Improving Door-to-Needle Times in Acute Ischemic Stroke: Principal Results from the Target: Stroke Initiative

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- **G.C. Fonarow:** Employment; Significant; Dr. Fonarow is an employee of the University of California, which holds a patent on retriever devices for stroke.
- **X. Zhao:** Other; Modest; Dr. Zhao is a member of the Duke Clinical Research Institute which serves as the American Heart Association GWTG data coordinating center.
- **E.E. Smith:** None.
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- **Y. Xian:** Other; Modest; Dr. Xian is a member of the Duke Clinical Research Institute which serves as the American Heart Association Get with the Guidelines data coordinating center.
- **A. Hernandez:** Research Grant; Modest; BMS, Janssen, Medtronic, Merck, Portola. Honoraria; Modest; Boston Scientific, BMS, Gilead, Janssen, Novartis.
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Background

- The benefits of intravenous tPA in acute ischemic stroke are highly time-dependent.
- Because of the importance of rapid treatment, AHA/ASA guidelines recommend a door-to-needle (DTN) time of ≤60 minutes.
- Yet prior studies suggested fewer than 30% of intravenous tPA treated acute ischemic stroke patients in the United States were meeting this goal.
- To address this shortfall, Target: Stroke, a national initiative organized by the AHA/ASA, was launched in January 2010 to increase the proportion of stroke patients with DTN times ≤60 minutes (initial goal of ≥ 50%).

Target: Stroke

- Target: Stroke was initiated by the AHA/ASA together with other partner organizations as a collaborative national initiative comprising a multidisciplinary group of clinicians and broad alliance of hospitals.

- The primary goal of Target: Stroke was for GWTG-Stroke participating hospitals in aggregate to treat at least 50% of acute ischemic stroke patients with tPA within 60 minutes or less of hospital arrival.

- An expert working group performed a systematic review of the published data on improving DTN times and identified 10 key evidence-based strategies associated with timely stroke reperfusion that could be most rapidly, feasibly, and cost effectively adopted by participating hospitals.

- Comprehensive implementation manual, clinical decision support tools, education, sharing of best practices, performance feedback, and national recognition opportunities.

Target: Stroke 10 Key Best Practice Strategies

1. Hospital pre-notification by Emergency Medical Services
2. Rapid triage protocol and stroke team notification
3. Single call/paging activation system for entire stroke team
4. Use of a stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale and other stroke tools
5. Rapid acquisition and interpretation of brain imaging
6. Rapid Laboratory Testing (including point-of-care testing) if indicated
7. Pre-mixing tPA medication ahead of time for high likelihood candidates
8. Rapid access to intravenous tPA in the ED/brain imaging area
9. Team-based approach
10. Rapid data feedback to stroke team on each patient’s DTN time and other performance data

Customizable Implementation Tools

- Patient time-trackers
- Guideline based algorithms
- tPA checklist
- Standardized order sets
- Dosing charts
- Clinical pathways
- Evidence-based protocols
- EMS tools
- Patient educational materials
- Other tools

Target: Stroke tools: www.targetstroke.org
Clinical tools library: heart.org/strokeclinicaltools.
Objectives

• To evaluate the principle results of the Target: Stroke by analyzing the temporal trends in DTN times and proportion of patients with DTN times ≤60 minutes before and after initiation of the Target: Stroke program among GWTG-Stroke participating hospitals.

• To evaluate whether potential improvements in DTN times were associated with improvements in clinical outcomes including in-hospital mortality, discharge destination, ambulatory status, symptomatic intracranial hemorrhage ≤36 hours after tPA, and overall tPA complications.

Methods

• This study included 71,169 stroke patients treated with tPA (27,319 pre-intervention, 43,850 post-intervention) from 1,030 GWTG-Stroke participating hospitals during the pre- and post-Target: Stroke periods.

• Quarterly rates of DTN times ≤60 minutes and clinical outcomes pre-Target: Stroke (2003-2009) were compared to post-Target Stroke (2010-2013).

• Adjustment for patient and hospital characteristics. To account for within-hospital clustering, generalized estimating equations were used. To compare the temporal change in rates of DTN times piecewise (segmented) logistic regression analyses were performed.

• Clinical outcomes assessed: in-hospital mortality, discharge destination, ambulatory status, symptomatic intracranial hemorrhage ≤ 36 hours after tPA, and overall tPA complications.

