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Door to Needle Time: Gold Standard of Stroke Treatment

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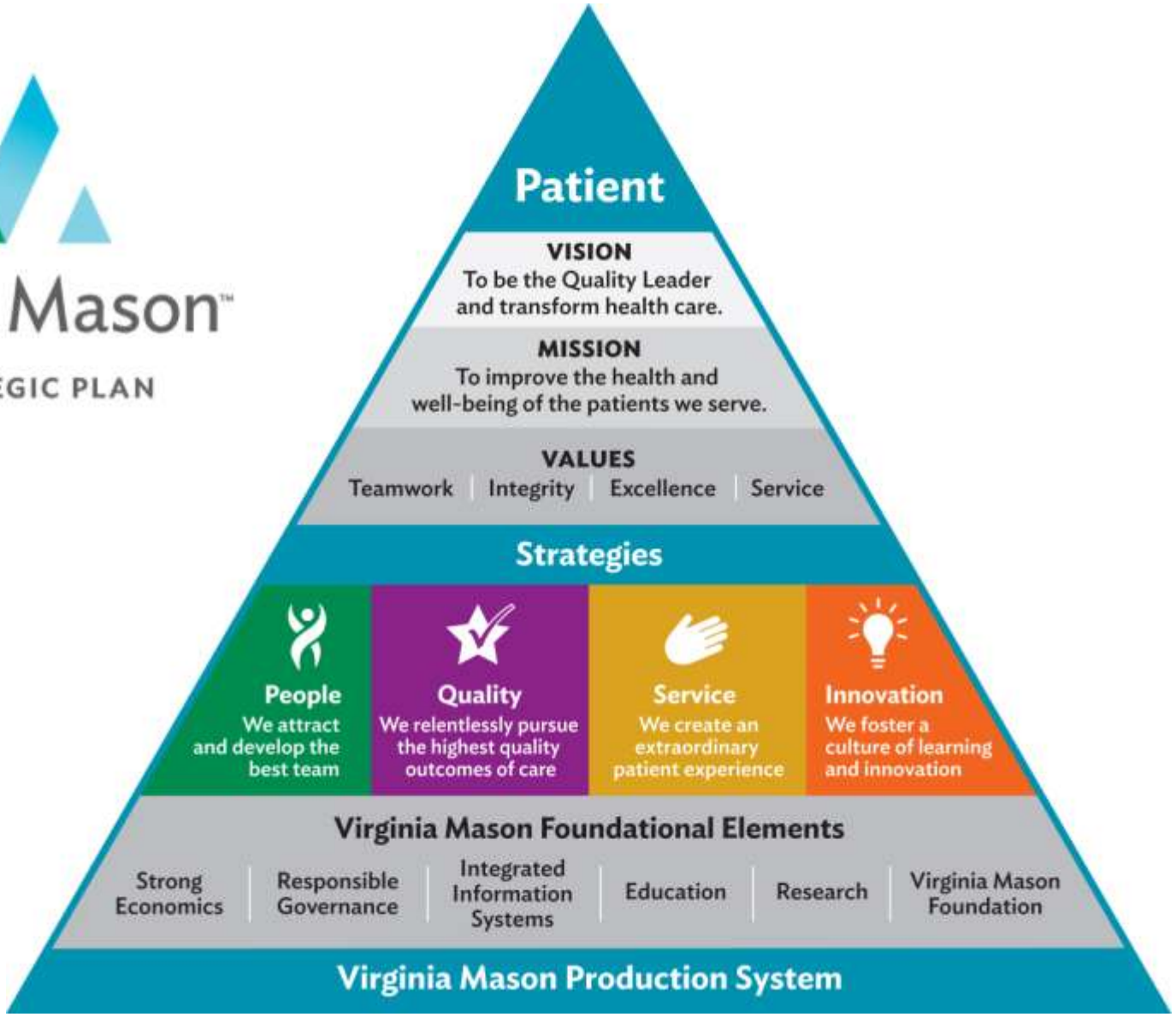
OUR STRATEGIC PLAN



No disclosure

Objectives

- General concepts about IV tPA
- Target: Stroke initiative
- Importance of door to needle time
- Role of tPA in patient outcome and Data
- First 24 h post IV tPA administration


B


HUFF
POST


TIME
IS
BRAIN


TIME LOST
IS BRAIN LOST

Question for the audience

How many neurons/synapses are lost per minute in a large vessel AIS?

1. 1.6 million/15 billion
2. 1.7 million/13 billion
3. 1.8 million/16 billion
4. 1.9 million/14 billion

Overview

- Benefits of IV tPA
- Timing for tPA
- National guidelines recommendations
- Are patients treated according to guidelines?

History

- National Institute of neurological disorder (NINDS) 1997
- The Brain Attack Coalition's target 2000
- Standard treatment with alteplase to reverse stroke (STARS)

How long can we go?

The European Study from Helsinki

Reducing in-hospital delay to 20 minutes in stroke thrombolysis

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ABSTRACT

Objectives: Efficacy of thrombolytic therapy for ischemic stroke decreases with time elapsed from symptom onset. We analyzed the effect of interventions aimed to reduce treatment delays in our single-center observational series.

Methods: All consecutive ischemic stroke patients treated with IV alteplase (tissue plasminogen activator [tPA]) were prospectively registered in the Helsinki Stroke Thrombolysis Registry. A series of interventions to reduce treatment delays were implemented over the years 1998 to 2011. In-hospital delays were analyzed as annual median door-to-needle time (DNT) in minutes, with interquartile range.

Results: A total of 1,860 patients were treated between June 1995 and June 2011, which included 174 patients with basilar artery occlusion (BAO) treated mostly beyond 4.5 hours from symptom onset. In the non-BAO patients, the DNT was reduced annually, from median 105 minutes (65–120) in 1998, to 60 minutes (48–80) in 2003, further on to 20 minutes (14–32) in 2011. In 2011, we treated with tPA 31% of ischemic stroke patients admitted to our hospital. Of these, 94% were treated within 60 minutes from arrival. Performing angiography or perfusion imaging doubled the in-hospital delays. Patients with in-hospital stroke or arriving very soon from symptom onset had longer delays because there was no time to prepare for their arrival.

Conclusions: With multiple concurrent strategies it is possible to cut the median in-hospital delay to 20 minutes. The key is to do as little as possible after the patient has arrived at the emergency room and as much as possible before that, while the patient is being transported. *Neurology*® 2012;79:306–313

