Community Use of Intravenous Tissue Plasminogen Activator for Acute Stroke

Results of the Brain Matters Stroke Management Survey

Irene L. Katzan, MD; Cathy A. Sila, MD; Anthony J. Furlan, MD

Background and Purpose—Little is known of neurologists’ viewpoints regarding intravenous tPA use or institutional readiness to evaluate potential thrombolytic candidates.

Methods—Surveys were distributed at the Brain Matters Stroke Management Workshops held in 16 cities in the United States.

Results—Intravenous tPA was administered by 46.9% of responding neurologists. Almost 30% (29.9%) of surveyed neurologists were “very convinced” of its efficacy, whereas 61.6% were “very concerned” about the risk of intracranial hemorrhage. Only half of the respondents believed their institutions could meet all NINDS-recommended stroke-evaluation time targets.

Conclusions—Neurologists’ enthusiasm for the efficacy of intravenous tPA is tempered by their concern about intracranial hemorrhage. Institutional readiness for evaluating acute stroke patients is not optimized. (Stroke. 2001;32:861-865.)

Key Words: health resources ■ health surveys ■ questionnaires ■ stroke, ischemic ■ thrombolysis

The approval of intravenous tissue plasminogen activator (IV tPA) for acute ischemic stroke in June 1996 has ushered in a new era of acute stroke management, but reservations have been expressed regarding its general use.1-3 The 3-hour time window required to evaluate acute stroke patients and administer IV tPA is a major obstacle to treatment and is the main reason that only 3% to 4% of stroke patients may be eligible for IV tPA.4,5 In 1996, time targets for the evaluation and treatment of acute stroke patients with IV tPA were developed at a National Institute of Neurological Disorders and Stroke (NINDS) National Symposium on the Rapid Identification and Treatment of Acute Stroke.6 Little is known, however, of neurologists’ viewpoints regarding IV tPA or the ability of hospital systems to meet the NINDS IV tPA time targets.

The Brain Matters Acute Stroke Workshops were held in 16 cities in 1997 and 1998. The workshops were a cooperative effort of multiple medical organizations including the American Heart Association, American Academy of Neurology, and National Stroke Association (see Appendix for a complete list). They were designed to educate healthcare personnel on IV tPA use and other new advances in acute stroke treatment.

Surveys were distributed at these workshops to explore neurologists’ attitudes toward IV tPA, as well as their assessment of their hospitals’ ability to meet the NINDS time targets.

See Editorial Comment, page 864

Methods

Surveys were distributed at the Brain Matters Stroke Management Workshops held in the late summer and fall of 1997 in 6 cities (Denver, Colo; Detroit, Mich; Memphis, Tenn; Miami, Fla; San Francisco, Calif; and Washington DC) and in spring/summer of 1998 in an additional 10 cities (Atlanta, Ga; Boston, Mass; Greensboro, NC; Kansas City, Mo; New Orleans, La; Pittsburgh, Pa; Rochester, NY; Sacramento, Calif; San Antonio, Tex; and Scottsdale, Ariz). The survey included questions on rates of IV tPA use, complications including intracerebral hemorrhage (ICH), and viewpoints on the cost and efficacy of IV tPA. Questions were also asked regarding institutional readiness for evaluating potential thrombolysis candidates based on the NINDS-recommended stroke time targets. Statistical analyses were performed with χ² test for categorical variables and t test for continuous variables.

Results

Response Rate

The survey response rate of the 1433 attendees varied from 32.8% in Denver to 69.8% in Memphis, with an overall response rate of 50.7%. Neurologists (n=406) made up the largest group of respondents (55.8%), followed by nurses (27.2%) and emergency medicine physicians (5.6%). The remaining 11.2% of respondents were from various other specialties.
Of the responding neurologists who had completed training, 46.9% (n = 175) had administered IV tPA a mean of 3.7 times (range 1 to 25) (see Figure). Mean years in practice did not differ significantly between those neurologists who had used tPA (12.6 years, SD 7.6) and those who had not (mean 13.4 years, SD 9.4) (P = 0.415). There was no significant difference in the rate of IV tPA use among neurologists of different practice types: group practice 50.8%, hospital with residency program 40.8%, multispecialty 47.8%, and solo practice 47.7%.

