Published in final edited form as:
Stroke. 2009 April ; 40(4): 1512–1514. doi:10.1161/STROKEAHA.108.527770.

Resident-Based Acute Stroke Protocol is Expeditious and Safe

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Abstract

Background—The decision to administer tPA to acute stroke patients is frequently made by stroke attendings or fellows, but placing residents in this position may make tPA delivery more efficient.

Methods—Beginning in 2004, we instituted a resident-based acute stroke protocol placing neurology residents in decision-making roles. Time-intervals, symptomatic hemorrhage rate, and discharge locations were prospectively collected and compared between two epochs, before and after 2004.

Results—59 acute ischemic stroke patients were treated with tPA prior to protocol initiation (1998 to 2002), while 113 patients were treated after protocol initiation (2004 to 2007). The average door-to-needle and onset-to-needle times were significantly shorter after initiation of the resident-based protocol, (81 vs 60 min [$p < 0.001$] and 138 vs 126 min [$p < 0.05$]), respectively. Symptomatic hemorrhage rate (5.1% vs 3.5%) and favorable discharge location (68% vs 76%) did not differ between the two time periods.

Conclusion—A resident-driven tPA protocol, with formal training and quality control, is safe and efficient.

Keywords

acute stroke; tPA; thrombolytic; stroke protocol; resident

Introduction

Tissue plasminogen activator (tPA) is a proven intervention for acute ischemic stroke patients presenting within three hours of symptom onset [1]. Analysis of the NINDS tPA study evaluating outcome as a function of time from symptom onset showed improved neurological outcomes with early tPA treatment [2]. The Brain Attack Coalition recommends that stroke

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Conflict of Interest Disclosures:
The authors have no conflict of interest to report.

teams include “personnel with experience and expertise in diagnosing and treating patients who have cerebrovascular disease” [3]. Indeed, many academic centers with neurology residency and fellowship training programs require an attending or fellow level physician to personally evaluate and make final treatment decisions (personal communications). While stroke fellows or attendings frequently take call from home during off-hours, residents are often available in-house at all hours. In 2004, we instituted a resident-based team, empowering residents with final decision-making capability in order to streamline tPA administration. Here we demonstrate the efficiency and safety of such a team in the setting of a large academic training program.

Methods

Data collection

Patient data (demographics, NIHSS, door-to-needle time, and onset-to-needle time) were collected starting in 1998 as part of a prospective database. Prior to 2004, stroke attendings and fellows made decisions regarding tPA administration. The tPA protocol followed the guidelines created by the Stoke Council of the American Heart Association and was initiated by the ED triage nurse upon activation of the acute stroke pager. On patient arrival, the junior neurology resident performed a rapid history and physical, while the stroke attending or fellow came to the ED (typically driving in from home during nights and weekends) to decide on tPA administration.

In 2004, a resident-driven protocol was initiated that was similar to the previous protocol, but the decision to administer tPA was made by the senior neurology resident (PGY-4 level), after discussion with the junior neurology resident (PGY-2 and PGY-3 level). Taking call from home, the senior neurology resident travelled to the ED only if uncertainty existed regarding tPA administration. The senior neurology resident had the option to contact the on-call stroke attending if questions arose (Supplemental Figure). Additionally, junior neurology residents underwent training which included: (1) National Institutes of Health Stroke Scale (NIHSS) training (lecture and online training); (2) NINDS tPA protocol training [1]; (3) review of data on outcome as a function of early treatment [2]; and (4) several case studies of patients treated with tPA. Finally, a quality-control committee (stroke attending, ED attending, clinical nurse specialist, ED nurse, and ED pharmacist) met monthly to review all cases, providing direct feedback to residents and ED staff.

Statistical analysis

Demographic and outcome variables were compared using independent sample t-tests. Door-to-needle and onset-to-needle times from 2004 to 2007 were compared using a one-way ANOVA.

Results

During the two epochs (1/98 to 6/02, before the resident-based protocol, and 2/04 to 7/07, after initiating the resident-based protocol), 59 and 113 patients were treated with tPA, respectively. Baseline patient characteristics did not differ between the two time periods (Table 1). Door-to-needle and onset-to needle times were significantly shorter under the resident-based protocol. Moreover, 47% of patients were treated less than two hours from symptom onset with the resident-based protocol in place compared to 30% prior to that (Table 2). Beginning in 2004, several additional metrics were tracked, most of which decreased with each successive year (Table 2).