Selection of the Study Population

1,587,230 Patients with Acute Ischemic Stroke

1,487,761 Excluded
  - In-Hospital Strokes (n=30,897)
  - Transferred In (n=174,002)
  - Not Treated with IV tPA (n=1,278,602)
  - tPA at Outside Hospital (n=4,260)

99,469 Patients Treated with IV tPA at Participating Hospital

21,500 Excluded
  - Experimental Protocol (n=458)
  - Time(s) Missing (n=4,421)
  - Treated >3 Hours Post Onset (n=16,621)

6,800 Excluded
  - Hospitals Not Participating During Both Pre- and Post-Target: Stroke Periods (n=6,800)

71,169 Patients Included in the Primary Analysis

Hospitals n=1030

Primary Analysis:
Patients with OTT times ≤3 hours (Class I in guidelines)

Sensitivity Analysis:
Patients with OTT times ≤4.5 hours (Class IIA in guidelines)

N=83,220

### Demographics and Clinical Characteristics Pre- and Post-Target: Stroke

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (N=71,169)</th>
<th>Pre-Target: Stroke (N=27,319)</th>
<th>Post-Target: Stroke (N=43,850)</th>
<th>Standardized Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (median, 25th, 75th)</td>
<td>72 (60-82)</td>
<td>72 (60-82)</td>
<td>72 (60-83)</td>
<td>3.70</td>
</tr>
<tr>
<td>Sex (%, women)</td>
<td>50.1</td>
<td>49.4</td>
<td>50.5</td>
<td>2.25</td>
</tr>
<tr>
<td>Race/Ethnicity (%)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>72.8</td>
<td>75.1</td>
<td>71.4</td>
<td>8.43</td>
</tr>
<tr>
<td>Black</td>
<td>13.8</td>
<td>12.6</td>
<td>14.5</td>
<td>5.80</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6.6</td>
<td>5.7</td>
<td>7.3</td>
<td>6.51</td>
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<tr>
<td><strong>Arrival and Admission</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Arrival Mode (%, EMS)</td>
<td>80.4</td>
<td>84.6</td>
<td>77.7</td>
<td>17.8</td>
</tr>
<tr>
<td>Arrival on Hours (%, yes)</td>
<td>47.4</td>
<td>47.4</td>
<td>47.4</td>
<td>0.10</td>
</tr>
<tr>
<td>Onset-to-Arrival Time</td>
<td>51 (36-72)</td>
<td>50 (35-70)</td>
<td>52 (36-73)</td>
<td>4.74</td>
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<tr>
<td><strong>Medical History</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrial Fibrillation/Flutter (%)</td>
<td>22.8</td>
<td>22.6</td>
<td>22.9</td>
<td>0.69</td>
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<tr>
<td>Previous Stroke/TIA (%)</td>
<td>23.7</td>
<td>22.5</td>
<td>24.5</td>
<td>4.79</td>
</tr>
<tr>
<td>CAD/Prior MI (%)</td>
<td>25.7</td>
<td>26.9</td>
<td>24.9</td>
<td>4.48</td>
</tr>
<tr>
<td>Diabetes Mellitus (%)</td>
<td>24.6</td>
<td>22.9</td>
<td>25.6</td>
<td>6.28</td>
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<tr>
<td>PVD (%)</td>
<td>3.5</td>
<td>3.4</td>
<td>3.5</td>
<td>0.87</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>72.4</td>
<td>71.2</td>
<td>73.1</td>
<td>4.24</td>
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<tr>
<td>Smoking (%)</td>
<td>17.8</td>
<td>18.7</td>
<td>17.3</td>
<td>3.71</td>
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<tr>
<td><strong>Evaluation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIH Stroke Scale (median, 25th, 75th)</td>
<td>11 (6-18)</td>
<td>12 (7-18)</td>
<td>11 (6-18)</td>
<td>12.9</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>5 (3-8)</td>
<td>5 (3-8)</td>
<td>5 (3-7)</td>
<td>11.2</td>
</tr>
</tbody>
</table>
### Hospital Characteristics Pre- and Post-Target: Stroke