The reported rate of ICH among responding neurologists was 8.3% (54/649) (95% CI 6.4% to 10.7%), of which 27 were symptomatic, 8 asymptomatic, and the remainder undefined. The reported ICH rate was significantly lower among neurologists who had administered the drug at least 5 times (5.5%, 20/361) than for neurologists who had given the drug <5 times (11.9%, 34/286) (P = 0.0038). Other reported hemorrhagic complications included 3 undefined hemorrhages, 1 fatal pericardial tamponade, 1 fatal retroperitoneal hematoma with disseminated intravascular coagulopathy, 1 systemic bleeding episode, 2 noncentral nervous system hematomas, 1 scleral hemorrhage, 2 cases with perioral bleeding, and 3 cases of ecchymosis.

### Neurologists’ Viewpoints

Responding neurologists believed the efficacy of IV tPA as reported in the medical literature was “very convincing” (29.9%), “somewhat convincing” (66.5%), or “not convincing” (3.6%). The majority of responding neurologists (82.6%) believed cost was not a major factor. Most were concerned about ICH: 61.6% were “very concerned” and 36.8% were “somewhat concerned.” Neurologists who had used tPA were more convinced of its efficacy and less concerned about ICH than neurologists who had not given tPA. The 90-day global impression of neurologists who had administered IV tPA was graded as excellent (24.2%; 39/161), good/fair (47.8%; 77/161), indeterminate/neutral (24.8%; 40/161), or poor (3.1%; 5/161) (See Table 1.)

The rate of IV tPA use among responding neurologists increased slightly from summer/fall 1997 to spring/summer 1998. There were no significant differences in the responses of neurologists between the 1997 and 1998 workshops.

The rate of IV tPA use was significantly higher in the 6 cities in the western half of the country. Neurologists from the western cities also thought that the data on efficacy of IV tPA were “very convincing” significantly more frequently than

### TABLE 1. IV tPA Use and Viewpoints of Responding Neurologists

<table>
<thead>
<tr>
<th>Responding Neurologists*</th>
<th>IV tPA Use, %</th>
<th>Efficacy Very Convincing</th>
<th>Very Concerned About ICH</th>
<th>Cost a Major Factor</th>
<th>Excellent 90-Day Global Impression† (Personal Experience)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>46.9</td>
<td>29.9</td>
<td>61.6</td>
<td>9.4</td>
<td>24.2</td>
</tr>
<tr>
<td>Fall 1997</td>
<td>43.5</td>
<td>27.8</td>
<td>63</td>
<td>9.1</td>
<td>20.5</td>
</tr>
<tr>
<td>Spring 1998</td>
<td>51.2</td>
<td>32.3</td>
<td>59.9</td>
<td>9.7</td>
<td>27.7</td>
</tr>
<tr>
<td>P</td>
<td>0.113</td>
<td>0.36</td>
<td>0.55</td>
<td>0.86</td>
<td>0.29</td>
</tr>
<tr>
<td>West‡</td>
<td>60.0</td>
<td>38.5</td>
<td>61.1</td>
<td>5.4</td>
<td>24.6</td>
</tr>
<tr>
<td>East§</td>
<td>41.2</td>
<td>26.2</td>
<td>61.8</td>
<td>11.2</td>
<td>24.0</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.001</td>
<td>0.019</td>
<td>0.89</td>
<td>0.085</td>
<td>0.91</td>
</tr>
<tr>
<td>(+) IV tPA</td>
<td>...</td>
<td>34.7</td>
<td>56.3</td>
<td>7.6</td>
<td>...</td>
</tr>
<tr>
<td>(-) IV tPA</td>
<td>...</td>
<td>25.7</td>
<td>66.1</td>
<td>11.0</td>
<td>...</td>
</tr>
<tr>
<td>P</td>
<td>...</td>
<td>0.062</td>
<td>0.053</td>
<td>0.28</td>
<td>...</td>
</tr>
<tr>
<td>(+) tPA complications</td>
<td>...</td>
<td>27.1</td>
<td>58.4</td>
<td>5.3</td>
<td>13.0</td>
</tr>
<tr>
<td>(-) tPA complications</td>
<td>...</td>
<td>39.3</td>
<td>52.5</td>
<td>9.0</td>
<td>30.2</td>
</tr>
<tr>
<td>P</td>
<td>...</td>
<td>0.113</td>
<td>0.46</td>
<td>0.39</td>
<td>0.016</td>
</tr>
</tbody>
</table>

