

# Attitudes and Approaches to Acute Ischemic Stroke in Wisconsin Hospitals

Douglas A. Dulli, MD, MS; Robert J. Dempsey, MD; Ross L. Levine, MD

## INTRODUCTION

The standard of care in acute ischemic stroke was radically altered in June, 1996 with the approval by the Food and Drug Administration of intravenous tissue plasminogen activator (t-PA). This followed the results of a multicenter trial by the National Institute of Nervous Disorders and Stroke (NINDS),<sup>1</sup> which demonstrated significant benefit of t-PA in acute ischemic stroke if administered within 3 hours. Community studies on the use of t-PA in acute ischemic stroke that have followed have reproduced the efficacy and relative safety indicated by the NINDS trial results.<sup>2-4</sup> Recently, efficacy and safety in reversing acute ischemic stroke have been established with the use of intraarterial cerebral thrombolysis within 6 hours of symptom onset,<sup>5</sup> and clinical trials are ongoing to establish benefit of neuroprotective therapy in acute stroke.<sup>6</sup>

In spite of these results, there has been variable acceptance of t-PA in particular and acute ischemic stroke therapy in general by many neurologists, emergency room physicians, and physicians in general.<sup>7-10</sup> There remains some concern that the benefit of thrombolysis may be outweighed by the risk of fatal intracerebral hemorrhage, particularly in facilities lacking expertise in the diagnosis and management of ischemic stroke, cerebral thrombolysis or hemorrhagic complications.<sup>11,12</sup> Many hospitals are remote from tertiary referral facilities, so that transport of the patient for thrombolysis or post-stroke monitoring is more difficult. This is particularly an issue with intra-arterial thrombolysis, which must be limited to larger or tertiary facilities and requires urgent transport of the patient. In addition, implementation of a protocol for acute ischemic stroke has required a significant change in priorities and attitude.<sup>13</sup> Such a

change may be met with significant inertia in facilities that have limited exposure to acute ischemic stroke or the availability of neurologic consultation.

We sought to assess the scope of this issue in Wisconsin. We specifically sought to assess whether the attitudes of emergency room directors to acute stroke therapy, and approaches to acute stroke, vary randomly or are dependent on the physical limitations of the treating hospital.

## METHODS

Questionnaires were mailed to emergency room directors of all 110 community hospitals and tertiary referral centers equipped with emergency rooms in Wisconsin. These questionnaires are divided into 2 sections. In the first section entitled "Attitudes," the physicians are asked 12 questions about their opinion toward treatment of acute stroke in general, thrombolysis in particular, their confidence in the management of acute stroke, and the desirability of consultation and education in acute stroke (Table 2). The answers were chosen from the list "strongly agree," "agree," "neither agree nor disagree," "disagree" and "strongly disagree."

The second section entitled "Approaches" asked about acute stroke protocols, special consideration for acute stroke, emergent computed tomography (CT), local or telephone neurologic consultation for acute stroke, and prior use of thrombolysis or transport of acute ischemic stroke to a tertiary referral center (TRC) (Table 3). The answers were chosen from a "yes/no" or "always/often/seldom" list. The Approaches questionnaire also contained questions regarding availability of CT scanning and local neurologic consultation, emergency physician training in stroke, and community education programs on acute stroke. Responses to these questions were treated as hospital characteristics. Other hospital characteristics to be used as predictors were obtained from each hospital prior to mailing of the questionnaire. These included number of hospital beds, distance to the nearest or most commonly used TRC, population of

Authors are with the Department of Neurology, University of Wisconsin Medical School. Doctors Dulli and Levine are Associate Professors; Dr. Dempsey is Professor and Department Chair. Address correspondence to Douglas A. Dulli, MD, MS, 608.263.9058; fax 608.263.0412; e-mail dulli@neurology.wisc.edu

the community and number of hospital and emergency room staff physicians.

Hospitals with less than 70 beds at maximum census were defined as small, and hospitals with at least 70 beds defined as large. Hospitals at least 30 miles from a TRC were defined as remote, and hospitals less than 30 miles from a TRC were defined as near. A hospital was designated a TRC if its staff declared it as a referral facility and it was recognized by surrounding hospitals as such. Using these definitions, 5 hospital categories were established:

1. Small community hospital remote from tertiary referral facility (SR),
2. Small community hospital close to tertiary referral facility (SN),
3. Large community hospital remote from tertiary referral facility (LR),
4. Large hospital close to tertiary referral facility (LN),
5. Tertiary referral facility (TRC).