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (N=71,169)</th>
<th>Pre-Target: Stroke (N=27,319)</th>
<th>Post-Target: Stroke (N=43,850)</th>
<th>Standardized Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Volume of Ischemic Stroke Admissions</td>
<td>233 (163-339)</td>
<td>240 (165-347)</td>
<td>230 (161-337)</td>
<td>2.50</td>
</tr>
<tr>
<td>(median, 25(^{th}), 75(^{th}))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Volume of IV tPA</td>
<td>19.5 (11.6-29.6)</td>
<td>19.2 (11.6-29.3)</td>
<td>19.7 (11.7-29.6)</td>
<td>1.15</td>
</tr>
<tr>
<td>(median, 25(^{th}), 75(^{th}))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Beds (median, 25(^{th}), 75(^{th}))</td>
<td>403 (283-595)</td>
<td>404 (283-601)</td>
<td>401 (280-588)</td>
<td>2.51</td>
</tr>
<tr>
<td>Region (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>21.5</td>
<td>21.2</td>
<td>21.7</td>
<td>1.23</td>
</tr>
<tr>
<td>South</td>
<td>33.9</td>
<td>32.3</td>
<td>34.8</td>
<td>5.27</td>
</tr>
<tr>
<td>Midwest</td>
<td>17.3</td>
<td>17.3</td>
<td>17.3</td>
<td>0.17</td>
</tr>
<tr>
<td>Northeast</td>
<td>27.3</td>
<td>29.2</td>
<td>26.2</td>
<td>6.83</td>
</tr>
<tr>
<td>Region (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Hospital (%)</td>
<td>65.2</td>
<td>65.5</td>
<td>65.0</td>
<td>0.94</td>
</tr>
<tr>
<td>Rural Location (%)</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>0.15</td>
</tr>
<tr>
<td>Certified Primary Stroke Center (%)</td>
<td>57.3</td>
<td>58.3</td>
<td>56.7</td>
<td>3.12</td>
</tr>
</tbody>
</table>

A standardized difference greater than 10 is typically considered meaningful.

Results: Impact on DTN Times

The percentage of patients with DTN times ≤60 minutes increased from 29.6% immediately prior to the start of Target: Stroke in Quarter 4 of 2009) to 53.3% in Quarter 3 of 2013 (P<0.0001).

The median DTN time was 74 minutes in Quarter 4 of 2009 immediately prior to initiation of Target: Stroke and declined to 59 minutes by Quarter 3 of 2013 (absolute difference 15 minutes, P<0.0001).

In 2009, prior to initiation of Target: Stroke, 15.6% of hospitals had DTN times ≤60 minutes in 50% or more of tPA treated stroke patients whereas in 2013, this benchmark was being met by 46.7% of participating hospitals (P<0.0001).

Time Trend in the Proportion of Patients with DTN Times within 60 Minutes
Pre- and Post-Target: Stroke

(P<0.0001 for comparison of the two slopes)
| Outcome | Variable | Unadjusted | | | | Adjusted* | | | |
|---------|----------|------------|---|---|---|---|---|---|
| DTN time ≤60 Minutes | Pre-Target: Stroke (per 4 quarters calendar time) | 1.08 | 1.05-1.12 | <0.0001 | 1.09 | 1.06-1.13 | <0.0001 | |
| | Post-Target: Stroke (per 4 quarters calendar time) | 1.32 | 1.28-1.35 | <0.0001 | 1.35 | 1.31-1.38 | <0.0001 | |
| | Post vs. Pre-Target: Stroke (per 4 quarters calendar time) | 1.22 | 1.16-1.28 | <0.0001 | 1.23 | 1.17-1.29 | <0.0001 | |
| | Post vs. Pre-Target: Stroke (cumulative difference) | 1.98 | 1.84-2.12 | <0.0001 | 2.09 | 1.95-2.25 | <0.0001 | |

*Adjusted for patient characteristics including age, sex, race, medical history of atrial fibrillation, prosthetic heart valve, previous stroke/transient ischemic attack, coronary heart disease or prior myocardial infarction, carotid stenosis, peripheral vascular disease, hypertension, dyslipidemia, and current smoking, stroke severity (NIHSS), arrival time during regular work hours, arrival mode, onset-to-arrival time; hospital characteristics of hospital size, region, teaching status, certified primary stroke center, annual volume of tPA, and annual stroke discharge.
Results: Impact on DTN Times

The annual rate of increase in the proportion of patients with DTN time ≤60 minutes was 1.36% per year pre-Target: Stroke with notable acceleration to 6.20% per year after implementation of Target: Stroke (P<0.0001).

The program goal of DTN times ≤60 minutes in at least 50% of patients was achieved in <4 years rather than the expected 15 or more years if the pre-Target: Stroke intervention slope of increase in the proportion of patients with DTN times ≤60 minutes had persisted.

The improvement in DTN times post-Target: Stroke were observed among clinically relevant subgroups of patients including men and women, patients older and younger than the median age of 72, white, black, and Hispanic patients, and patients with greater and lesser stroke severity (NIHSS above and below the median of 11).