ICH indicates intracranial hemorrhage.*Excludes neurologists still in training (residents/fellows).†Refers to responses only from neurologists who have given IV tPA in past.‡Western cities: Sacramento, San Francisco, Denver, Scottsdale, San Antonio, and Kansas City.§Eastern cities: Detroit, Rochester, Boston, Pittsburgh, Memphis, Washington DC, Greensboro, Atlanta, Miami, and New Orleans.
TABLE 2. NINDS-Recommended Stroke Evaluation Time Targets and Methods by Which They Were Accomplished*

<table>
<thead>
<tr>
<th>Time Target</th>
<th>Accomplishment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door-to-doctor &lt;10 min</td>
<td>67.6%</td>
</tr>
<tr>
<td>Triage personnel knowledgeable on stroke diagnosis on duty at all times</td>
<td>74.0%</td>
</tr>
<tr>
<td>All ED personnel trained to regard stroke patients as emergencies</td>
<td>80.5%</td>
</tr>
<tr>
<td>Emergency transport personnel notify ED en route of all patients with potential strokes</td>
<td>52.3%</td>
</tr>
<tr>
<td>Access to neurological expertise &lt;15 min</td>
<td>62.5%</td>
</tr>
<tr>
<td>ED physicians certified in NIHSS or 1997 ACLS</td>
<td>52.5%</td>
</tr>
<tr>
<td>Neurologist familiar with IV tPA selection criteria present in ER within 15 min</td>
<td>51.4%</td>
</tr>
<tr>
<td>Neurologist familiar with IV tPA selection criteria available by phone</td>
<td>80.0%</td>
</tr>
<tr>
<td>24-Hour access to “stroke” beeper system</td>
<td>29.3%</td>
</tr>
<tr>
<td>Head CT performed and interpreted within 45 min</td>
<td>83.5%</td>
</tr>
</tbody>
</table>

*All survey respondents.

**Discussion**

Slightly fewer than half of responding neurologists had given IV tPA 1 to 2 years after IV tPA approval. The national rate among neurologists is likely to be less because the participants in these workshops were presumably motivated to use tPA.

The reported ICH experience was comparable to that seen in the NINDS trial. The reported rate of ICH was significantly lower among neurologists who had administered tPA 5 or more times, suggesting a learning curve. It is also possible that neurologists who experienced complications decreased their utilization. This method of data collection, however, is subject to errors in recall and underreporting, and these findings must be viewed with caution.

Neurologists attending the workshops were cautious, characterized by moderate enthusiasm about the efficacy of tPA and much concern about ICH. Concern about the cost of tPA, though, was low. Cities in the western portion of the United States had a higher rate of IV tPA use and more positive viewpoints of tPA. These results, if replicated, will have implications for national educational efforts on IV tPA for stroke.

Only half of the survey respondents thought their institutions met all the NINDS-recommended time targets, indicating a need for improvement in the ability of hospitals to rapidly assess potential thrombolysis candidates. This survey suggests that the time targets most difficult to meet are “door to doctor” within 10 minutes, access to neurological expertise within 15 minutes, and “door to treatment” within 60 minutes. Institutional efforts should focus on these specific problem areas.

Straightforward strategies to improve “door to doctor” times that were underutilized by the respondent’s hospitals included having triage personnel knowledgeable in the diagnosis of stroke always on duty, training all emergency department personnel to regard stroke patients as emergencies, and implementing critical care pathways once a stroke has been identified. A simple method for improving access to neurological expertise is the implementation of a stroke beeper system, which was in place in only 29% of respondents’ institutions meeting this target.
Methods to reduce the times to completion and interpretation of head CTs include cross-training radiology technicians to perform CTs and to increase the utilization of teleradiology. Depending on the hospital organization and physicians involved in acute stroke care, another potential strategy to reduce time to CT interpretation is to train neurologists to interpret hyperacute CT scans.

