Door to Intravenous Tissue Plasminogen Activator Time and Hospital Length of Stay in Acute Ischemic Stroke Patients, Georgia, 2007-2013

Moges Seyoum Ido, MD, MS, MPH,*† Ike S. Okosun, MPH, PhD,* Rana Bayakly, MPH,† Lydia Clarkson, MPH,† James Lugtu, RN, MSN, FNP,† Sanita Floyd, BSc,† Kerrie Krompf, BS,‡ and Michael Frankel, MD‡

Background: Ischemic stroke patients benefit most from intravenous thrombolysis when they receive the treatment as quickly as possible after symptom onset. Hospitals participating in the Georgia Coverdell Acute Stroke Registry reduced the time from patient arrival to administration of intravenous tissue plasminogen activator. This study evaluates the benefit of reducing door-to-treatment (DTT) time as measured by hospital length of stay (LOS). *Methods:* Data from 3154 ischemic stroke patients treated with intravenous thrombolysis from 2007 to 2013 were analyzed. The impact of door-to-treatment time on patients' length of hospital stay, discharge disposition, ambulatory status at discharge, and bleeding complications was assessed, controlling for patient-, hospital- and event-related characteristics. *Results:* Patients who received intravenous thrombolysis within 30 minutes of hospital arrival had a 19% shorter (95% confidence interval [CI]: 2%-32%, *P* value = .04) hospital LOS than those treated for more than 120 minutes after arrival. Patients treated within 60 minutes of arrival were 27% more likely (odds ratio = 1.28, 95% CI: 1.06-1.56, *P* = .01) to have a better discharge disposition than patients treated after 60 minutes of arrival while having a similar rate of bleeding complications. *Conclusions:* Shortening the door-to-treatment time is associated with a decrease in patient LOS and better patient outcomes. Hospitals should be encouraged to measure, monitor, and reduce DTT time progressively for a better patient outcome.
Key Words: Ischemic stroke—intravenous thrombolysis—tissue plasminogen activator—door-to-treatment time—hospital length of stay—patient outcome.

Introduction

Time is critical in the management of acute ischemic stroke; for every minute that passes without reperfusion, a patient loses about 2 million neurons.[1,2] Hospitals strive to shorten the time to administration of intravenous tissue plasminogen activator (IV tPA), and they use door-to-IV tPA time (door-to-treatment [DTT] time) as a performance indicator for improving the quality of stroke patient care. The American Heart Association's Target Stroke program encourages hospitals to administer IV tPA within 60 minutes of hospital arrival, that is, a DTT of 60 minutes, and sets the target to achieve this in at least 60% of IV tPA-treated ischemic stroke patients.[3]

The Georgia Coverdell Acute Stroke Registry (GCASR) is a collaborative effort between the Georgia

From the *Division of Epidemiology & Biostatistics, School of Public Health, Georgia State University, Atlanta, Georgia; †Georgia Department of Public Health, Atlanta, Georgia; and ‡Marcus Stroke and Neuroscience Center, Grady Memorial Hospital, School of Medicine, Emory University, Atlanta, Georgia.

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Address correspondence to Moges Seyoum Ido, MD, MS, MPH, Georgia Department of Public Health, 2 Peachtree St, NW, Suite 14-277, Atlanta, GA 30303-3142. E-mail: Moges.Ido@dph.gov.ga.

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Department of Public Health, the Centers for Disease Control and Prevention, participating hospitals, emergency medical service providers, and other key stakeholders to monitor and improve the quality of prehospital and hospital acute stroke care. The GCASR provides technical assistance such as thematic telephone conferences, onsite visits, guidance in quality improvement, and data feedback for hospitals engaged in quality improvement activities including efforts to reduce the door-to-IV tPA time. Currently, there are 68 acute care facilities of which 4 comprehensive and 39 primary stroke centers participate in the registry.