Frequencies of positive responses between hospital categories and TRCs in the questionnaires were compared using chi-square tests of 2-by-2 tables. Pearson's correlation coefficient was used to assess correlation between independent hospital characteristics and questionnaire scores. For correlation analysis, the questionnaire responses were treated as ordinal variables (e.g. strongly disagree to strongly agree) where applicable, rather than dichotomous positive-versus-negative responses. Statistical tests were performed with SPSS (SPSS Inc., Chicago IL).

## RESULTS

Table 1 compares hospital characteristics of the 66 (60%) responders to non-responders. Non-responder hospitals were smaller and more remote from a TRC than responders, although the differences were not statistically significant. Table 2 gives the results of the "Attitudes" questionnaire. Overall, attitudes were very similar between TRC physicians and those of the other hospital categories. An exception is that significantly fewer physicians in all categories except SR hospitals agreed that neurologic consultation was useful in stroke. This applied both to consultation from local neurologists, where available, or neurology/stroke services at TRCs. In addition, physicians of small hospitals tended to feel less comfortable participating in acute stroke care, while physicians of large hospitals tended more to have reservations about acute stroke therapy itself. LR hospital physicians felt that acute stroke protocols were useful less frequently than those of TRC physicians, while LN hospital physicians disagreed less often than TRC

**Table 1.** General hospital information

Hospital Category	Responders (sd) <sup>†</sup>	Non-Responders (sd)	p (t-test)
N	66	44	
Mean bedsize	148.1 (162.8)	121.2 (113.4)	0.305
Median bedsize	74.0	74.0	
Mean community size x 1000	75.58 (118.8)	68.4 (115.1)	0.748
Mean number doctors on staff	115.9 (156.1)	99.7 (156.0)	0.605
Mean distance (miles) from TRC	38.0 (31.2)	45.4 (43.0)	0.336

† sd = standard deviation

physicians with the statement "Thrombolysis is too dangerous to justify its use." This last difference was of borderline significance.

Table 3 gives results of the "Approaches" questionnaire. Here overall significant differences were seen between TRC and non-TRC hospitals in the use of an acute stroke protocol and urgent head CT for acute stroke patients. Large hospitals were less likely than small hospitals to transport acute stroke patients to a TRC. In LR hospitals physicians were also less likely than those of TRCs to have a protocol for acute stroke or consult a specialist in stroke (either a local neurologist or TRC stroke service). In small hospitals urgent CT was less likely to be obtained in acute stroke, while SN hospitals were also less likely to obtain neurologic consult in acute stroke. SR hospitals were as likely as TRCs to obtain neurologic consult in stroke, and surprisingly showed no significant difference in the use of thrombolysis in acute stroke, despite less likelihood of obtaining urgent CT.

In Table 4, information comparing hospital capabilities is shown. LN hospitals revealed no significant differences in frequencies of capabilities in management of acute stroke compared to TRCs. The other hospitals reported deficiencies in monitoring of t-PA patients, but also in the availability of neurologists. In aggregate, non-TRC hospitals also demonstrate significantly less involvement of potentially or intermittently available neurologists.

Table 5 demonstrates correlations between hospital capabilities and significant differences noted in the Attitudes and Approaches questionnaires. The existence and relevance of stroke protocols were correlated positively with hospital bed size, community size, number of staff physicians, the ability to monitor stroke after t-PA use, and the involvement,

**Table 2.** "Attitudes" questionnaire. Numbers and percentages of agreement or disagreement are given for hospitals where question is applicable