## 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>
</tr>
<tr>
<td>Ambulatory Status</td>
<td>42.2%</td>
<td>45.4%</td>
<td>+3.2%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Independent</td>
<td></td>
<td></td>
<td></td>
<td></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>

### Outcomes Pre- and Post-Target: Stroke- GEE Analyses

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Unadjusted Odds Ratios (95% CI)</th>
<th>P Value</th>
<th>Adjusted Odds Ratios (95% CI)*</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Hospital Mortality</td>
<td>0.81 (0.77-0.86)</td>
<td>&lt;0.0001</td>
<td>0.89 (0.83-0.94)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Discharge Home</td>
<td>1.23 (1.18-1.27)</td>
<td>&lt;0.0001</td>
<td>1.14 (1.09-1.19)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Ambulatory Status Independent</td>
<td>1.14 (1.09-1.20)</td>
<td>&lt;0.0001</td>
<td>1.03 (0.97-1.10)</td>
<td>0.3091</td>
</tr>
<tr>
<td>Symptomatic ICH</td>
<td>0.81 (0.75-0.88)</td>
<td>&lt;0.0001</td>
<td>0.83 (0.76-0.91)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any tPA Complications</td>
<td>0.80 (0.75-0.87)</td>
<td>&lt;0.0001</td>
<td>0.83 (0.77-0.90)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

*Adjusted for patient characteristics including age, sex, race, medical history of atrial fibrillation, prosthetic heart valve, previous stroke/transient ischemic attack, coronary heart disease or prior myocardial infarction, carotid stenosis, peripheral vascular disease, hypertension, dyslipidemia, and current smoking, stroke severity (NIHSS), arrival time during regular work hours, arrival mode, onset-to-arrival time; hospital characteristics of hospital size, region, teaching status, certified primary stroke center, annual volume of tPA, and annual stroke discharge.

Results: tPA Use

The Target: Stroke intervention was also associated with an increase in tPA use.

tPA use in eligible patients arriving by 2 hours and treated by 3 hours: 64.7% pre- vs. 85.2% post-intervention, P<0.0001

tPA use in eligible patients arriving by 3.5 hours and treated by 4.5 hours: 22.5% pre- vs. 63.9% post-intervention, P<0.0001

tPA use among all acute ischemic stroke patients: 5.7% pre- vs. 8.1% post-intervention, P<0.0001

No evidence for unintended consequences with the intervention with tPA use being avoided in patients who may have less favorable DTN times

Results: Sensitivity Analyses

• Similar findings were obtained in sensitivity analyses including all intravenous tPA treated patients with onset-to-treatment times within 4.5 hours (n=83,220).

• There was a marked improvement in the proportion of patients with DTN times ≤60 minutes after initiation of Target: Stroke with a significant slope change starting in January 2010.

• This improvement in DTN times was accompanied by lower in-hospital mortality, symptomatic intracranial hemorrhage, and overall tPA complications with more patients able to be discharged to home.

• These findings remained highly statistically significant after adjusting for patient and hospital characteristics.

Time Trend in the Proportion of Patients with DTN Times within 60 Minutes Pre- and Post-Target: Stroke in Patients with OTT Time within 4.5 Hours

(P<0.0001 for comparison of the two slopes)

### Clinical Outcomes Pre- and Post-Target: Stroke in Patients with Onset to Treatment Time within 4.5 Hours

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre-Target: Stroke (n=29,986)</th>
<th>Post-Target: Stroke (n=53,234)</th>
<th>P Value</th>
<th>Unadjusted Odds Ratios (95% CI)</th>
<th>P Value</th>
<th>Adjusted Odds Ratios (95% CI)*</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Hospital Mortality</td>
<td>9.95%</td>
<td>8.08%</td>
<td>&lt;0.0001</td>
<td>0.79 (0.75-0.84)</td>
<td>&lt;0.0001</td>
<td>0.90 (0.84-0.95)</td>
<td>0.0004</td>
</tr>
<tr>
<td>Discharge Home</td>
<td>37.6%</td>
<td>43.3%</td>
<td>&lt;0.0001</td>
<td>1.25 (1.20-1.29)</td>
<td>&lt;0.0001</td>
<td>1.13 (1.08-1.17)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Ambulatory Status</td>
<td>42.2%</td>
<td>45.9%</td>
<td>&lt;0.0001</td>
<td>1.16 (1.10-1.22)</td>
<td>&lt;0.0001</td>
<td>1.02 (0.96-1.09)</td>
<td>0.4538</td>
</tr>
<tr>
<td>Independent</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptomatic ICH</td>
<td>5.74%</td>
<td>4.74%</td>
<td>&lt;0.0001</td>
<td>0.81 (0.75-0.88)</td>
<td>&lt;0.0001</td>
<td>0.84 (0.78-0.92)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any tPA Complications</td>
<td>6.75%</td>
<td>5.54%</td>
<td>&lt;0.0001</td>
<td>0.80 (0.75-0.86)</td>
<td>&lt;0.0001</td>
<td>0.84 (0.78-0.91)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