GLOSSARY

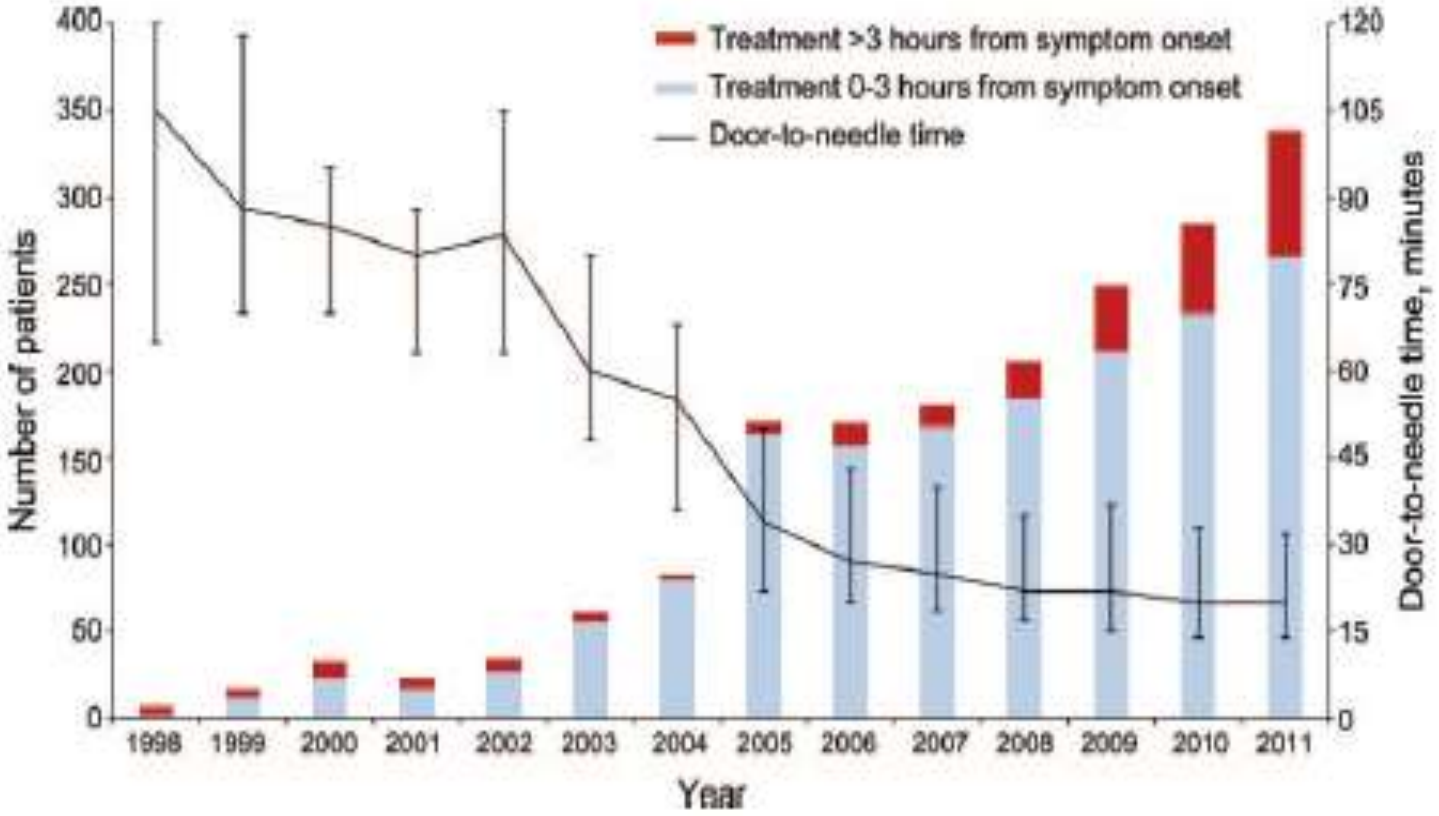
BAO = basilar artery occlusion; **DNT** = door-to-needle time; **EMS** = emergency medical service; **ER** = emergency room; **INR** = international normalized ratio; **IQR** = interquartile range; **mRS** = modified Rankin Scale; **NIHSS** = NIH Stroke Scale; **NNT** = number needed to treat; **OTT** = onset-to-treatment time; **POC** = point-of-care; **RCT** = randomized controlled trials; **tPA** = tissue plasminogen activator.

Table 1 Twelve measures to reduce treatment delays

Measure	Description	Year
EMS involvement	Education of dispatchers and EMS personnel, stroke high-priority dispatch	1998
Hospital prenotification	EMS contacts stroke physician directly via mobile phone	2001
Alarm and preorder of tests	Laboratory and CT computer-ordered and alarmed at prenotification	2001
No-delay CT interpretation	Stroke physician interprets the CT scan, not waiting for formal radiology report	2001
Premixing of tPA	With highly suspect thrombolysis candidates, tPA premixed prior to patient arrival	2002
Delivery of tPA on CT table	Bolus administered on CT table	2002
CT relocated to ER	Patient transfers of several hundred meters, including elevators, were no longer needed	2003
CT priority and CT transfer	CT emptied prior to patient arrival, and patient transferred straight onto CT table, not ER bed	2004
Rapid neurologic evaluation	Patient is examined upon arrival, on CT table	2004
Preacquisition of history	Statewide electronic patient records and eyewitness interview before/during transportation	2005
Point-of-care INR	Laboratory personnel draw blood while patient on CT table, and perform instant POC INR	2005
Reduced imaging	While all patients have a CT, advanced imaging reserved for unclear cases only	2005

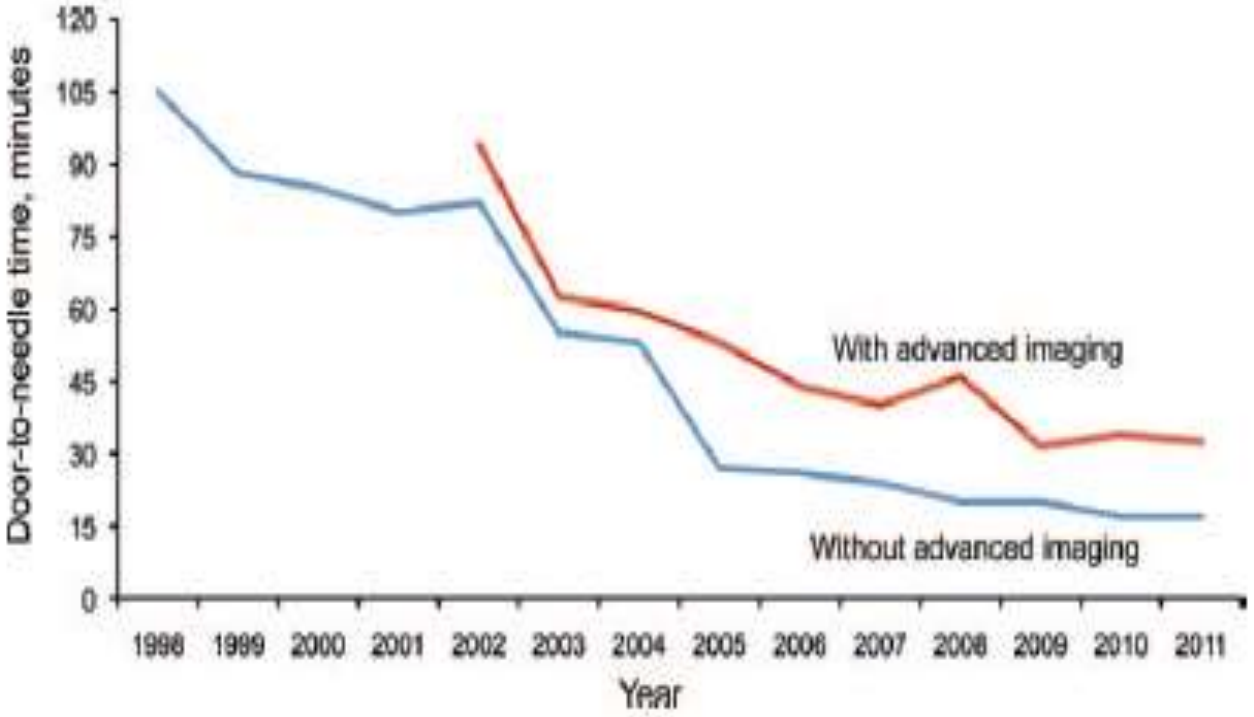
Abbreviations: EMS = emergency medical service; ER = emergency room; INR = international normalized ratio; POC = point-of-care; tPA = tissue plasminogen activator.

