# Emergency Department Healthcare Providers' Knowledge of Ischemic Stroke

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**ARTICLE INFO**

**ABSTRACT**

*Introduction:* Stroke is one of the leading causes of death and disability in the United States. Nationally, only 3-8% of patients with Acute Ischemic Stroke (AIS) who are eligible for thrombolysis currently receive recombinant tissue plasminogen factor (r-TPA). Lack of knowledge and familiarity with thrombolytics in stroke therapy are major impediments. We investigated the baseline stroke management concepts and knowledge of AIS therapy in Emergency Department (ED) healthcare providers and then assessed the impact of a brief educational intervention. *Method:* An anonymous 14-item (11 multiple choice and 3 open-ended) questionnaire was administered to a convenience sample of 58 healthcare providers in the ED of a Level-1, tertiary care, academic, urban hospital. The survey was collected and a 15-minute lecture was provided to the group. A post-test was administered immediately and six months after the intervention. Data collected were analyzed with chi-square, analysis of variance and Kruskal-Wallis analysis using SAS 9.1.3. *Results:* Of the 58 respondents 77% (45/58) identified r-TPA as the thrombolytic agent, but only 56% (33/58) knew the therapeutic window and 29% (17/58) knew the "Door-to-CT" time. Sixty-two percent (36/58) of the respondents reported unfamiliarity with the National Institute of Health's Stroke Scale and the eligibility criteria of r-TPA. Median score pre-education was 5/14 which improved to 11/14 (CI 8-12, p<0.0001) and six months later was 8/14 (best score was 12, p<0.0001). Only 8% (5/58) of the respondents expressed a special interest in stroke. *Conclusion:* Few medical personnel express a special interest in stroke and many misunderstand basic management concepts as well as eligibility criteria for thrombolysis in AIS. A brief targeted intervention improves knowledge and familiarizes ED healthcare providers about the use of r-TPA in AIS. Improvement in knowledge was demonstrated on testing immediately and at six month follow-up.

## Introduction

Stroke is the third leading cause of death and disability in the United States (US). The US Food and Drug Administration (FDA) approved intravenous recombinant tissue plasminogen activator (r-TPA) for acute ischemic stroke in 1996.[1] Consensus statements from the American Heart Association[2] and American Academy of Neurology,[3,4] based on the National Institute of Neurologic Disease trials[4] (support the use of intravenous r-TPA. In the US, between one and three percent of acute stroke patients currently receive thrombolytics in spite of the supporting studies, consensus statements, and guidelines.[5]

Barriers to early delivery of r-TPA include[6] a delay in symptom recognition by patients,[6] contacting a primary care provider instead of emergency services,[7] Emergency Department (ED) triage as non-urgent[8] slow in-hospital care,[9] physician concern about adverse reactions,[10] and a delay in obtaining and reading head CT scans.

The benefits of r-TPA outweigh the risks immediately following the onset of symptoms of acute ischemic stroke (AIS). The risk to benefit ratio progressively increases with time. Hence, four and a half hours from the onset of symptoms the risks outweigh the benefits and systemic r-TPA is no longer indicated.[11] Although treatment times are subject for debate, it remains clear that the earliest this drug can be administered, the greatest benefit can be achieved. Lack of knowledge of ischemic stroke therapy in ED healthcare providers may cause a delay and thus increase risk or decrease drug efficacy.

Objectives of this study were to identify the current level of knowledge and familiarity with the use of thrombolytics among ED healthcare providers of a tertiary care stroke referral center and to study the impact of a brief 15 minute educational intervention on the immediate and intermediate (6-month) knowledge of AIS management concepts.

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## Materials and methods

The study was conducted in the ED of an urban tertiary care center with more than 90,000 visits per year. The institution serves as a referral center for patients with ischemic stroke and has a protocol instituted for identification, management, and treatment of AIS patients. We developed and distributed a 14-question (11 multiple choice, 3 open ended) anonymous questionnaire to a convenience sample of 58 volunteer ED healthcare providers members. The sample included ED Attending Physicians, Registered Nurses, Advanced Practice Nurses, Neurology and Internal Medicine residents, and medical students completing their clinical rotation in the ED. Since any of these health care providers may potentially serve as the initial point of AIS patient contact, we considered their knowledge base to be crucial in the recognition and initiation of AIS evaluation and management. A throughput process is most successful when it is not physician driven or physician dependent. Treatment must be an integrated into the core functioning of the department.

Upon completion of the pre-test, the study participants were shown a 15-20 minute Power Point lecture addressing the National Institute of Neurologic Disorders and Stroke[5] trials, National Institute of Health (NIH) Stroke Scale, and thrombolytic eligibility criteria for AIS. The questionnaire was designed to reflect stroke topics presented in the lecture, namely thrombolytic therapeutic criteria. After the educational intervention, the study participants completed a post-test which was comprised of the same questions as the pre-test. Six months later, 31 of the original 58 subjects were available to participate in the follow-up questionnaire. These subjects included attending physicians, nurses, and some medicine residents (Figure 1). Data collected were analyzed with chi-square, analysis of variance, and Kruskal-Wallis analysis using SAS 9.1.3. We compared pre and immediate post-test scores of individual subjects as we had initially numbered the pre and immediate tests as well as assigned an "A" and "B" to the pre and immediate post test, respectively. However, we were only afforded the opportunity to compare the pre and six month follow-up test scores based on the level of training (attending, resident, RN/APN) as we had anonymously administered the questionnaire and did not assign the numbers and a "C" to the six month follow-up test. Statistical comparisons between time 0 (pre-test) and time 1 (post-test) examined changes in the scores of individuals. The only comparative statistics we present involving time 2 (post-test six months later) are nonparametric tests and data were reported in aggregate. Statistical comparisons between time 0 and time 1 are repeated measures test. Confidence Intervals (CI) about medians are the 5th and 95th percentiles.