Attitude questions	Tertiary Referral Center (TRC)	All non-TRC Hospitals	Small Remote (SR)	Small Near (SN)	Large Remote (LR)	Large Near (LN)
N (% of all hospitals)	12 (18.1)	54 (81.8)	24 (36.4)	6 (9.1)	15 (22.7)	9 (13.6)
1. Our view of acute stroke has evolved over the past 3 years to one of a "brain attack," where "time is brain" (% agree)	11 (91.7)	46 (85.2)	21 (87.5)	6 (100)	13 (86.7)	6 (66.7)
2. Protocols for acute ischemic stroke therapy are not yet clinically relevant at our hospital (% disagree)	10 (83.3)	36 (66.7)	17 (70.8)	5 (83.3)	6 (40.0) <sup>†</sup>	8 (89.9)
3. Thrombolysis is an important and powerful advance in the therapy of acute ischemic stroke (% agree)	8 (66.7)	32 (59.3)	16 (66.7)	4 (66.7)	9 (60.0)	3 (33.3)
4. Thrombolysis is too dangerous to administer in acute ischemic stroke to justify its use (% disagree)	9 (75.0)	31 (57.4)	17 (70.8)	3 (50.0)	8 (53.3)	3 (33.3) <sup>†</sup>
5. Our emergency room physician staff feel confident in the diagnosis of acute ischemic stroke (% agree)	12 (100)	44 (81.5)	17 (70.8)	6 (100.0)	12 (80.0)	9 (100)
6. Our emergency room physician staff feel comfortable in participating in therapy for acute ischemic stroke (% agree)	9 (75.0)	21 (38.9) <sup>†</sup>	8 (33.3) <sup>†</sup>	1 (16.7) <sup>†</sup>	6 (40.0)	6 (67.7)
7. Discussion with the tertiary care center stroke service or the community neurology service is very helpful in acute stroke (% agree)	12 (100)	37 (68.5) <sup>†</sup>	21 (87.5)	2 (33.3) <sup>‡</sup>	9 (60.0) <sup>‡</sup>	5 (55.6) <sup>‡</sup>
7a. The tertiary care center stroke service is very helpful (% agree)	12 (100)	23 (42.6) <sup>§</sup>	16 (66.7)	2 (33.3) <sup>‡</sup>	4 (26.7) <sup>§</sup>	1 (11.1) <sup>§</sup>
7b. The community neurology service is very helpful (% of available agree)	12 (100)	25 (46.3) <sup>‡</sup>	7 (77.8)	1 (25.0) <sup>‡</sup>	6 (66.7)	5 (55.6) <sup>‡</sup>

\*Chi-Square, two-tailed, compared to TRC  
<sup>†</sup> Significant at 0.05 level  
<sup>‡</sup> Significant at 0.01 level  
<sup>§</sup> Significant at 0.001 level

although not availability, of community neurologists.

Stroke protocols were negatively correlated with distance to a TRC. Consultation with a local neurologist or TRC stroke service was positively correlated with these variables as well, although the attitude that such consultation is useful was significantly correlated only with involvement of the local neurologist.

## DISCUSSION

It is noteworthy that there were no significant differences between TRC and non-TRC Wisconsin hospitals in answers to attitude questions regarding stroke as "brain attack," the relevance of protocols for acute stroke and the importance of thrombolysis as an advance in acute stroke therapy. There was surprising agreement among ER physicians regarding comfort in the diagnosis of acute stroke, and there were no overall significant differences in training of ER

physicians in acute stroke. The lack of comfort in physicians of LR hospitals participating in acute stroke therapy seems reasonable, given the reported lack of intensive monitoring or neurologic expertise at those facilities. In other respects there is surprising similarity in both attitudes and approaches between TRC physicians and those of the smallest and most remote hospitals in the LR group.

There was, however, a significant difference in attitudes between TRCs and larger non-TRC hospitals toward the usefulness of neurologic consultation in acute stroke. This is of concern because larger hospitals are more likely than small hospitals to have local neurologists available. It is also of note that physicians in LR facilities were less likely than those of TRCs to feel that acute stroke protocols were relevant at their facility, while physicians of LN hospitals were more likely to feel that thrombolysis was

**Table 3.** Approaches questionnaire. Numbers and percentages of agreement or disagreement are given for hospitals where question is applicable

Hospital Category	Tertiary Referral Center (TRC)	All non-TRC Hospitals	Small Remote (SR)	Small Near (SN)	Large Remote (LR)	Large Near (LN)
N (% of all hospitals)	12 (18.1)	54 (81.8)	24 (36.4)	6 (9.1)	15 (22.7)	9 (13.6)
Is there a stroke protocol? (% yes)	11 (91.7)	30 (55.6) <sup>†</sup>	14 (58.3)	4 (66.7)	4 (26.7) <sup>†</sup>	8 (88.9)
Special consideration for acute stroke? (% often to always)	8 (66.7)	34 (64.2)	19 (82.6)	6 (100)	5 (33.3)	4 (44.4)
Is CT obtained urgently for acute stroke patients? (% always)	12 (100)	34 (65.4) <sup>†</sup>	15 (65.2) <sup>†</sup>	2 (33.3) <sup>†</sup>	10 (71.4)	7 (77.8)
Is specialist consulted for acute stroke (% yes, local or TRC)	12 (100)	38 (71.7)	18 (78.3)	3 (50.0) <sup>†</sup>	7 (53.8) <sup>†</sup>	8 (88.9)
Have you ever used t-PA in acute stroke or transported an acute stroke to a TRC? (% ever)	11 (91.7)	47 (90.4)	20 (87.0)	6 (100)	12 (85.7)	9 (100)
Have you used t-PA or transported to TRC often? // (% yes)	6 (50)	28 (53.8)	12 (52.2)	2 (33.3)	7 (50.0)	7 (77.8)
Have you ever used t-PA in acute stroke? (% yes)	11 (91.7)	34 (65.4)	14 (60.9)	2 (33.3) <sup>†</sup>	9 (100)	9 (100)
Do you transport acute stroke to a TRC?	12 (100) <sup>#</sup>	36 (70.6) <sup>†</sup>	18 (81.8)	6 (100)	8 (57.1) <sup>†</sup>	4 (44.4) <sup>†</sup>