Figure 1 Number of annually treated patients and median door-to-needle times



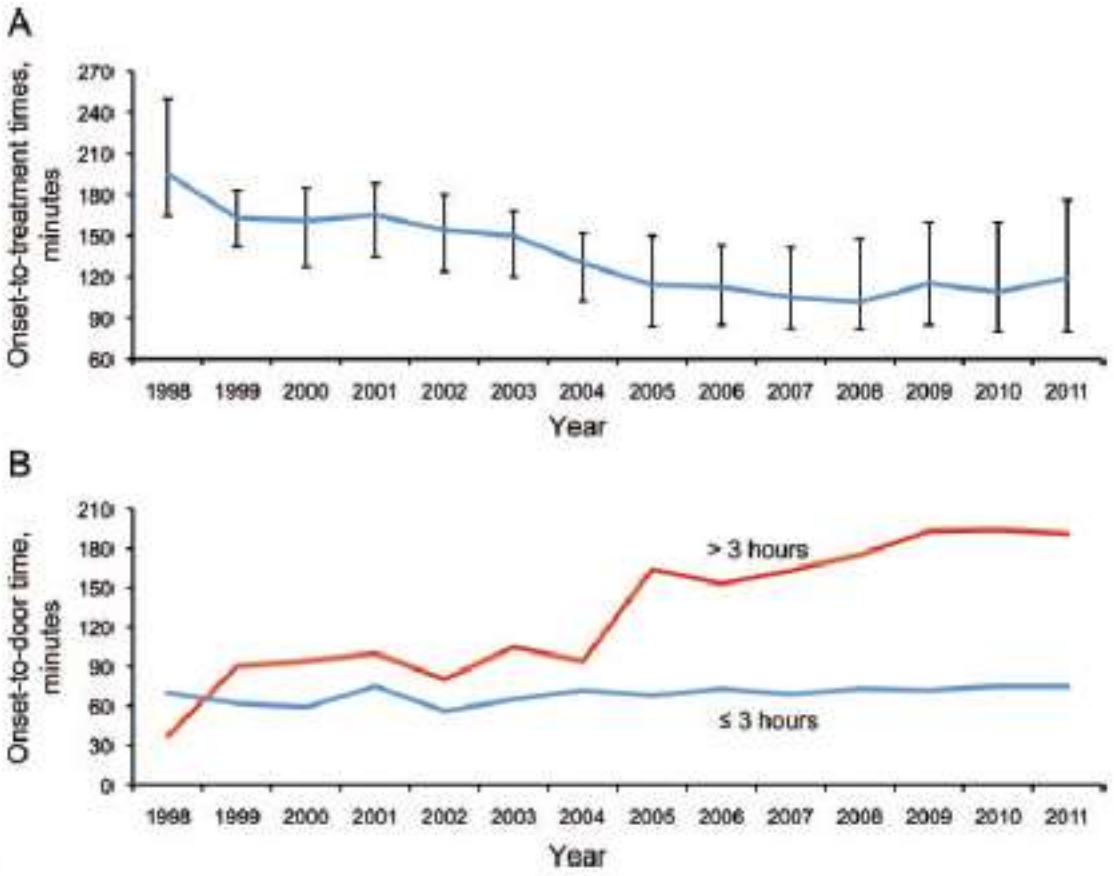
Annual patients, with those treated beyond 3 hours in red (bars, left axis) and median door-to-needle time in minutes with interquartile range (line, right axis). Total n = 1,686. The projected number of patients for 2011 is based on the observed numbers of the first 6 months.

Figure 2 **Advanced imaging and in-hospital delays**



Annual median door-to-needle time in minutes for patients treated with (upper red line, n = 369) and without (lower blue line, n = 1,317) prior CT angiography or perfusion imaging.

Figure 3 Trends in onset-to-treatment and symptom-to-door times



Median onset-to-treatment times in minutes, with interquartile range (A), and median symptom-to-door time separately for patients treated within (B, blue line, n = 1,465) and beyond (B, red line, n = 221) 3 hours from symptom onset.

Target Stroke Initiative

About Target: Stroke

http://www.strokeassociation.org/STROKEORG/Professionals/TargetStroke/About-Target-Stroke_UCM_432409_Article.jsp#.VpbXmsK3ruso

Timeliness of Tissue-Type Plasminogen Activator Therapy in Acute Ischemic Stroke

Patient Characteristics, Hospital Factors, and Outcomes Associated With Door-to-Needle Times Within 60 Minutes

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Background—The benefits of intravenous tissue-type plasminogen activator (tPA) in acute ischemic stroke are time dependent, and guidelines recommend an arrival to treatment initiation (door-to-needle) time of ≤60 minutes.

Methods and Results—Data from acute ischemic stroke patients treated with tPA within 3 hours of symptom onset in 1082 hospitals participating in the Get With the Guidelines–Stroke Program from April 1, 2003, to September 30, 2009 were studied to determine frequency, patient and hospital characteristics, and temporal trends in patients treated with door-to-needle times ≤60 minutes. Among 25 504 ischemic stroke patients treated with tPA, door-to-needle time was ≤60 minutes in only 6790 (26.6%). Patient factors most strongly associated with door-to-needle time ≤60 minutes were younger age, male gender, white race, or no prior stroke. Hospital factors associated with ≤60 minute door-to-needle time included greater annual volumes of tPA-treated stroke patients. The proportion of patients with door-to-needle times ≤60 minutes varied widely by hospital (0% to 79.2%) and increased from 19.5% in 2003 to 29.1% in 2009 ($P<0.0001$). Despite similar stroke severity, in-hospital mortality was lower (adjusted odds ratio, 0.78; 95% confidence interval, 0.69 to 0.90; $P<0.0003$) and symptomatic intracranial hemorrhage was less frequent (4.7% versus 5.6%; $P<0.0017$) for patients with door-to-needle times ≤60 minutes compared with patients with door-to-needle times >60 minutes.