*Adjusted for patient characteristics including age, sex, race, medical history of atrial fibrillation, prosthetic heart valve, previous stroke/transient ischemic attack, coronary heart disease or prior myocardial infarction, carotid stenosis, peripheral vascular disease, hypertension, dyslipidemia, and current smoking, stroke severity (NIHSS), arrival time during regular work hours, arrival mode, onset-to-arrival time; hospital characteristics of hospital size, region, teaching status, certified primary stroke center, annual volume of tPA, and annual stroke discharge.

Limitations

• Participation in GWTG-Stroke/Target: Stroke was voluntary and these hospitals likely have greater interest in stroke quality improvement.

• Target: Stroke did not have a concurrent control group of hospitals and it is possible that the improvements in DTN times may have been influenced by other factors. However, efforts in place in the 2003-2009 timeframe were observed to have little impact on DTN times.

• Possibility for there to be residual measured and unmeasured confounders related to the improvements in DTN times and clinical outcomes.

• Data collected as part of GWTG-Stroke including DTN times are dependent on the accuracy and completeness of abstraction from the medical record.

Conclusions

- The timeliness of tPA administration improved substantially in GWTG-Stroke hospitals after initiation of the multidimensional AHA/ASA Target: Stroke quality initiative.
- The proportion of patients with DTN times ≤60 minutes increased from 29.6% to 53.3%. There was also a more than 4-fold increase in the annual rate of improvement in patients with DTN time ≤60 minutes.
- This improvement was accompanied by lower in-hospital mortality, symptomatic intracranial hemorrhage, and overall tPA complications with more patients able to be discharged to home.
- The results of this study suggest a favorable impact of applying performance improvement techniques of identifying best practices, clinical decision support, guideline-driven care improvement tools, educational outreach, collaborative support, performance profiling, feedback, and recognition.

Conclusions

• While there have been concerns that attempting to achieve shorter DTN times may lead to rushed assessments, inappropriate patient selection, dosing errors, and greater likelihood of complications, our findings suggest that more rapid reperfusion therapy in acute ischemic stroke is not only feasible, but can be achieved with actual reductions in complications and improved outcomes.

• These findings further reinforce the importance and substantial clinical benefits of more rapid administration of intravenous tPA.

Original Investigation

Door-to-Needle Times for Tissue Plasminogen Activator Administration and Clinical Outcomes in Acute Ischemic Stroke Before and After a Quality Improvement Initiative

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The benefits of intravenous tissue plasminogen activator (tPA) in patients with acute ischemic stroke (AIS) are time dependent and guidelines recommend a door-to-needle (DTN) time of 60 minutes or less. However, studies have found that less than 30% of US patients are treated within this time window. Target: Stroke was designed as a national quality improvement initiative to improve DTN times for tPA administration in patients with AIS.

OBJECTIVES: To evaluate DTN times for tPA administration and the proportion of patients with times of 60 minutes or less before and after initiation of a quality improvement initiative and to determine whether potential improvements in DTN times were associated with improvements in clinical outcomes.

DESIGN, SETTING, AND PATIENTS: The Target: Stroke initiative disseminated 10 care strategies to achieve faster DTN times for tPA administration. This project included 71 hospitals with 1,491 patients treated with tPA from April 2003-December 2005 and 43,185 during the postintervention period from January 2010-September 2010 from IMS Get With The Guidelines—Stroke participating hospitals (52.8% of total).

MAIN OUTCOMES AND MEASURES: The DTN times for tPA administration of 60 minutes or less and in-hospital risk-adjusted mortality, symptomatic intracranial hemorrhage, ambulatory status at discharge, and discharge destination.

RESULTS: Measures of DTN time for tPA administration improved significantly during the postintervention period compared with the preintervention period as did clinical outcomes.

CONCLUSIONS AND RELEVANCE: Implementation of a national quality improvement initiative was associated with improved timelines of tPA administration following AIS on a national scale, and this improvement was associated with lower in-hospital mortality and intracranial hemorrhage, along with an increase in the percentage of patients discharged home.
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