)</td>
</tr>
<tr>
<td></td>
<td>25 (b)</td>
<td>8 (d)</td>
</tr>
<tr>
<td><strong>LVO negative</strong></td>
<td>52</td>
<td>15</td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
<td>33</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Formula</th>
<th>Value</th>
<th>95% CI</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>( \frac{a}{a + b} )</td>
<td>79.41%</td>
<td>62.10% to 91.30%</td>
<td>85</td>
</tr>
<tr>
<td>Specificity</td>
<td>( \frac{d}{c + d} )</td>
<td>24.24%</td>
<td>11.09% to 42.26%</td>
<td>68</td>
</tr>
<tr>
<td>Positive Likelihood Ratio</td>
<td>( \frac{\text{Sensitivity}}{1 - \text{Specificity}} )</td>
<td>1.05</td>
<td>0.81 to 1.36</td>
<td></td>
</tr>
<tr>
<td>Negative Likelihood Ratio</td>
<td>( \frac{1 - \text{Sensitivity}}{\text{Specificity}} )</td>
<td>0.85</td>
<td>0.35 to 2.08</td>
<td></td>
</tr>
<tr>
<td>Disease prevalence</td>
<td>( \frac{a + b}{a + b + c + d} )</td>
<td>50.75% (*)</td>
<td>38.24% to 63.18%</td>
<td></td>
</tr>
<tr>
<td>Positive Predictive Value</td>
<td>( \frac{a}{a + c} )</td>
<td>51.92% (*)</td>
<td>45.49% to 58.30%</td>
<td>42</td>
</tr>
<tr>
<td>Negative Predictive Value</td>
<td>( \frac{d}{b + d} )</td>
<td>53.33% (*)</td>
<td>31.85% to 73.65%</td>
<td>94</td>
</tr>
</tbody>
</table>
How about on the hospital side...
Via Christi 2017 (Q1-2) SCEMS LVO Alert
Endovascular Treatment

90 day outcome
n=13

mRs 5-6 33%
mRs 0-2 25%
mRs 3-4 42%
In order to move forward...

• Can we accurately sort patients in the field?
  – So far in my system...no.

• Are we measuring outcomes instead of just times?
  – Kinda...but with lots of misleading data points
We need a plan.

• “To succeed in America, you need three things: A smile, a gun, and a plan. If you have to give up one, give up the smile. If you have to give up two, give up the gun – whatever you do, don’t give up your plan.”

- Al Capone
Pursuing outcomes or metrics that are directed at profits, recognition, market share, or personal advancement

Systems of Care focused on the patient
Selecting easy to measure metrics that are poorly tied to patient outcomes

Measuring high-quality metrics
The Plan and the Trap 3/5

Plan

Eliminate waste, implement quality

Trap

“The way we’ve always done it.”
The Plan and the Trap 4/5

Plan

Right care for the right situation

Trap

Not being honest with ourselves about the quality and accuracy of our performance
...and last but not least...
The Plan and the Trap 5/5

Plan

To take simply the best care of our families, friends, neighbors, and loved ones

Trap

Forgetting why we got into this game in the first place
Questions?

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