Conclusions—Fewer than one-third of patients treated with intravenous tPA had door-to-needle times ≤60 minutes, with only modest improvement over the past 6.5 years. These findings support the need for a targeted initiative to improve the timeliness of reperfusion in acute ischemic stroke. (***Circulation***. **2011;123:750-758.**)

Key Words: hospital performance ■ mortality ■ registries ■ stroke ■ thrombolytics

Table 1. Characteristics of Ischemic Stroke Patients With Door-to-Needle Times ≤60 Minutes Compared With Those With Door-to-Needle Times >60 Minutes

	Door-to-Needle Time ≤60 min	Door-to-Needle Time >60 min	*P*
n	6790	18 714	
Patient-level characteristics			
Age, mean (SD), y	68.9 (14.5)	70.1 (14.8)	<0.0001
<46, %	6.5	6.6	<0.0001
46–65, %	33.1	28.7	
66–85, %	48.4	50.7	
>85, %	12.0	14.0	
Female sex, %	46.0	50.3	<0.0001
Race-ethnicity, %			
White, non-Hispanic	77.0	75.7	0.0115
Black	10.9	12.7	
Asian	2.0	2.1	
Hispanic	5.4	5.3	
Arrival by emergency medical services (vs private transport), %	85.9	84.2	<0.0001
Arrival on-hours (vs off-hours), %	50.7	45.5	<0.0001
Time from symptom onset to arrival, median (25th–75th percentile), min	60 (40–95)	49 (34–65)	<0.0001
NIHSS, median (25th–75th percentile), %*	12 (8–18)	12 (7–18)	0.1113
0–9	29.8	30.9	0.1111
10–14	20.2	18.8	
15–20	21.8	19.2	
21–42	13.0	13.8	
Not documented	15.2	17.3	
Atrial fibrillation/flutter, %	22.1	25.0	<0.0001
Prior stroke/TIA, %	20.7	25.1	<0.0001
Coronary artery disease/prior myocardial infarction, %	27.7	29.5	0.0099
Carotid stenosis, %	3.2	3.3	0.7782
Peripheral vascular disease, %	3.2	3.8	0.0367
Prosthetic heart valve, %	1.1	1.4	0.0588
Diabetes mellitus, %	23.5	24.5	0.1032
Hypertension, %	75.0	76.5	0.0168
Smoker, %	22.8	20.1	<0.0001
Dyslipidemia, %	38.0	39.0	0.1444
Hospital diagnostics and treatment intervals			
Time from arrival to CT scan, median (25th–75th percentile), min	18 (11–26)	24 (15–36)	<0.0001
Door to CT scan ≤25 min, %	68.5	53.0	<0.0001
Time from symptom onset to tPA treatment, median (25th–75th percentile), min	110 (88–144)	145 (124–165)	<0.0001
Door-to-needle time, mean (SD), min	46.0 (12.2)	91.4 (21.7)	<0.0001
Median (25th–75th percentile), min	49 (40–55)	88 (74–105)	

CT indicates computerized tomography.
*NIHSS values were recorded in 21 277 patients. Sex was missing in 0.07%, race/ethnicity in 0.17%, medical history in 2.08%, and arrival mode in 2.68%.

Table 3. Patient- and Hospital-Level Characteristics Associated With Door-to-Needle Time ≤60 Minutes

Variables	Adjusted OR	Lower 95% CI	Upper 95% CI	*P*
Demographics				
Age, per 10-y increase	0.92	0.90	0.95	<0.0001
Sex, female	0.87	0.81	0.93	0.0001
Race/ethnicity (reference non-Hispanic white)				
Black	0.80	0.71	0.89	0.0001
Hispanic	0.96	0.82	1.13	0.6598
Other	0.98	0.83	1.15	0.7916
Admission characteristics				
Arrival mode, emergency medical services	1.10	0.97	1.23	0.1275
Arrival time, on-hours	1.27	1.18	1.37	<0.0001
Symptom-onset-to-arrival times, per 10-min increase	1.23	1.22	1.25	<0.0001
NIHSS (reference: 0–9)				
10–14	1.37	1.25	1.51	<0.0001
15–20	1.58	1.44	1.73	<0.0001
21–42	1.37	1.23	1.54	<0.0001
Medical history				
Atrial fibrillation	0.89	0.81	0.97	0.0077
Prosthetic heart valve	0.75	0.55	1.00	0.0539
Coronary artery disease/prior myocardial infarction	0.95	0.86	1.04	0.2313
Carotid stenosis	1.01	0.84	1.22	0.9225
Diabetes mellitus	0.89	0.83	0.97	0.0051
Peripheral vascular disease	0.89	0.73	1.08	0.2444
Hypertension	1.01	0.94	1.08	0.8625
Smoker	1.00	0.92	1.10	0.9637
Dyslipidemia	1.01	0.94	1.09	0.7223
Stroke/TIA	0.81	0.74	0.88	<0.0001
Hospital characteristics				
The Joint Commission primary stroke center	1.02	0.88	1.17	0.7903
No. of hospital beds, per 200-bed increase	0.96	0.91	1.01	0.1260
Academic hospital	1.01	0.89	1.15	0.8233
Hospital region (reference: Northeast)				
Midwest	1.05	0.88	1.25	0.5826
South	0.97	0.83	1.14	0.7273
West	0.89	0.74	1.07	0.2237
Ischemic stroke admissions per year (reference: ≤100)				
>100–300	0.86	0.74	1.00	0.0467
>300	0.53	0.38	0.75	0.0003
Intravenous tPA patients per year (reference: ≤10)				
>10–20	1.38	1.18	1.61	<0.0001
>20	2.03	1.51	2.74	<0.0001

The table reflects multivariable modeling performed with 20 358 patients with full data available, including NIHSS. No major differences (apart from NIHSS) were observed when the model was constructed using the more complete cohort of patients (n = 24 385) without recorded NIHSS. The findings were also similar when hospital characteristics of annual ischemic stroke admissions and annual tPA patients treated were analyzed as continuous variables and interaction terms were included in the model.

Table 4. Clinical Outcomes of Ischemic Stroke Patients With Door-to-Needle Times ≤60 Minutes Compared With Those With Door-to-Needle Times >60 Minutes

Hospital Events and Discharge Status	Door-to-Needle Time ≤60 min	Door-to-Needle Time >60 min	*P*
n	6790	18 714	
In-hospital mortality, %*	8.6	10.4	<0.0001
Discharge destination, %			<0.0001
Home	37.3	37.3	
Rehabilitation	34.4	31.7	
Skilled nursing facility	17.8	18.8	
Hospice	4.1	4.9	
Transfer out	5.3	6.4	
Against medical advice/other	0.5	0.5	
Length of stay†			0.2082
Median (25th–75th percentile), d	5 (3–8)	5 (3–8)	
Mean (SD), d	7.0 (6.8)	7.0 (6.8)	
>4 d, %	53.9	56.5	0.4457
Ambulatory status, %*			0.7519
Able	40.2	39.6	
With assistance	29.8	30.1	
Not able	22.0	22.5	
Not documented	2.0	2.0	
tPA complications, %*			
Any	8.0	9.0	0.0065
Symptomatic intracranial hemorrhage	4.7	5.6	0.0017
LT or serious systemic hemorrhage	1.2	1.5	0.0932
Other complication	1.2	1.0	0.0900

LT indicates life-threatening.
*Excludes patients who transferred out.
†Excludes transfer-in and -out patients.

What was the message from this study?

- Clear data supporting benefits of timely IV TPA in AIS.
- Time to treatment with IV TPA important determinant 90 day and 1 year functional outcome.
- Pooled analysis 6 randomized placebo–controlled trials of IV tPA started within 360 minutes of sxs onset of stroke in 2775 pts: Odds of favorable 3 months outcome increased as on sent of treatment decreased
- Odds: 2. 8 for 0 to 90 min; 1. 6 for 91 to 180 min; 1.4 for 181–270 min and 1.2 for 271–360 min.
- Disparity: age, gender, sex
- Symptom onset to arrival times where shorter in patients with door to needle times > 60 min.