\* Chi-Square, two-tailed, compared to TRC  
 † Significant at 0.05 level  
 ‡ Significant at 0.01 level  
 // Often = more than 4 times for t-PA, or more than twice per year for transport to TRC  
 # Set to 100% by definition

**Table 4.** Hospital information obtained from the "Approaches" questionnaire.

Hospital Category	Tertiary Referral Center (TRC)	All non-TRC Hospitals	Small Remote (SR)	Small Near (SN)	Large Remote (LR)	Large Near (LN)
N (% of all hospitals)	12 (18.1)	54 (81.8)	24 (36.4)	6 (9.1)	15 (22.7)	9 (13.6)
Is there a local neurology service (% yes)	12 (100)	31 (57.4) <sup>‡</sup>	10 (41.7) <sup>§</sup>	3 (50.0) <sup>†</sup>	9 (60.0) <sup>†</sup>	9 (100)
If a neurology service, is it involved in acute stroke? (% often or always)	12 (100)	23 (74.2) <sup>†</sup>	5 (50.0) <sup>†</sup>	2 (66.7)	7 (77.8)	9 (100)
Can your hospital monitor stroke after t-PA? (% yes)	10 (83.3)	12 (23.1) <sup>§</sup>	0 (0) <sup>§</sup>	0 (0) <sup>†</sup>	5 (35.7) <sup>†</sup>	7 (77.8)
Is computed tomography (CT) present? (% always)	12 (100)	43 (82.7)	17 (73.9)	4 (66.7)	13 (92.9)	9 (100)
Do ER MDs have training in acute stroke? (% "some" or yes)	11 (91.7)	43 (81.1)	17 (73.9)	6 (100)	11 (73.3)	9 (100)
Are you aware of community education programs on stroke? (% yes)	9 (75.0)	21 (40.4)	5 (21.7) <sup>†</sup>	4 (66.7)	5 (35.7)	7 (77.8)

\* Chi-Square, two-tailed, compared to TRC  
 † Significant at 0.05 level  
 ‡ Significant at 0.01 level  
 § Significant at 0.001 level

too dangerous to use in acute ischemic stroke. These responses suggest either some reservations about acute stroke therapy itself, or a lack of enthusiasm for this therapy from their neurologists. In small hospitals, physicians are less likely to feel comfortable in participating in acute stroke therapy, although this is balanced in SR hospitals by agreement that either local (when available) or TRC neurologic con-

sultation is useful. Such consultation is less likely to be considered useful in SN hospitals.

In the approach questions, LR hospitals in particular are less likely to either have a protocol for acute ischemic stroke or obtain neurologic consultation. This may reflect a greater tendency for self-sufficiency in patient care in larger facilities coupled with a lesser tendency for neurologists to participate in