## Results

Only 5/58 (8%) respondents expressed a special interest in stroke. While 45/58 (77%) of subjects identified r-TPA as the thrombolytic of choice, only 33/58 (56%) knew the therapeutic window of three hours (time during the survey administration; this window has been changes to 4.5

hours). Additionally, 17/58 (29%) knew that the guideline Door-to-CT time is 25 minutes[12] (Figure 1). When asked to identify eligibility criteria, 36/58 (62%) experienced uncertainty and a majority 45/58 (74%) were not familiar with the basics of the NIH Stroke Scale. Moreover, 27/58 (46%) were unsure if a written stroke protocol existed at this hospital. When queried about adding other agents to r-TPA for treatment of AIS, 49/58 (84%) believed aspirin and 50/58 (86%) heparin should be given within 1-4 hours (Figure 1). Median pre-education score was 5/14 (CI: 1-9) and improved to 11/14 (CI: 8-12, best score-12, p<0.0001); the improvement was not significantly related to education level. For the 31 subjects tested at six months, the median score was 8 (CI: 6-11, p<.0001), which remained higher than both the pre-education score and immediate post-education scores.
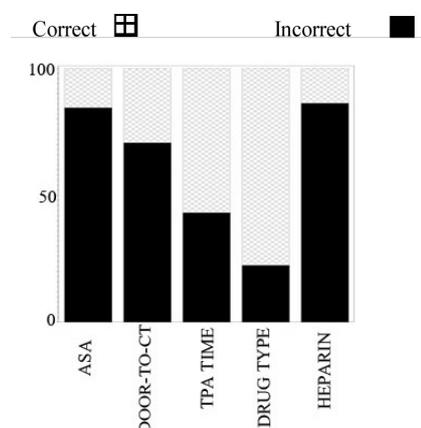


**Figure 1. Pre-education Scores of BasicQuestions**

## Discussion

Despite endorsement of established guidelines by scientific research for over a decade, the use of thrombolytics in the treatment of AIS continues to remain significantly low.[5] Multiple barriers exist at various levels, such as at the level of the patient, physician, and hospital/institution. The lack of education of the health care providers may represent the largest barrier of all. Prior studies have evaluated educational programs directed at communities, paramedics, and ED healthcare providers and have demonstrated small, statistically significant increased treatment rates.[13,14,15] The Temple Stroke Project included both public and professional education.[13] Patients were encouraged to ask for r-TPA in the ED. Since public and professional education were intertwined, it is difficult to measure the effect of one in isolation. The methods used to educate varied among the studies. In one study the professional multilevel educational interventions lasted two hours[14], whereas another was a series of scheduled continuing medical education seminars taught by a multidisciplinary team.[15] The curriculum included workup and treatment of mock stroke patients. Both educational programs required significant time commitments. Our study assessed stroke management concepts and knowledge of recommended

stroke diagnostic and treatment guidelines among our ED healthcare providers and prior to, immediately after, and 6 months after a brief (15 minute) educational intervention on immediate and intermediate knowledge of these guidelines.

Professional education is a major step to reduce physician reluctance to give r-TPA to stroke patients when the treatment is indicated. The study by Brown et al (2005) surveyed 1,105 emergency physicians and found that 40% were not likely to use r-TPA in AIS patients either because of either lack of perceived benefit, the risk of symptomatic intra-cerebral hemorrhage, or both.

Lack of familiarity with the use of a therapeutic intervention remains a major barrier in its widespread acceptance and use in those eligible. Our study found that a significant number of respondents indicated that aspirin and heparin (84% and 86%, respectively) should be given within 1-4 hours of presentation in AIS. This likely reflects the healthcare providers' extensive experience with the use of r-TPA in the treatment of Acute Coronary Syndrome and Myocardial Infarction.

As demonstrated above, the presence of a protocol will not guarantee that it will be appropriately executed without education on the details of the protocol and the underlying rationale. Physicians who make the final decision of whether to treat, need to understand the details of risk and benefit assessment. Treating physicians also need to understand eligibility criteria, therapeutic window, Door-to-CT time, and the effect of time progressively increasing the risk to benefit ratio. The establishment of a "Stroke Team" may play a role in early therapy, but the activation of this system still relies heavily on the judgment and knowledge of the initial providers, usually the Emergency Department healthcare providers.

Limitations of our study are as follow: We studied emergency department personnel working at a University tertiary level stroke center. Our findings might not apply in other settings. We can not know from this limited study what affect the presence of a stroke team had on baseline knowledge, or response to our educational program. The test questions have not been validated.

Another limitation of the study is that we were unable to track the scores of the subjects at the six-month follow-up and therefore cannot accurately assess retention of the educational intervention. In addition, we also cannot determine if other educational interventions within the six-month time period contributed to the improvement of scores on the six-month follow-up questionnaire.

In retrospect, another short-coming to this study may be in the wording of questions and answer choices on the pre and post-tests. For example, question number two perhaps may not have been as intuitive as we had thought when designing the study instrument. Our hope was that at the time of administration, the correct response elicited would have been representative of the three hour therapeutic window to treatment time.

## Conclusion

A brief targeted educational intervention improves knowledge and familiarizes ED healthcare providers concerning the use of thrombolytics in stroke. Improvement in knowledge testing was seen immediately after the education and after six months.

## Ethical issues

Participants' information was kept confidential.

## Competing interests

No competing financial interests exist.

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