Quality Assessment of Practices

A Qualitative Assessment of Practices Associated With Shorter Door-to-Needle Time for Thrombolytic Therapy in Acute Ischemic Stroke

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ABSTRACT

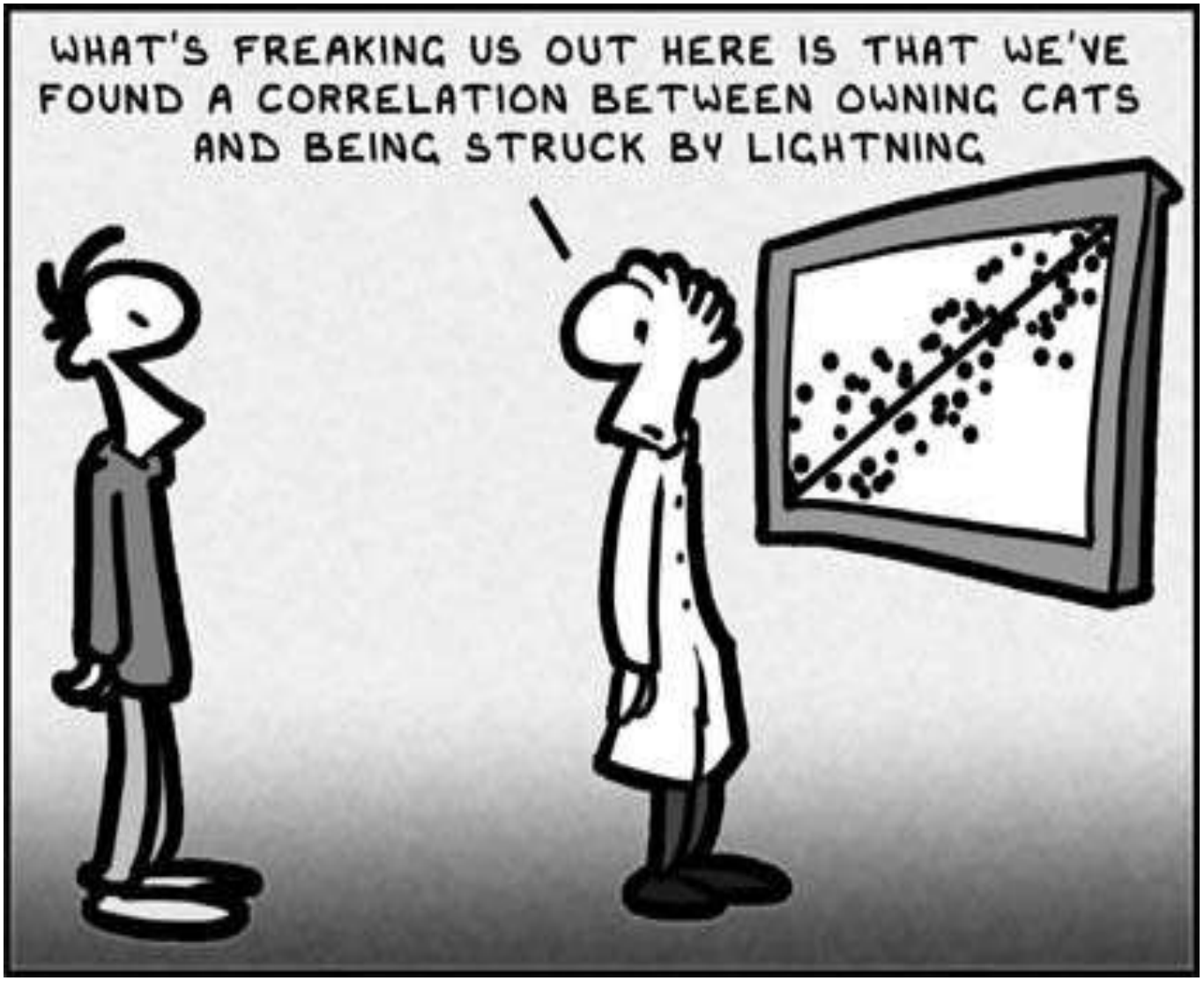
Early treatment with intravenous (IV) recombinant tissue plasminogen activator/alteplase (tPA) is associated with improved outcomes for patients with an acute ischemic stroke. Thus, rapid triage and treatment of stroke patients are essential, with a goal of door-to-needle time of no more than 60 minutes. We sought to identify best practices associated with faster treatment among hospitals participating in Get With the Guidelines—Stroke. Qualitative telephone interviews were conducted to elicit strategies being used by these centers to assess, treat, and monitor stroke patients treated with IV tPA. We sequentially carried out these interviews until we no longer identified novel factors. Interviews were conducted with 13 personnel at 7 top-performing U.S. hospitals. With the use of a hermeneutic–phenomenological framework, 5 distinct domains associated with rapid IV tPA delivery were identified. These included (a) communication and teamwork, (b) process, (c) organizational culture, (d) performance monitoring and feedback, and (e) overcoming barriers.

TABLE 1. Five Domains of Early IV tPA Administration With Defined Lower and Upper End Anchors

Domain	Lower End Anchor	Upper End Anchor
Communication and teamwork	The focus of care is on the individual; staff complain that there is little or no communication and no sense of team	Staff identify themselves as part of a team; communication extends beyond the immediate event
Process	The process of assessing for and administering IV tPA is different for each patient; there is no set pattern	There is a predetermined explicit and written pattern of care (e.g., policy or procedure) that is adhered to by all team members
Organizational culture	Staff verbalize a lack of support from management; there is a sense of "everyone is out for themselves"	Staff are fully supported by—and supportive of—the administration. Early IV tPA is a goal at the organizational level
Performance monitoring and feedback	There are no performance monitoring activities (e.g., quality improvement) in place	There are multiple performance monitoring activities that involve staff at all levels. There are explicit methods of providing regular constructive feedback on performance
Overcoming barriers	Staff are unable to provide examples of successful strategies that have been used in the past	There is an explicit process for identifying a barrier and for removing or resolving that barrier

Note. IV = intravenous; tPA = tissue plasminogen activator/alteplase.

Research


WHAT'S FREAKING US OUT HERE IS THAT WE'VE FOUND A CORRELATION BETWEEN OWNING CATS AND BEING STRUCK BY LIGHTNING

Research investigation: DTN for tPA administration and clinical outcome

- Benefits of IV TPA are time-dependent
- Guidelines recommend a door to needle time of 60 minutes are less
- Studies have found that less than 30% of US patients are treated within this time window.

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

Gregg C. Fonarow, MD; Xin Zhao, MS; Eric E. Smith, MD, MPH; Jeffrey L. Saver, MD; Mathew J. Reeves, PhD; Deepak L. Bhatt, MD, MPH; Ying Xian, MD, PhD; Adrian F. Hernandez, MD, MHS; Eric D. Peterson, MD, MPH; Lee H. Schwamm, MD

IMPORTANCE 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, provided clinical decision support tools, facilitated hospital participation, and encouraged sharing of best practices. This study included 71 169 patients with AIS treated with tPA (27 319 during the preintervention period from April 2003-December 2009 and 43 850 during the postintervention period from January 2010-September 2013) from 1030 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.