Although 85% of the respondents believed their institutions could perform and interpret CTs within 45 minutes, this may be an overestimation. Kothari and colleagues retrospectively measured time to CT from medical records in several hospitals that had participated in the NINDS study and found the mean time from arrival in the emergency room to CT was 96 minutes. Results were similar in an evaluation of emergency department management of acute stroke patients at 8 Houston, Tex, hospitals, where mean time to head CT was 100 minutes.8 The differences between the time measurements from these studies and respondents’ impressions in the present report suggest the need for an objective methodology to assess the capabilities of institutions in meeting stroke-evaluation time targets.

Although IV tPA is the only approved therapy for acute ischemic stroke, its use has not been widely embraced, and the infrastructure for its use has been slow to develop. It echoes the experience of tPA for acute myocardial infarction (MI); although the use of tPA for MI has increased over time, the infrastructure for its use has been slow to develop. It echoes the experience of tPA for acute myocardial infarction (MI); although the use of tPA for MI has increased over time, it remains an underutilized therapy.9 Given that the risk of ICH is much greater when IV tPA is administered for stroke than for MI, the caution demonstrated by neurologists responding to this survey is not unexpected.

The capability of hospitals to evaluate and treat acute stroke patients is a significant healthcare issue. Efficient delivery of tPA demands major professional and institutional cooperation at all levels of the healthcare delivery spectrum. The Brain Attack Coalition, an organization that includes most of the major organizations involved in stroke care, has recently made recommendations for the establishment of designated Stroke Centers.10 The criteria include meeting many of the time targets discussed above. In addition to the Brain Attack Coalition’s recommendations, we hope that the information revealed by surveys such as this may assist hospitals in developing the necessary infrastructure for providing optimal care of the acute stroke.

Appendix

Organizations Involved in the Brain Matters Stroke Initiative


Acknowledgments

This study was supported by a National Stroke Association Fellowship Award (Dr Katzan). We would like to thank Kara Pesky and Ashley Crittenden for their assistance.

References


issues raised by rtPA use in the acute stroke setting. About half were certified neurologists, and the survey was carried out with them.

As an instrument to determine ideas, attitudes, and experience about rtPA use within the United States, this survey has important limitations. The questionnaire was fairly brief. The response rate was only 50%. Several key issues were not dealt with, such as issues of public awareness or the prehospital management. The attendees chose to attend the workshop and as such showed a particular interest in stroke.

Despite these limitations, the results provide important information. The 406 neurologists who completed the survey were fairly representative of neurologists from across the country. The majority were from nonteaching institutions. Of particular interest, about one half (195) had never used rtPA, and of those who had, the median use was only 3 times, with no difference between neurologists with community and those with academic affiliation. A majority (66.5%) felt the relevant literature was “somewhat convincing”; 62% were “very concerned” about intracranial hemorrhage. Considering the incidence of stroke and the likelihood that these neurologists had a special commitment to and interest in stroke, these data indicate a slow acceptance of rtPA. Far from a widespread embracing of thrombolysis as treatment for stroke, these figures point to a slow, cautious acceptance.

Of particular note was the view that only 49.6% felt their institution could meet the NINDS time targets, thus highlighting the crucial institutional issues.

Despite the limitations, this report is the only national survey of neurologists in the 2 years following publication of the level 1–type evidence and FDA approval of rtPA for the single most important disease dealt with by neurologists. This led to a sea change in acute care management, one that is continuing and is likely to continue and even accelerate. This has necessitated major professional and institutional changes that have created stresses at all levels of the healthcare delivery spectrum. These changes, though regularly discussed, have limited documentation. The value of the study lies in the documentation, albeit imperfect, of neurologists’ practice patterns in these 2 years. By demonstrating what seems to be a lack of preparedness at multiple levels to efficiently deliver rtPA to acute stroke patients, it will be of interest to healthcare planners responsible for acute stroke care as systems of delivery continue to be developed and implemented.

David C. Howse, MD, Guest Editor
Division of Neurology
Department of Medicine
Queen’s University
Kingston, Ontario, Canada

Reference
Community Use of Intravenous Tissue Plasminogen Activator for Acute Stroke: Results of the Brain Matters Stroke Management Survey
Irene L. Katzan, Cathy A. Sila and Anthony J. Furlan

*Stroke.* 2001;32:861-865
doi: 10.1161/01.STR.32.4.861

*Stroke* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2001 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/32/4/861

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Stroke* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Stroke* is online at:
http://stroke.ahajournals.org/subscriptions/