Symptomatic intracerebral hemorrhage (sICH) rate, defined as ICH within 36 hours of stroke onset accompanying any decline in neurological status, remained unchanged between the two epochs. Furthermore, the rate of hospital discharge to favorable location (home or inpatient rehabilitation) was not significantly different (Table 3).

Discussion

Direct comparison of treatment time intervals between the two time periods demonstrated greater efficiency during the resident-based stroke protocol, which had significantly shorter door-to-needle and onset-to-needle times. In addition, safety (sICH rate) and crude outcome measures were equivalent. Moreover, the door-to-needle times compare favorably to published data from other centers. The STARS multi-center tPA study of 57 academic and community centers in the United States found a median door-to-needle time of 96 minutes with a 3.3% rate of sICH [4]. The SITS-MOST trial of 285 centers and 6483 patients in the European Union had an average door-to-needle time of 68 minutes with a 1.7% sICH rate [5]. The shortest published door-to-needle time was 50 minutes on a cohort of 427 patients in Cologne, Germany with a 4% sICH rate [6]. While shorter time intervals in our resident-based protocol may be attributable to the presence of in-house physicians (residents), it should be noted that the PGY-4 residents (the final decision-makers) were highly experienced by their final year of residency. The cumulative experience of these residents is likely a critical variable ensuring safety of this resident-based team. Previous studies have reported that ED physicians deliver tPA efficiently [7], with good agreement about tPA decisions among ED attendings, ED residents, and neurology residents [8], suggesting that with formalized training, tPA may be appropriately administered by physicians with diverse specialty training. In the current study, we demonstrate that neurologists-in-training (with quality control measures) can perform as well as vascular neurology specialists.

It is critical to note that several important changes were implemented concurrent with the resident-driven protocol: (1) annual training on NIHSS and NINDS tPA study and (2) monthly review by an inter-departmental committee, providing immediate feedback to residents and staff. Therefore, we emphasize that a resident-based protocol is efficient and safe, only when coupled with strict quality control measures.

There are several limitations to the current study. We report data from a single-center with small patient numbers and historical controls. Time-dependent variables unrelated to protocol changes could have affected outcomes. Discharge locations were utilized as crude outcome measures whereas validated outcome scales would have provided more meaningful comparisons.

Conclusions

Resident-based protocols, with formal training and quality control measures, may enhance efficient delivery of tPA to acute ischemic stroke patients.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Acknowledgments and Funding:

This study was supported by the NIH NINDS P50 NS055977 and the Lillian Strauss Fund for Neuroscience Research of the Barnes-Jewish Hospital Foundation, James S. McDonnell Foundation Collaborative Award. We would like to thank the hard work of our neurology and emergency medicine residents.

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Table 1

Baseline characteristics before and after the resident-based protocol

	1998 – 2002 (N = 59)	2004 – 2007 (N = 113)	P-value
Age, years	69	67	NS
Female, %	57	49	NS
Black, %	48	50	NS
White, %	52	50	NS
NIHSS	13	12	NS

Table 2

Protocol intervals before and after the resident-based protocol (average time in minutes)

	1998–2002 N = 59	2004–2007 N=113	P-value	Feb–Dec 2004 N=29	Jan–Dec 2005 N=27	Jan–Dec 2006 N=36	Jan–Jul 2007 N=21
Door-to-stroke page	---	3	---	5	6	1	0
Door-to-evaluation time	---	10	---	15	11	8	1
Door-to-labs drawn time	---	18	---	23	19	14	10
Door-to-head CT completion time	---	23	---	30	25	18	17
Door-to-needle time	81	60	< 0.001	68	66	55	51 *
Onset-to-needle time	138	126	< 0.05	130	126	116	131
Onset-to-needle time < 2 hours	30%	47%	< 0.05	38%	52%	55%	41%

* From 2004 to 2007, door-to-needle times decreased with each successive year, $p < 0.05$, one-way ANOVA.

Table 3

Patient outcomes: discharge location and rate of sICH before and after the resident-based protocol

	1998–2002 N=59	2004–2007 N=113	P value
sICH	5.1%	3.5%	NS
Favorable discharge location *	68%	76%	NS
Unfavorable discharge location +	32%	24%	NS

NS = non-significant

* Favorable discharge location = discharge to home or inpatient rehabilitation

+ Unfavorable discharge location = discharge to nursing home or death prior to discharge