	Study Period		Adjusted Odds Ratio (95% CI)	*P* Value
	Preintervention (n = 27 319)	Postintervention (n = 43 850)		
tPA DTN time, median (IQR), min	77 (60-98)	67 (51-87)		< .001
tPA DTN time ≤ 60 min, % (95% CI)	26.5 (26.0-27.1)	41.3 (40.8-41.7)		< .001
End of each period	29.6 (27.8-31.5)	53.3 (51.5-55.2)		< .001
Improvement in tPA DTN time ≤ 60 min, % per year (95% CI)	1.36 (1.04-1.67)	6.20 (5.58-6.78)		< .001
In-hospital all-cause mortality, %	9.93	8.25	0.89 (0.83-0.94)	< .001
Discharge to home, %	37.6	42.7	1.14 (1.09-1.19)	< .001
Independent ambulatory status, %	42.2	45.4	1.03 (0.97-1.10)	.31
Symptomatic intracranial hemorrhage within 36 h, %	5.68	4.68	0.83 (0.76-0.91)	< .001

CONCLUSIONS AND RELEVANCE Implementation of a national quality improvement initiative was associated with improved timeliness 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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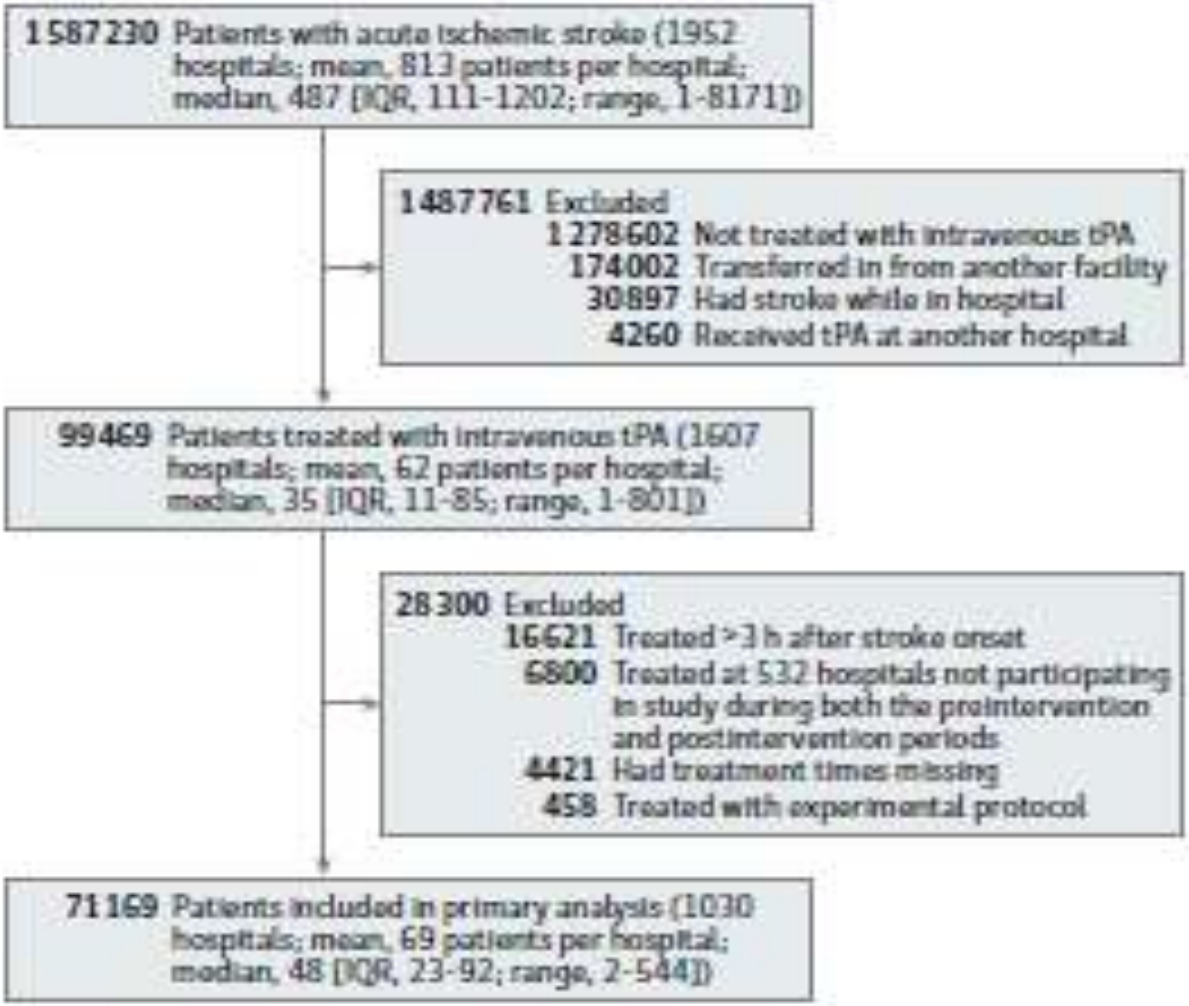
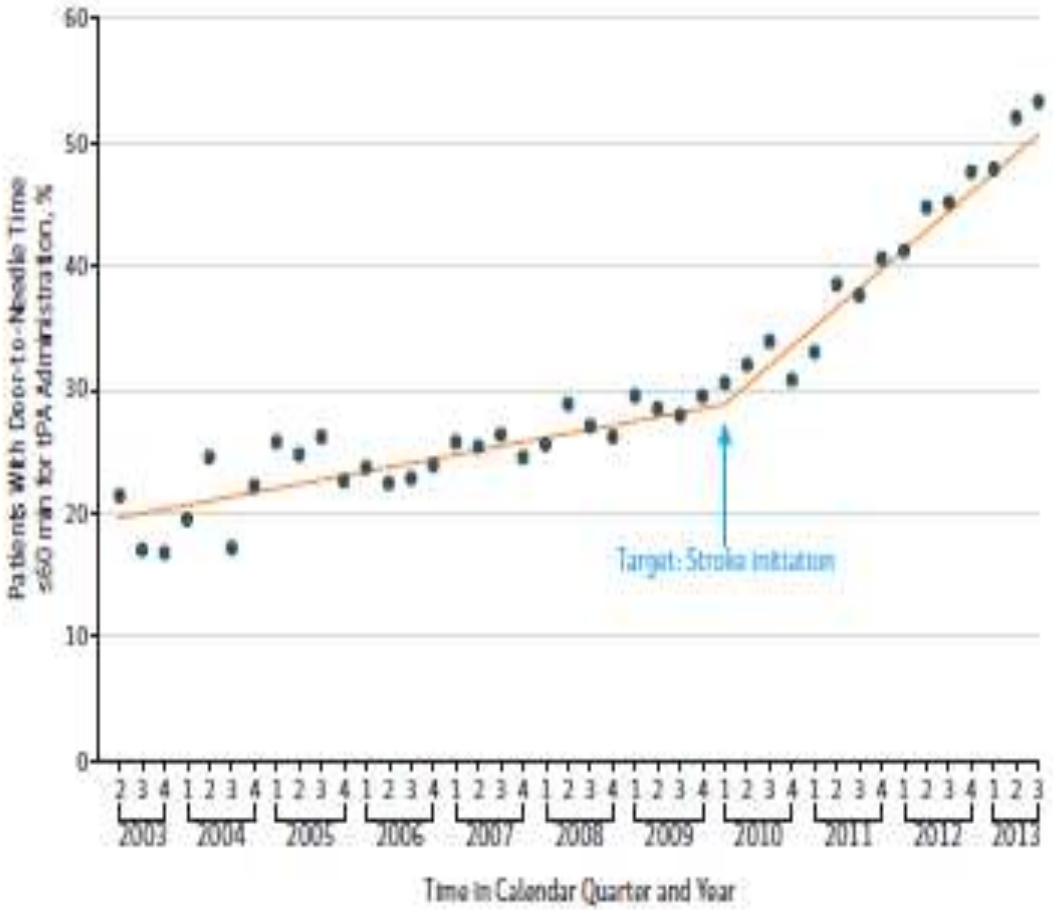


IQR indicates interquartile range; tPA, tissue plasminogen activator.

