

Feasibility and Efficacy of Nurse-Driven Acute Stroke Care

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Background: Acute stroke care requires rapid assessment and intervention. Replacing traditional sequential algorithms in stroke care with parallel processing using telestroke consultation could be useful in the management of acute stroke patients. The purpose of this study was to assess the feasibility of a nurse-driven acute stroke protocol using a parallel processing model. **Methods:** This is a prospective, nonrandomized, feasibility study of a quality improvement initiative. Stroke team members had a 1-month training phase, and then the protocol was implemented for 6 months and data were collected on a "run-sheet." The primary outcome of this study was to determine if a nurse-driven acute stroke protocol is feasible and assists in decreasing door to needle (intravenous tissue plasminogen activator [IV-tPA]) times. **Results:** Of the 153 stroke patients seen during the protocol implementation phase, 57 were designated as "level 1" (symptom onset <4.5 hours) strokes requiring acute stroke management. Among these strokes, 78% were nurse-driven, and 75% of the telestroke encounters were also nurse-driven. The average door to computerized tomography time was significantly reduced in nurse-driven codes (38.9 minutes versus 24.4 minutes; $P < .04$). **Conclusions:** The use of a nurse-driven protocol is feasible and effective. When used in conjunction with a telestroke specialist, it may be of value in improving patient outcomes by decreasing the time for door to decision for IV-tPA. **Key Words:** Nursing—acute ischemic stroke—systems of care—door to needle.

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Background and Significance

A typical acute ischemic stroke patient loses 1.9 million neurons each minute.¹ In comparison with the normal rate of neuronal loss in brain aging, the ischemic brain ages 3.6 years each hour without treatment.¹ In 1995, intravenous (IV) tissue plasminogen activator (tPA) was established as an effective treatment for patients with acute ischemic stroke.^{2,3} Although the window for effectiveness was extended from 3 to 4.5 hours⁴ from last known normal, earlier treatment is associated with a significantly higher likelihood of better outcomes.^{5,6} These findings led to the development of national guidelines by the American Heart Association/American Stroke Association for target door-to-treatment (DTT) time of 60 minutes for eligible patients.⁷ Despite the efficacy^{8,9} of thrombolytic therapy, only 3.4%-5.2% of eligible patients with acute ischemic stroke receive IV-tPA.¹⁰ In 2011, less than one-third

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of the patients treated with IV-tPA received it within the recommended 60-minute window from hospital arrival.¹¹

Specialized stroke training is required to facilitate timely administration of IV-tPA. However, access to providers with specialized stroke training is often limited to larger urban stroke centers. An estimated 22.3% of Americans have access to a primary stroke center within 30 minutes, 43.2% within 45 minutes, and 55.4% within 60 minutes.^{6,12} The use of telestroke consultation, in conjunction with education and training of healthcare providers in acute stroke management, is necessary to increase the rate of IV-tPA use at community hospitals that lack on-site specialized stroke expertise.¹³ In such hospitals with limited resources, it may be necessary to train nurses to lead a stroke management protocol using a telestroke consult in order to avoid delays in IV-tPA administration. Telestroke systems have evolved as a way to provide adequate care to stroke patients, especially those in remote locations without access to stroke specialists.¹⁴ Although practice recommendations were published in 2009,¹⁵ and further defined for use in acute stroke-ready hospitals in 2013,¹⁶ there are no specific guidelines for the practice of stroke care via telestroke.

Stepwise approaches, however, take longer to execute and suffer from bottlenecks. The success of parallel processing in reducing the time spent in the repair pit, as seen in the “pit-stop” model in automobile racing, has given us an insight to restructure the traditional stepwise approach to stroke care into a parallel processing approach. The automotive pit crew manages to completely refuel a high performance racing car and change all four tires in a remarkable 12-14 seconds using parallel processing. We decided to adapt this model to the care of stroke patients using telestroke consultation with nurses as the primary code drivers.

Methods

QCI-Nurse-driven Acute Stroke CARE (QCI-NASCAR) is a prospective, nonrandomized, feasibility study of a quality improvement initiative conducted over the course of 7 months. The project was reviewed and approved by the institutional review board at the University of Texas Southwestern. The University of Texas Southwestern Medical Center has been collecting stroke care metrics for admitted patients, and this served as the baseline data for our project. Emergency department (ED) acute stroke admissions were designated as level 1 through level 3, and all patients included in this analysis were enrolled from direct ED visits and telestroke consults. Level 1 strokes are defined as stroke onset within 0-4.5 hours of symptom onset, level 2 strokes are defined as stroke onset within 4.5 hours to 8 hours from symptom onset, and level 3 strokes as stroke onset within 8-72 hours from symptom onset. In strokes with an unknown symptom onset, the last known normal time is used.

The definitions used in this project include the following: door-to-CT (DTCT) scan time, defined as the amount of time from patient entering the ED to first entering the computed tomography (CT) scanner. Door-to-physician time (DTMD) referred to the amount of time from patient entering the ED to the first evaluation by a physician. Door-to-decision time (DTDT) is the amount of time between when the patient entered the ED to when the decision to treat or not to treat with tPA occurred. DTT time¹⁷⁻¹⁹ is the amount of time between when the patient entered the ED to when the treatment (IV-tPA) was provided to the patient. The primary outcome of this quality care and improvement (QCI) project was to assess the feasibility and efficacy of the nurse-driven, parallel processing protocol, as well as to examine the impact on stroke code time metrics compared with a non-nurse-driven protocol. Hence, the primary outcome measure for this was changes in DTDT and DTT times.

The first 3 months of this study were dedicated to developing the NASCAR protocol. Protocol education (run-in phase) was done over a 1-month period and implementation occurred over the subsequent 6 months. All results presented in this study are from the implementation phase. At the time of this study, there were no data available to support endovascular revascularization therapy, which is why a protocol for endovascular revascularization therapy referral was not included in the study.

Prior to implementing the QCI-NASCAR protocol, champions (team leaders) were identified to represent each clinical discipline involved in acute stroke code, namely nurses, ED physicians, stroke specialists, laboratory technicians, radiologists, and pharmacists. Bedside nurses in the ED were identified as the empowered “drivers” of the stroke code with defined roles such as getting a CT scan and initiating telestroke consultation. Other members of the team worked simultaneously to evaluate the patient (ED physicians), establish IV lines (other nurses), and obtain home medication list, as well as prepare IV-tPA, if indicated (pharmacist). A run-sheet (Fig 1) was developed to facilitate data collection. The run-sheet contained information on the stages of stroke code and the responsibilities of each team member, task completion times, and any protocol violations. Nurses, ED staff, laboratory, pharmacy, and radiology staff were trained on the QCI-NASCAR protocol during a 1-month run-in phase.

During the implementation phase, at the end of each stroke code, the nurse who was selected as the protocol driver was responsible for documenting the task completion times on the run-sheet, and note protocol violation if any. The designated nurse driver was also asked to fill out a questionnaire on the back of the run-sheet (Fig 1, back page). The questionnaire focused on the nurse driver’s perspective on the level of involvement each had in running the stroke code. The questionnaires were scored

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