**Table 5.** Correlations between independent hospital variables and Attitude or Approach questionnaire scores

Hospital Variables	Attitude Questions			Approach Questions		
	Stroke protocols not relevant?	Thrombolysis too dangerous?	Stroke consult helpful?	Is there a stroke protocol?	Is urgent CT obtained?	Is specialist consulted?
Mean Bedsize	-.211	.061	.204	.228	.301 <sup>†</sup>	.253 <sup>†</sup>
Mean community size x 1000	-.245 <sup>†</sup>	.031	.175	.269 <sup>†</sup>	.207	.273 <sup>†</sup>
Mean no. doctors on staff	-.263 <sup>†</sup>	.096	.168	.263 <sup>†</sup>	.303 <sup>†</sup>	.298 <sup>†</sup>
Mean no. full-time doctors in ER	-.197	.065	.027	.315	.061	.177
Mean distance (miles) from a TRC	.301 <sup>†</sup>	-.164	-.106	-.344 <sup>‡</sup>	-.147	-.275 <sup>‡</sup>
Is there a local neurology service?	-.144	.074	.078	.216	.081	.148
If a neurology service, is it involved in acute stroke?	-.568 <sup>§</sup>	.036	.303 <sup>†</sup>	.336 <sup>†</sup>	.131	.386 <sup>†</sup>
Can your hospital monitor stroke after t-PA?	-.333 <sup>‡</sup>	.199	.096	.433 <sup>§</sup>	.256 <sup>†</sup>	.283 <sup>†</sup>
Are you aware of community education programs on stroke?	-.122	.083	-.108	.051	-.109	.043

\*Pearson's correlation coefficient  
<sup>†</sup> Significant at 0.05 level  
<sup>‡</sup> Significant at 0.01 level  
<sup>§</sup> Significant at 0.001 level

emergent care at these facilities. The higher frequency of stroke protocols and neurologic consultation in SR hospitals, by contrast, seems to reflect a tradition of deferral to the care and patterns of specialized care of the TRCs, upon which the SR facilities are more dependent for specialists. In the case of hospitals near to TRCs, SN hospitals are less likely to have a stroke protocol or obtain neurologic consultation in stroke, possibly because they are less accustomed to providing emergent care in the area than nearby LN hospitals. In turn, the LN hospitals have their own neurologists and stroke protocols, which are similar in scope and competing with those of neighboring TRCs.

Both the presence and relevance of an acute stroke protocol correlated with community size, hospital size in terms of number of physicians, distance from a TRC, and particularly ability to monitor stroke after t-PA. These correlations are intuitive, since thrombolytic therapy requires hospital capabilities more likely found in larger and more urban centers, while such centers are more likely to have treated acute ischemic stroke with significant frequency to prompt establishment of a protocol. Stroke protocol also correlated with involvement of neurologists, but not availability of neurologists only. This suggests that the participation of the local neurologist directly influences the approach to acute stroke therapy, and that if no neurologist is available, that influence is more likely to be generated by the nearest TRC neurology or stroke service.

These conclusions must be viewed with some cau-

tion, particularly given the relatively small numbers in each hospital category, particularly SN hospitals. Moreover, the significance of the differences to attitude and approach questions must be interpreted in the context of multiple comparisons. These reservations may be balanced by the uniqueness of this study in assessing reactions to acute stroke therapy in non-tertiary emergency room physicians. This is important because there remains some controversy about the usefulness and hazards of thrombolysis among neurologists and emergency physicians. On one hand there is an admonition to respond to acute ischemic stroke with a proven therapy, and to move away from a more traditional "therapeutic nihilism"<sup>13,14</sup> in acute stroke. On the other hand are questions regarding the usefulness of IV t-PA in particular, balanced by its potentially lethal complication of intracerebral hemorrhage. A survey of Houston neurologists published in 1998 found that of 16% that had used t-PA in acute ischemic stroke, 97% would do so again, whereas only 60% of those who had not used t-PA would do so.<sup>15</sup> An Indiana physician survey found that 49% of emergency physicians and 85% of neurologists would give t-PA in an appropriate patient scenario.<sup>16</sup>

## SUMMARY

Although acute stroke is a common presentation to an emergency room, the presentation of a patient with acute ischemic stroke, within a limited time window as an appropriate candidate for cerebral

thrombolysis, is not common. In many of these patients, their candidacy can be improved through community education toward emergent transfer to an emergency room if they manifest symptoms of stroke. This would improve the "symptom-to-door" time. Another goal is to improve the recognition and approach of the hospital itself toward improving the "door-to-drug" time in appropriate patients.<sup>13,17</sup> The obstacle to this second goal does not seem to be a nihilistic or evasive attitude on the basis of this study. Contrary to what was expected, enthusiasm for the use of cerebral thrombolysis was found in emergency physicians of all hospital categories, particularly of small remote hospitals. Instead, educational initiatives should focus on the facilitation of protocols for present and future ischemic stroke therapy, particularly in larger remote facilities that may be more self-dependent in their approach to acute stroke. An equally important focus should be toward more active participation by local neurologists who may be available for acute stroke care. Further, as this study demonstrates a correlation between the involvement of a local neurologist and the use of a stroke protocol, neurologists of non-tertiary facilities should be recruited to participate in these educational initiatives.

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