Studies have shown that patients who received IV tPA with shorter DTT benefit most from the treatment; they had better functional status and were more likely to be discharged to home.[4-7] However, how much reducing DTT affects patients' hospital length of stay (LOS) has not been examined yet. The purpose of the present study, thus, was to assess the impact of shorter DTTs on patient LOS and to evaluate the effect on bleeding complications, patient's ambulatory status at discharge, and discharge disposition.

Methods

The GCASR collects sociodemographic data on patients, as well as information on stroke events, such as severity, stroke treatment provided, and discharge disposition. Seven years' data collected from medical records from 2007 to 2013 were used for this analysis. The primary outcome of interest was patient's length of hospital stay measured in days; we also looked at discharge disposition, bleeding complications after IV tPA administration (life-threatening bleeding and symptomatic cerebral bleeding), and patient's ambulatory status at discharge.

Patients could be discharged to home, hospice–home, or hospice–healthcare facility; another acute care facility; or other healthcare facilities; or they might have had a fatal outcome or left the hospital against medical advice. We classified discharge disposition into 3 categories: died in hospital or discharged to hospice care, discharged to another acute or chronic care facility but not hospice, and discharged to home. Similarly, ambulatory status at discharge had 3 values: ambulating independently without help from another person (with or without a device), ambulating with assistance from a person, and unable to ambulate. Bleeding complication was a dichotomous variable. Patients whose clinical condition deteriorated due to a computed tomography-detected intracranial hemorrhage within 36 hours of IV tPA administration and patients who developed systemic hemorrhage within 36 hours of IV tPA that required more than 3 units of blood within 7 days were classified as having a bleeding complication.

DTT time was calculated in minutes, taking the difference between the times of the patient's arrival at a hospital and IV tPA administration. The data were collected by trained data abstractors using the Get With the Guidelines-Stroke PMT coding instructions. Quality of data was regularly monitored through reabstraction of randomly selected records. Sociodemographic and clinical characteristics and hospital features including bed size and urbanicity were covariates in the analysis. We classified hospitals by bed size thusly: medium–small (<250 beds), medium–large (250-399 beds), and large (≥400 beds). The 2010 Rural-Urban Commuting Area primary codes were used to classify hospitals geographically into metropolitan (codes 1-3) and nonmetropolitan (codes > 3).[8]

From January 2007 to December 2013, 3571 acute ischemic stroke patients were treated with IV tPA in GCASR participating acute care hospitals. We excluded from the analyses patients who were on comfort measures only or who left against medical advice, patients with no documented discharge destination, patients with in-hospital stroke onset, individuals treated with intra-arterial recanalization or experimental therapy, patients who received IV tPA and were transferred to another hospital, and those who received IV tPA for more than 270 minutes after the last time seen to be well. To have stable estimates, we also excluded from analysis patients from hospitals with fewer than 10 observations. The final number of subjects analyzed was 3154 from 36 hospitals.

Statistical Analysis

Patient-related variables (gender, age, race, health insurance type, National Institutes of Health Stroke Scale [NIHSS] score, ambulatory status, atrial fibrillation or flutter, previous medical and medication history, and time from last known well to hospital arrival), hospital location, bed size and hospital primary stroke center status, and event-related variables (transport to hospital by emergency medical service or other means, arrival hour of day, day of week, and calendar year) were covariates in the analyses.

For the analysis of hospital LOS, we categorized DTT into 5 categories as follows: 30 minutes or less, more than 30 minutes to 60 minutes or less, more than 60 minutes to 90 minutes or less, more than 90 minutes to 120 minutes or less, and more than 120 minutes. For the analyses of other outcomes—discharge disposition, ambulatory status on discharge, and bleeding complications—we classified DTT into 2 categories, 60 minutes or less and more than 60 minutes, in alignment with the stroke care performance indicator and for better statistical efficiency. We analyzed the hospitals' progress achieved in shortening DTT over the 7-year time period descriptively.

Hospital LOS had a distribution skewed to the right, and we transformed the values into a logarithmic scale. We checked the statistical assumptions and applied multivariable linear regression to assess hospital LOS using the generalized linear mixed model. We repeated the analysis using only subjects discharged to home, to exclude