Table 1. Demographics and Clinical Characteristics of the Overall Patient Population and Hospital Characteristics

	Patients With Acute Ischemic Stroke, %[a]			Standardized Difference, %[b]
	Total (n = 71 169)	Preintervention (n = 27 319)	Postintervention (n = 43 850)	
Patient demographics				
Age, median (25th-75th), y	72 (60-82)	72 (60-82)	72 (60-83)	3.70
Female sex	50.1	49.4	50.5	2.25
Race/ethnicity				
White	72.8	75.1	71.4	8.43
Black	13.8	12.6	14.5	5.80
Hispanic	6.6	5.7	7.3	6.51
Patient arrival and admission				
Via emergency medical services	80.4	84.6	77.7	17.8
On hours[c]	47.4	47.4	47.4	0.10
Onset-to-arrival time, median (25th-75th), min	51 (36-72)	50 (35-70)	52 (36-73)	4.74
Patient medical history				
Atrial fibrillation or flutter	22.8	22.6	22.9	0.69
Prosthetic heart valve	1.2	1.3	1.1	1.17
Previous stroke or TIA	23.7	22.5	24.5	4.79
Coronary artery disease or prior MI	25.7	26.9	24.9	4.48
Carotid stenosis	2.8	3.1	2.7	2.32
Diabetes mellitus	24.6	22.9	25.6	6.28
Peripheral vascular disease	3.5	3.4	3.5	0.87
Hypertension	72.4	71.2	73.1	4.24
Smoking	17.8	18.7	17.3	3.71
Dyslipidemia	39.6	36.5	41.5	10.4
Heart failure	7.8	4.9	9.6	18.2
Patient evaluation				
NIH Stroke Scale score[d]				
Median (25th-75th)	11 (6-18)	12 (7-18)	11 (6-18)	12.9
Documented	90.3	84.0	94.2	32.8
Length of stay, median (25th-75th), d	5 (3-8)	5 (3-8)	5 (3-7)	11.2
Hospital characteristics, median (25th-75th)				
Ischemic stroke admissions/y	233 (163-339)	240 (165-347)	230 (161-337)	2.50
Intravenous tPA administration/y	19.5 (11.6-29.6)	19.2 (11.6-29.3)	19.7 (11.7-29.6)	1.15
No. of beds	403 (283-595)	404 (283-601)	401 (280-588)	2.51
Location of hospital by region				
West	21.5	21.2	21.7	1.23
South	33.9	32.3	34.8	5.27
Midwest	17.3	17.3	17.3	0.17
Northeast	27.3	29.2	26.2	6.83
Teaching hospital	65.2	65.5	65.0	0.94
Hospital in rural location	2.2	2.2	2.2	0.15
Certified primary stroke center	57.3	58.3	56.7	3.12

DTN times



Clinical outcomes

Table 3. Clinical Outcomes During the Preintervention and Postintervention Periods

Outcome	Patients With Acute Ischemic Stroke, %						
	Preintervention (n = 27 319)	Postintervention (n = 43 850)	P Value	Unadjusted OR (95% CI)	P Value	Adjusted OR (95% CI)[a]	P Value
In-hospital all-cause mortality	9.93	8.25	<.001	0.81 (0.77-0.86)	<.001	0.89 (0.83-0.94)	<.001
Discharged to home	37.6	42.7	<.001	1.23 (1.18-1.27)	<.001	1.14 (1.09-1.19)	<.001
Ambulatory status of independent	42.2	45.4	<.001	1.14 (1.09-1.20)	<.001	1.03 (0.97-1.10)	.31
Symptomatic ICH ≤36 h	5.68	4.68	<.001	0.81 (0.75-0.88)	<.001	0.83 (0.76-0.91)	<.001
tPA Complications	6.68	5.50	<.001	0.80 (0.75-0.87)	<.001	0.83 (0.77-0.90)	<.001

Various hospitals experiences

Dr. Stroke Activation system

Other Stroke centers experience

Various hospitals experiences

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Delays in door-to-needle time for acute ischemic stroke in the emergency department: A comprehensive stroke center experience

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ABSTRACT

Background: Current American Stroke Association guidelines recommend initiating intravenous thrombolysis (IVT) for acute ischemic stroke (AIS) within 60 min of patient arrival, given the benefits of IVT for AIS are time dependent. This study aimed to identify the delaying factors in door-to-needle time (DTN) in the emergency department of one of the largest comprehensive stroke centers in New York State. We also recommended measures to reduce the delays.

Methods: We retrospectively reviewed the medical charts of all AIS patients who received IVT in our emergency department patients between April 1, 2012 and December 31, 2015 to identify those with a DTN time of >60 min. We categorized the factors causing the delay into different groups. For each group, we recommended measures to reduce the treatment delays.

Results: A total of 487 patients received IVT for AIS during the 3.7-year period. Of these, 96 patients (20.4%) met our DTN time delay criteria. Delays for obtaining stroke imaging and hypertension control were the most common factors. Thirty eight patients (39.5%) had delay in obtaining CT-based stroke imaging. Twenty-two patients (22.9%) required control of elevated blood pressure prior to IVT. Other causes for delay in DTN time included delay in stroke triage and paging (11.4%), fluctuating neurological symptoms (7.2%), uncertainty about diagnosis (12.5%), delays associated with obtaining consent (9.3%), and uncertainty about the time of symptom onset (5.2%).

Conclusion: Important and common causes of delay in IVT for AIS were identified in a review of charts at our comprehensive stroke center. The authors recommend strategies to achieve faster DTN time for each of the delaying factor categories including faster acquisition and interpretation of stroke imaging, more effective triage protocols and faster blood pressure control for AIS patients who are eligible for IVT.

Various hospitals experiences

The strategies to reduce the treatment delays.

