Achieving a Door-to-Needle Time of 25 Minutes in Thrombolysis for Acute Ischemic Stroke: A Quality Improvement Project

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Background: Providing intravenous thrombolysis with short door-to-needle time is the result of a complex process that requires specific work standards. To expedite care for acute ischemic stroke patients, close collaboration between all participating health care professionals is required. The aim of this project was to reduce in-hospital treatment delay for acute ischemic stroke patients through the introduction of a standard operating procedure and by creating higher and sustained awareness of the importance of intravenous thrombolysis. *Methods:* This study was set up as a before-versus-after study, divided into a preintervention period, an immediate postintervention period, and a late postintervention period. During the study, a standard operating procedure was implemented that defined the targeted standard of care to be provided to all acute stroke patients. Involved health care professionals received regular feedback to create greater awareness of the importance of this time-driven protocol. *Results:* The median door-to-needle time decreased significantly, from 60 minutes in the preintervention period to 30 minutes in the immediate postintervention period ($P < .001$), and compared with the immediate postintervention period it decreased significantly further, to 25 minutes, in the late postintervention period ($P < .001$). The proportion of patients with a door-to-needle time <30 minutes and <20 minutes increased significantly across the 3 study periods ($P < .001$). *Conclusions:* The door-to-needle time for acute ischemic stroke patients can be reduced through the introduction of a standard operating procedure and by creating higher and sustained awareness of the importance of intravenous thrombolysis among health care professionals involved. **Key Words:** Stroke—emergency service—hospital—thrombolytic therapy—time factors—quality of health care.

Intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) significantly improves the chance of recovery in acute ischemic stroke patients, but its benefit is strongly time-dependent.[1-3] Because of the importance of rapid treatment initiation, national and international guidelines emphasize the importance of initiating the intravenous thrombolysis as soon as possible after ischemic stroke onset.[4] Providing intravenous thrombolysis with short door-to-needle time is the result of a complex process that requires specific work standards. To expedite care for acute ischemic stroke patients, close collaboration between all participating health care professionals is required. Because hospitals are dynamic environments that operate with many people rotating in and out of jobs, 24 hours a day, 7 days a week, differing work methods may compromise patient safety and may

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result in treatment delay. Furthermore, it is of vital importance that all health care professionals participating in the process of intravenous thrombolysis are aware of the time-dependent effects of this treatment.

To guide health care professionals through the process of intravenous thrombolysis, a written document detailing all necessary steps, including precautions, to complete the process of intravenous thrombolysis may be useful. Such a document is called a standard operating procedure and is generally defined as a detailed written instruction designed to achieve uniformity in the performance of a specific process.

The aim of this quality improvement project was to reduce in-hospital treatment delay for acute ischemic stroke patients through the introduction of such a standard operating procedure and by creating higher and sustained awareness of the importance of this time-driven protocol among all health care professionals involved in the process.

Methods

Design and Participants

This study was set up as a before-versus-after study, divided into 3 periods: the preintervention period (January 1, 2007-April 30, 2009), the immediate postintervention period (May 1, 2009-December 31, 2010), and the late postintervention period (January 1, 2011-December 31, 2012). All acute ischemic stroke patients who received intravenous thrombolysis at the Sint Lucas Andreas Hospital, a community hospital in Amsterdam, between January 1, 2007, and December 31, 2012, were enrolled in the study. The study is based on a prospective stroke registry of consecutive ischemic stroke patients treated with intravenous thrombolysis in the Sint Lucas Andreas Hospital since 2007. This database is used to drive iterative quality of care improvement for ischemic stroke patients. We obtained institution review board approval to conduct this analysis.

Interventions

First, a multidisciplinary team consisting of a neurologist, a neurology resident, a stroke nurse, and an emergency department nurse analyzed the existing process pathway of intravenous thrombolysis. Second, the team implemented several systemic improvements to improve patient flow and reduce in-hospital treatment delay (Table 1). Third, the team developed a standard operating procedure that defined the targeted standard of care to be provided to all patients eligible for intravenous thrombolysis. This standard operating procedure described all necessary steps, including precautions, to complete the process of intravenous thrombolysis in acute ischemic stroke patients (Fig 1). In addition, it defined the roles and responsibilities of every member of the participating departments at each moment during the process. The standard operating procedure became effective on May 1, 2009. This marked the beginning of the immediate postintervention period. Instructional meetings were held for several weeks before the standard operating procedure became effective. These meetings were held to increase awareness among the health care professionals involved about

Table 1. *Systemic improvements incorporated in the standard operating procedure*

Systemic improvement	Description
The formation of an acute stroke team	A team consisting of a neurologist, a neurology resident, a stroke nurse, an emergency department nurse, a radiology technician, and a laboratory analyst were immediately available, 24 hours a day, 7 days a week.
The introduction of hospital prenotification	Health care professionals working at the emergency medical dispatcher service notified the hospital's emergency department when a possible candidate for intravenous thrombolysis was being transported. This allowed the complete acute stroke team to be prepared before patient arrival at the emergency department.
The use of a point-of-care laboratory	The laboratory analyst was equipped with a point-of-care INR device. This device offers a simple and fast way of directly determining if a patient is using vitamin K antagonists. It allowed this key laboratory examination to be transferred from the centralized hospital laboratory to the patient in the emergency room. In addition to the INR, glucose was also tested with a point-of-care device.
The achievement of CT priority	CT priority was achieved for patients eligible for intravenous thrombolysis. The CT room was cleared prior to hospital arrival of a possible candidate for thrombolysis.
Administering the rt-PA bolus on the CT table	After performing a head CT, patients were immediately transferred from the CT table to a hospital bed and the rt-PA bolus was subsequently administered in the CT room. This was followed immediately by administration of the continuous infusion. After the start of the continuous infusion patients were directly transferred to the stroke unit of our hospital.

Abbreviations: CT, computed tomography; INR, international normalized ratio; rt-PA, recombinant tissue plasminogen activator.