Contributors to delay in IVT	Strategies
Prolonged stroke imaging (>20 min)	– IV rtPA must be premixed and available to be given in the CT scanner – Provide IV rtPA bolus after noncontrast CT on CT table prior to CTA/CTP – Continue with CTA/ATP after IVT
Required blood pressure management prior to thrombolysis	– Recognize severe hypertension in triage – Monitor the blood pressure during CT scanning – Antihypertensive medications to be available in CT and given in case needed
Triage to initiation of imaging scan > 25 min	– EMS pre-notification call system in place with EMS personnel educated – Moving the patient from the ambulance stretchers straight into CT table – Measure the blood glucose and INR with a point-of-care device, obtain venous access and also draw blood samples in the CT scanner
Required treatment for other emergent conditions prior to thrombolysis	– Pre-hospital management if possible – Page neurology on arrival – Allow stroke team to be ready for IVT when opportunity first arises and can prevent additional delay
Delay in paging to neurology	– Page neurology for all possible AIS/-TIAs within time window even if symptoms have improved
MRI of brain completed prior to thrombolysis	– Consider IV tPA prior to brain MRI in case of doubt
Lengthy consenting for thrombolysis	– Initial discussion on IVT as potential treatment early in AIS evaluation
Fluctuating neurological deficits	– Frequent neurological examination and treat early if needed
Logistical/other issues	– Measure the blood glucose and INR with a point-of-care device – Laboratory confirms receiving samples – Two experienced personnel attempting IV access
Difficulty in identifying time of symptom onset	– EMS pre-notification system providing witness/next of keen phone numbers – Calling witnesses/next of kin prior to arrival

IVT: intravenous thrombolysis; CTA: CT angiography of head and neck; CTP: CT perfusion of head; EMS: emergency medical service; NIHSS: National Institutes of Health Stroke Scale; AIS: acute ischemic stroke; TIA: transient ischemic stroke.

First 24 post IV tPA

For your acute ischemic stroke patients

The first 24 hours are critical when Activase (alteplase) is administered[1-3]

Close observation and frequent monitoring of patients for neurologic changes, any signs/symptoms of intracranial hemorrhage, and any signs of adverse drug reactions are important during patient recovery.

Consider using the Activase Therapy Checklist as a guide in tracking your patients' recovery

During tPA therapy

- ☐ **Perform neurologic assessment**[1*]
  The use of a stroke rating scale, preferably the NIHSS, is recommended.
  - Repeat every 15 minutes during the 1-hour infusion to monitor for neurologic deterioration[1,4*]
- ☐ **Check for major and/or minor bleeding**[2]
  All body secretions should be tested for occult blood.[3]
  - Major bleeding: intracranial, retroperitoneal, gastrointestinal, or genitourinary hemorrhages[2]
  - Minor bleeding: gums, venipuncture sites, hematuria, hemoptysis, skin hematomas, or ecchymosis[2]
  - Arterial and venous punctures should be minimized and checked frequently[3]
- ☐ **Monitor blood pressure** every 15 minutes during the 1-hour infusion[1,2,4*]
  - Blood pressure should be monitored frequently and controlled during and after tPA administration (systolic blood pressure ≤185 mm Hg and diastolic blood pressure ≤110 mm Hg)[4]
  - Administer antihypertensive medications to maintain blood pressure at or below these levels[1*]
- ☐ **Discontinue infusion and obtain an emergency CT scan** if the patient develops severe headache, acute hypertension, nausea, or vomiting; or has a worsening neurologic examination[1*]
- ☐ **Monitor for signs of orolingual angioedema**[4]
  If angioedema is noted, promptly institute appropriate therapy (eg, antihistamines, intravenous corticosteroids, or epinephrine) and consider discontinuing tPA infusion.

Post tPA therapy

- ☐ **Continue to monitor for neurologic deterioration**[1,2*]
  - Every 15 minutes for the first hour after the infusion is stopped
  - Every 30 minutes for the next 6 hours
  - Hourly from the eighth postinfusion hour until 24 hours after the infusion is stopped
- ☐ **Continue to check for major and/or minor bleeding**[2]
- ☐ **Continue to monitor and control blood pressure**[1,2*]
  - Every 15 minutes for the first hour after the infusion is stopped
  - Every 30 minutes for the next 6 hours
  - Hourly from the eighth postinfusion hour until 24 hours after the infusion is stopped
- ☐ **Obtain a follow-up CT scan or MRI** at 24 hours before starting anticoagulants or antiplatelet agents[1*]
- ☐ **Continue to monitor for signs of orolingual angioedema**[4]

If any complications occur, immediately inform the attending physician or neurologist.

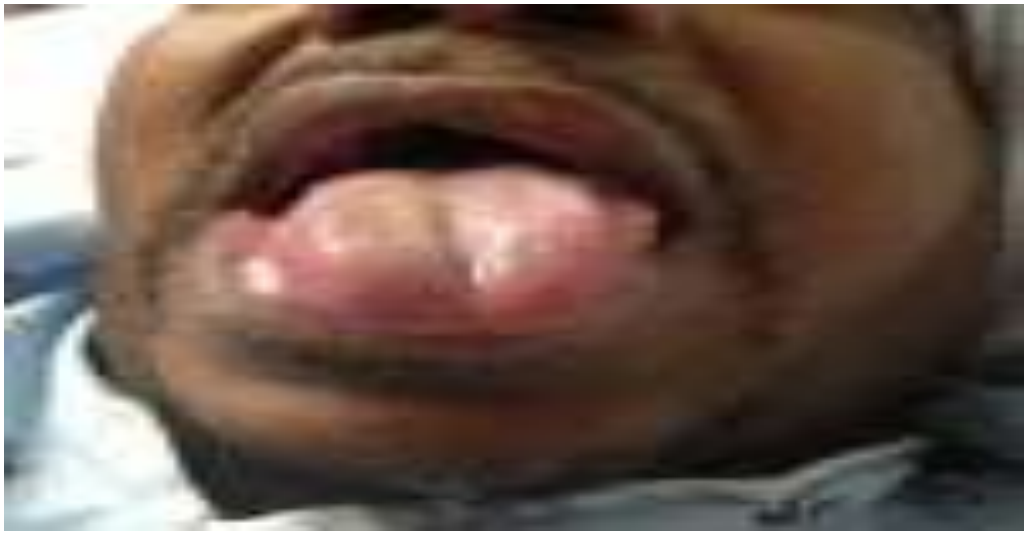
*Adapted from the American Heart Association/American Stroke Association (AHA/ASA).

First 24 h post IV tPA

- Rates of symptomatic intracerebral hemorrhage (sICH) have varied (between 1.9% and 6.4%)
- Most cases of sICH are caused by reperfusion injury.

- Population at risk: elderly, diabetes, severe hyperglycemia, uncontrolled HTN and larger hypodensity on baseline CT scan. Pts with microbleeds although this association is not entirely certain.

- Orolingual angioedema is a rare but potentially serious complication of rtPA administration. The risk is higher in patients previously taking angiotensin converting enzyme inhibitors. It is typically asymmetric and tends to involve the hemiparetic side.



Conclusion

- IV thrombolysis is the standard of care for eligible patients with acute ischemic stroke.
- Limitations: short time window (3 and 4.5 h), contraindication in patients with increased bleeding risk, IV rtPA often fails to recanalize proximal artery occlusions caused by large clots.
- Studies have found that less than 30% of US pts are treated within door to needle time of 60 minutes or less.
- Target: Stroke a multidimentional initiative elevates clinical performance in the care of acute ischemic stroke patient, facilitate a rapid integration of evidence into clinical practice and improve outcomes.
- Implementation of a national quality improvement initiative was associated with improved timelines of TPA administration following acute ischemic stroke, which correlates with lower in-hospital mortality and intracranial hemorrhage along with an increase percentage of patients discharged home.
- Close observation, frequent neurochecks/blood pressure/monitoring signs and symptoms of ICH as well as adverse drug reaction are crucial in the first 24 hours after IV tPA administration for patient safety.

Virginia Mason™

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Every Moment.
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